

THE BETTER ANGELS OF THEIR NATURE: DECLINING VIOLENCE THROUGH TIME AMONG PREHISPANIC FARMERS OF THE PUEBLO SOUTHWEST

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The central Mesa Verde and the northern Río Grande regions housed two of the densest populations of prehispanic Pueblo peoples in the North American Southwest. We plot incidence of violent trauma on human bone through time in each region. Such violence peaked in the mid-A.D. 1100s in the central Mesa Verde, and in general was higher through time there than in the northern Río Grande region. In the central Mesa Verde, but not in the northern Río Grande, there is a tendency for violence to be greater in periods of low potential maize production per capita and high variance in maize production, though these structural tendencies were on occasion overridden by historical factors such as the expansion and demise of the Chacoan polity and the regional depopulation. Violence generally declined through time in the northern Río Grande until the arrival of the Spanish, even as populations increased. We propose that this decline was due to the combination of increased social span of polities, the importance of inter-Pueblo sodalities, the nature of religious practice, “gentle commerce,” and increased adherence to a set of nonviolent norms.

Las regiones de Mesa Verde central y Río Grande norte albergaron dos de las poblaciones más densas de las gentes Pueblo prehispánicas en el Suroeste Norteamericano. Registramos la incidencia de trauma producto de violencia en huesos humanos a través del tiempo en cada región. La violencia alcanzó su máximo a mediados de los 1100s A.D. en Mesa Verde central, y en general fue más alta a través del tiempo ahí que en la región de Río Grande norte. En Mesa Verde Central, pero no en Río Grande norte, hay una tendencia de incremento en la violencia en periodos de bajo potencial en la producción de maíz per capita y alta variación en la producción de maíz, aunque estas tendencias estructurales en ocasiones fueron anuladas por factores históricos como la expansión y decaimiento del gobierno de Chaco y la despoblación regional. La violencia generalmente declinó con el tiempo en Río Grande norte hasta la llegada de los españoles, incluso con el incremento de la población. Proponemos que este declive se debió a la combinación del incremento del alcance social de los gobiernos, la importancia de las sociedades inter-Pueblo, la naturaleza de la práctica religiosa, el “comercio gentil,” y un aumento en la adhesión a un grupo de normas no violentas.

Claims that intergroup conflict has been a key structuring process in human social evolution, with roots in our primate ancestry and our long existence in small foraging bands (e.g., Bowles 2009; Wrangham 2004; but see Fry and Söderberg 2013), ultimately depend on archaeological evidence. Quantifying the intensity of conflict in prehistory is also critical for evaluating hopeful claims, such as Pinker’s (2011), that we currently enjoy much more peaceful conditions than were typical in the past. Here

we contribute to these discussions by analyzing the prevalence of violence in two of the most populous regions of the prehispanic North American Southwest.

The first region is the central Mesa Verde (CMV), centered in southwestern Colorado. This was first settled by ancestral Pueblo farmers ca. A.D. 600, and by the early 1200s¹ it was one of two main population centers in the Greater Southwest. Over the course of the 1200s this population dwindled, with many of its people moving to our

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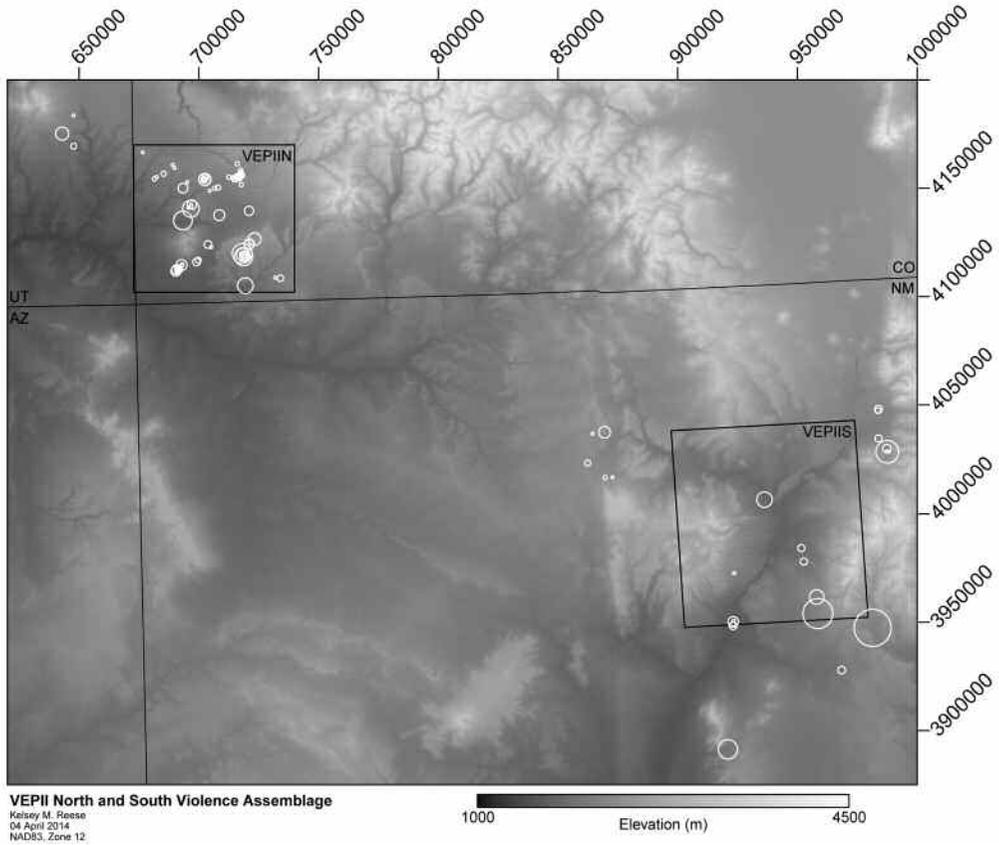


Figure 1. Location of CMV (VEPIIN) and NRG (VEPIIS) study areas and sites with osteological samples used in this analysis. Circle sizes proportional to sample sizes of human remains.

second region, the northