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ARTICLE

Sociopolitical Complexity and the Bow and Arrow in the American Southwest

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The evolution of sociopolitical complexity, including heightened relations of cooperation and competition among large nonkin groups, has long been a central focus of anthropological research.[1,2] Anthropologists suggest any number of variables that affect the waxing and waning of complexity and define the precise trajectories that groups take, including population density, subsistence strategies, warfare, the distribution of resources, and trade relationships.[3,4] Changes in weaponry, here the introduction of the bow and arrow, can have profound implications for population aggregation and density, subsistence and settlement strategies, and access to resources, trade, and warfare.[5]

Bingham and Souza provide a general conceptual model for the relationship between complexity and the bow and arrow, arguing that this compound weapon system, whereby smaller projectiles travel at higher speed and are capable of hitting targets more accurately and at greater distances than hand-thrown darts, fundamentally favors the formation of larger groups because it allows for cost-effective means of dealing with conflicts of interest through social coercion, thereby dramatically transforming kin-based social relations.[6] Here we consider the impacts the introduction of the bow and arrow had on sociopolitical complexity in the North American Southwest.

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LATE PREHISTORIC SOUTHWESTERN WEAPONRY

The bow and arrow were present in the Southwest perhaps as early as AD 500 and became the dominant weapon system by AD 700.[7,8] Southwestern bow technology was comparatively simple. Short self bows, those made from a single piece of wood and which, in profile, are usually straight or, less commonly, slightly recurved, were the primary form until sometime after AD 1200, when compound recurve bows, those made from wood and backed with sinew (hence the term "compound") replaced them.[9–12] Bows were made from a wide variety of woods. In a cache of 94 bows found in a small cliff house in the Mogollon Mountains of New Mexico, which, based on associated ceramic sherds, appears to date to AD 1000–1150, Hibben[13] identified black oak, pine, piñon, mountain mahogany, and sycamore.

Southwestern ethnographic and archeological evidence indicates arrows were used in warfare, hunting, and ritual.[14–17] Southwestern arrows are: self-arrows, made of a single piece of hardwood, or compound arrows, made of a wooden foreshaft and a lighter material such as cane or reed.[9,12,14,18,19] Through time, wooden self-arrows became increasingly common, perhaps as a result of warfare and the need to pierce wicker shields.[12] Some arrows were fitted with a stone tip (arrowhead), whereas others were either left blunt at the tip, perhaps for target practice or stunning small game, or tapered to a sharp point.[11,20] Pointed ends allow penetration and are effective for killing, although stone projectile points, especially of cyptocrystaline/noncrystaline materials such as chert and obsidian, allow deeper penetration and produce larger wounds.[21–23]

Southwestern stone arrowheads are small, typically weighing less than 5 gm, and vary considerably in shape.[23] They are among the most common stone tools recovered from late prehistoric Southwestern contexts, but arrow-shaft fragments recovered from caves and other contexts indicate that blunt-end arrows and tapered-end arrows likely were more common.[15] For example, Haury's excavation of Ventana Cave (Fig. 1) produced more arrows with tapered ends ($n > 27$) and blunt tips ($n = 44$) than stone-tipped arrows ($n < 11$).[18] The use of stone tips may have been tied at least partly to warfare, where the increased penetration and wound size would have been particularly useful.

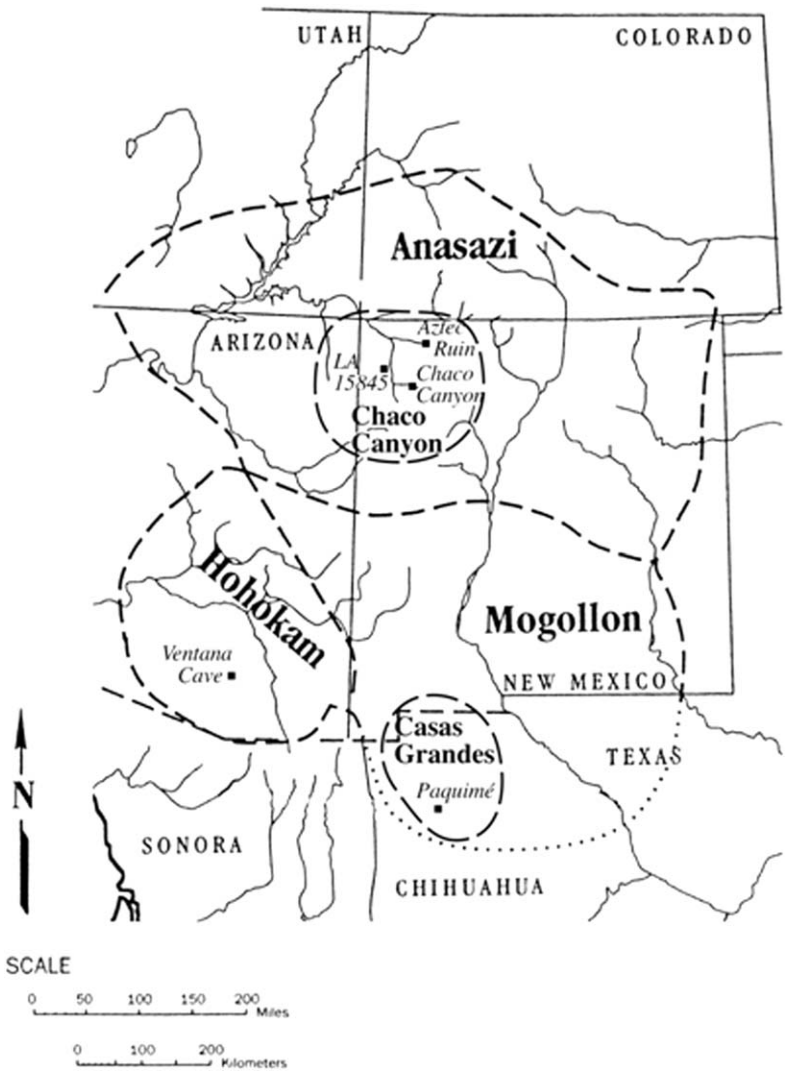

Figure 1. Culture areas of the American Southwest showing locations of sites mentioned in the text.

SOUTHWESTERN SOCIOPOLITICAL COMPLEXITY

Most researchers conclude that Southwestern sociopolitical complexity developed as a result of three interrelated factors: irrigation agriculture, population aggregation, and warfare.[24–26] Similarly, complexity in the Southwest often is described in terms of three general regional systems: the Hohokam region along the Salt and Gila river drainages of south-central Arizona, the Chaco/Aztec Ruins region of northwestern New Mexico, and the Casas Grandes region of northern Chihuahua and southern New Mexico (Fig. 1).[27]

Sociopolitical complexity in the Hohokam region resulted from the nucleation of smaller settlements into large communities relying on irrigation agriculture.[28] The process began with a rise in population and increased social complexity associated with the cultivation of domesticates, including maize; the construction of irrigation ditches associated with small pithouse villages; and the use of food-storage facilities in the Tucson Basin.[29] By AD 400, populations had settled into more permanent settlements, many of which remained continuously occupied for hundreds of years.[30] These communities built massive irrigation systems, stretching as long as 15 km from their source. Social differentiation and architectural elaboration increased through time, leading to the development of a regional architectural style characterized by ball courts and central plazas surrounded by pithouses.[29] Irrigation systems appear to have been managed at the community level.[31] Complexity in these communities predates adoption of the bow and arrow in the Southwest, indicating that the initial formation of nonegalitarian societies was not initially influenced by or subsequently controlled by the weapon system. Between AD 950 and AD 1100, well after the bow and arrow became the dominant Hohokam weapon system, community organization did change through the formation of multivillage irrigation communities in which politically distinct groups cooperated with each other to build and maintain large irrigation works.[31] As part of this reorganization, some settlements that had been occupied for hundreds of years, such as Snaketown, were abandoned. There is no evidence of defensive locations or architecture, warfare, or violent coercion during this time.[12]

After AD 1100, archery-based warfare may have become a more significant consideration for the Hohokam. A 40-km-long line of defensive "lookout" settlements was built by neighboring peoples living in the Cohonina region of northern and western Arizona along their border with the Hohokam.[12,32] These settlements were small habitations, often with two-story towers, which are interpreted as lookout posts on prominent land forms with excellent views of the surrounding area (Fig. 2). They were constructed using a highly visible red-yellow sandstone that made them visible from quite a distance, suggesting that they served as both lookouts and deterrents to possible encroachment from Hohokam and other hostile groups, perhaps launched in retaliation for raids perpetrated by the comparatively dispersed and smaller Cohonina groups.[32] Still, based on available evidence, the introduction of the bow and arrow did not significantly affect the development or trajectory of political complexity in the Hohokam

Box 1. Evidence of the Use of the Bow and Arrow in Southwestern Warfare

Although people throughout the prehistoric Southwest used a variety of weapons, including clubs, axes, and even rocks thrown from pueblo rooftops, as well as projectile systems such as the thrusting spear, and the atlatl and dart, the bow and arrow were central to Southwestern warfare after their introduction.[12,19] Zuni archers formed phalanx-like battle formations during the initial hostilities associated with the Spanish entradas, and archers were central to subsequent warfare among the Apache, Navaho, Pueblos, Tohono and Akmiel O'odam, Utes, and other Southwestern native peoples.[14,54] Rock-art imagery shows a strong association between the bow and prehistoric warriors. [17]

Despite archery's clear role in Southwest warfare, evidence of violence done using the bow and arrow is limited relative to other weapon systems. Arrows tend to cause soft-tissue wounds that do not leave any evidence of violent trauma on the skeleton except where a point happens to hit bone. Even then, the damage may not be recognizable.[55] Further, arrows likely were removed when possible, either from wounded individuals who survived or from bodies recovered after battle. Evidence of the use of bow and arrow in warfare will consequently be limited primarily to those cases where a point became embedded in a bone and could not be recovered; where a bone shows unambiguous evidence of a projectile impact; or where bodies could not be recovered because of circumstances (for example, a burning building collapsed on an injured individual or there were too many dead to recover). Despite these issues, several archeological cases demonstrate the use of the arrow as a weapon:

- Site 616, Mariana Mesa (west-central New Mexico) (Fig. 1): Two skeletons show evidence of violence. One, an adolescent female, had a severed left arm and was likely killed by a blow from a stone axe to the head. A young adult male had a projectile point embedded in his leg.[56]
- LA 15845 (northwestern New Mexico) (Fig. 1): A body found on the floor of a collapsed pithouse had a projectile point embedded between the third and fourth cervical vertebrae. A broken point and three whole points were also associated with the skeleton and likely had been embedded in the individual's soft tissue.[57]
- Pueblo Bonito, Chaco Canyon (north-central New Mexico) (Fig. 1): A point was embedded in the third cervical vertebra of a disarticulated skeleton.[19]
- 29SJ1360, Chaco Canyon (north-central New Mexico) (Fig. 1): The skeleton of a female adult had a projectile point in the abdominal region and another in the chest cavity. A hole in the right elbow may have been caused by a pointed wood-tipped arrow.[58]

Additional examples are listed by Wilcox and Haas.[59]

region before the influx of war refugees, starting around AD 1275, which we will discuss.

The bow and arrow fundamentally changed the form of warfare and contributed to development of the regional systems at Chaco Canyon and later at Aztec Ruins in north-central New Mexico (Fig. 1). Chaco Canyon was the heart of an expansive political system characterized by large pueblos with distinctive architectural styles that included enclosed plazas and large kivas. The system grew from large pithouse settlements such as Shabik'eschee village in Chaco Canyon and reached its maximum extent between AD 900 and AD 1125.[33] It then likely retrenched into a slightly smaller regional system centered on Aztec Ruins until it collapsed around AD 1250.[33] Control of political power, based at least in part on warfare, was central to the system's formation and operation.[27,33,34]

Before the rise of the large Chacoan settlements, warfare in the northern Southwest was characterized by tit-for-tat raiding in which small numbers of people fought and died. [12,35] Occasional massacres of whole villages occurred.[12,36,37] During and after development of the Chaco Canyon polity around AD 900, warfare appears to have been generally curtailed in favor of targeted killings of specific individuals or family groups. These were violent executions in which the victims were killed, their bodies burned and perhaps cannibalized, and their bones shattered.[35,36] Given the evidence of what Lekson has called "Chacoan enforcers," warfare and war symbolism were likely central to the development of Chaco Canyon.[35] The bow and arrow constituted the primary projectile-based weapon. Arrows have also been found in ritual contexts at Pueblo Bonito in Chaco Canyon and at Aztec Ruins. These arrows were painted green, unlike most arrows from elsewhere, which typically lack paint or were painted red, indicating the presence of distinct Chacoan ritual practices focused on the bow and arrow.[15]

The significance of the bow to sociopolitical complexity increased even more after the end of the Chaco Canyon/Aztec Ruins regional system around AD 1250, as the northern Southwest became enmeshed in brutal, sustained warfare that often led to the destruction of entire villages.[12] During this time, the recurved bow likely became the dominant weapon system, which may have increased the deadliness of archery-based warfare. The result was the migration of

Figure 2. NA26344, a lookout "fort" in Sycamore Basin on the Hohokam/Cohonia frontier. Photo courtsey of David R. Wilcox. (Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.)

thousands of people out of the northern Southwest into communities along the Rio Grande and throughout central New Mexico and Arizona.[38] Increased warfare spread with the movement of these groups and transformed the settlement strategies used throughout the region, including Hohokam settlements in Arizona and western New Mexico. With the influx of immigrants, previously dispersed communities with long histories of occupation, sometimes lasting hundreds of years, were eventually abandoned, often after being burned. Groups began to shift to much larger, more aggregated settlements in defensive locations. Communities also formed defensive clusters—what Wilcox and colleagues[39,40] have called defense by layers, and likely formed intercommunity defensive alliances. Wooden palisades were also built around some Hohokam habitation clusters and mounds, perhaps for defense.

Thus, the intensely lethal warfare made possible at least in part by the bow and arrow led to population migration and aggregation, as well as intra- and intercommunity social differentiation throughout the central portion of the North American Southwest. This pattern remained and intensified through the historic period.

Thus, the intensely lethal warfare made possible at least in part by the bow and arrow led to population migration and aggregation, as well as intra- and intercommunity social differentiation throughout the central portion of the North American Southwest.

Settlements in the Hohokam region changed as the previous integrative architecture such as ball courts fell from favor, walled village compounds became more common, and platform mounds formed the heart of elite residential districts.[29,35,38]

Shifting attention to central New Mexico, warfare made possible by the bow and arrow transformed political organization, but did not necessarily cause increased political complexity relative to the preceding Chacoan system. To the contrary, reorganization of the existing communities and immigrant populations flowing from the Chaco/Aztec region into the area adjacent to the Rio Grande after AD 1275 included the development of social structures such as the kachina religion, which established diffuse power structures and prevented the institutionalization of extreme social differentiation. This, in turn, limited the amount of political differentiation and the ability of elites to exert political control. Some researchers have suggested

these movements reflected a direct, conscious rejection of the sort of social inequity or political complexity associated with the Chaco/Aztec system.[41] Certainly no integrated regional system rose to take its place.

During the same time that warfare caused population aggregation throughout the central Southwest, increased political complexity and aggregated communities also formed in the Casas Grandes region of northern Chihuahua and the southern edge of New Mexico.[42] The center of this system was the large community of Paquimé (Fig. 1), which became the heart of one of the most politically complex systems in post–AD 1300 North America.[43] Research into the Casas Grandes region is limited relative to the areas previously discussed, and our knowledge of the culture history is comparatively incomplete. However, it is clear that Casas Grandes political complexity grew as dispersed settlements nucleated into larger villages and village clusters, as was the case among the Hohokam and at Chaco Canyon.

Intensive warfare, presumably using atlatl-thrown darts and hand-thrown spears, likely affected settlement patterns during the Late Archaic period (1500 BC – AD 700), as shown by at least 13 villages created by using dirt and rubble to fill spaces behind rock walls built on the sides of steep hill slopes—highly defensible locations.[44] In contrast, settlements founded between AD 700 and AD 1200, during which the bow spread to the area, were widely dispersed, small communities in areas where maize agriculture was possible.[45] To our knowledge, there is no evidence of warfare or systematic violence, although tit-for-tat warfare presumably was present there as elsewhere in the Southwest.[45,46] After AD 1200, political complexity increased and large settlements such as Paquimé and Galeana (Fig. 1) were built in river valleys, where irrigation and other water-control strategies were possible.[47,48]

The role of warfare in the formation and form of aggregated communities is unclear. Complexity and the degree of social differentiation increased dramatically around AD 1300.[48,49] This "quickening" of the Casas Grandes system may reflect the real or perceived threat of warfare made possible by the bow and the increased warfare to the north. Evidence cited as indicating warfare includes *atalayas*, circular stone features on hilltops throughout the Casas Grandes region. Charles Di Peso, the original excavator of Paquimé, and others have argued that these *atalayas* formed a warning system used to alert people at Paquimé and nearby communities of pending attacks, the idea being that brush was piled on top of the *atalayas* and then set on fire.[43,50] The *atalayas* do have greater intervisibility than expected by chance, but it is unclear whether fires were ever lit on them and, if so, whether their role was ritual or related to defense.[50]

Di Peso also proposed that Paquimé was abandoned because of warfare.[43] The entire community was burned at the end of its occupation, and Di Peso proposed that about 80 fragmentary bodies that were burned and not buried in a manner that is typical of the Casas Grandes culture were the remains of massacred individuals. However, Walker suggested that Paquimé may have been burned as part of a ceremonial closing of the settlement, and Casserino concluded that the bodies do not reflect a single event but were instead deposited over time.[51,52] A handful of trophy skulls found in ritual contexts could reflect warfare, although again, alternative explanations such as ancestor worship have been suggested.[43,49] Analysis of additional burials also does not reflect substantial evidence of warfare-related trauma, although slain warriors could have been buried elsewhere. Cannibalism was apparently present, but no evidence indicates it was focused on captured or killed enemies.[49,52] Further, settlements throughout the Casas Grandes region do not have the evidence of defensive locations and settlement clusters characteristic of settlements to the north. Based on the available evidence, then, it is unclear that warfare was a major factor leading to aggregated settlements in the Casas Grandes region. Instead, most authors argue that sociopolitical complexity was based on access to imported goods and rituals associated with the Aztatlán trading system of western Mexico.[43,46,49,53]

In some contexts, the bow and arrow encouraged and facilitate the formation of extreme social differentiation and led to larger corporate units, as predicted under the social coercion theory. In other contexts, the resulting social inequity and corporate-unit size may have been smaller, even in the same environment and with similar demographic structures. . .

DISCUSSION

Using the criteria provided by Bingham and coworkers in their introduction to this issue,[60] our analysis does not support the utility of the warfare theory in the North American Southwest. In none of the cases does it appear that intense warfare led to the formation of social complexity. If anything, available evidence indicates that the increased complexity in the Chaco/Aztec Ruins region, where the link between complexity and archery is most clear, is associated with a decrease in warfare intensity, which is the exact opposite of the expected pattern of the warfare hypothesis.

Our analysis lends only limited support for the social coercion theory. In the Chaco/Aztec Ruins

region, archery fundamentally altered the structure of human interaction, helping to determine where humans lived and the form of their social relationships. As predicted by Bingham and colleagues[60] the implied and realized social coercion made possible by the bow and arrow (and related weaponry such as shields) apparently transformed both intrapolity "law enforcement," in the form of targeted killings of specific individuals, and interpolity relations, with the formation of the large Chaco/Aztec Ruins regional system, both of which led to increasingly hierarchical social structures.

After the Chaco/Aztec Ruins system ended in brutal warfare, however, descendants did not reestablish a comparable regional system, indicating that the effect of the bow and arrow on both intrapolity and interpolity relations is not fixed within a particular demographic and environmental context. Instead of using the bow and arrow to increase the intensity of social coercion and reestablish extreme social differentiation, as seemingly implied by the social coercion theory, the offspring of those who lived in the Chaco/Aztec Ruins systems adopted social structures such as the kachina religion, which directly prevented such coercive relationships and limited the degree of social differentiation. This is not to say that all warfare stopped, that intracommunity coercion was not present, and that the bow and arrow did not impact community structure and the negotiation of conflicts of interest. Large, defensive community clusters formed, and there was continued emphasis on warrior symbolism, but large regional systems did not re-form, and intrapolity social complexity never reached the level of the Chaco/Aztec Ruins systems, despite similar demographic and environmental contexts and even general improvements in the bow and arrow, such the increased prevalence of recurved bows. This is not necessarily contradictory to the social coercion theory, but it does indicate that additional factors beyond weaponry may limit social coercion below its potential maximum expression in a given cultural context.

The Hohokam and Casas Grandes regions do not seem to fit well with the social coercion theory. In the case of the Hohokam, cultural complexity developed too early (before the adoption of the bow and arrow), and its continued elaboration was not clearly affected by the presence of archery. Factors other than improved weaponry and/or warfare apparently led to the social cooperation/coercion necessary for the development of complexity in the Hohokam region. This situation changed as the direct threat of armed conflict increased after AD 1100 and especially after AD 1300.

The development of cultural complexity in the Casas Grandes region, is, in contrast, too late to fit with the social coercion theory. Meaningful cultural complexity such as that reflected in the Hohokam and Chaco/Aztec Ruins regions postdates the general adoption of the bow and arrow by up to 500 years. Although our understanding of the region's prehistory is limited, the lack of changes in settlement size and location toward defensible settings and unambiguous evidence of increased violence or social coercion indicates that the bow and arrow did not significantly change inter- or intrapolity relations until the thirteenth century, as warfare spread across the Southwest.

Ultimately, our study indicates that the impact of weaponry is variable and must be understood in its cultural-historical context. In some contexts, the bow and arrow encouraged and facilitate the formation of extreme social differentiation and led to larger corporate units, as predicted under the social coercion theory. In other contexts, the resulting social inequity and corporate-unit size may have been smaller, even in the same environment and with similar demographic structures, such as the Ancestral Puebloan culture before and after the end of the Chaco/Aztec systems. Still, the eventual impact of the bow and arrow on political complexity and related cultural attributes such as settlement location in all three regions does support the general thrust of the social coercion theory in that changes in weaponry did, in time, affect the nature of interpolity and intrapolity coercion strategies. Archery at least allowed for potentially increased social complexity relative to what was possible without the weaponry, even if the bow and arrow were not used to their maximum potential in coercive relations.

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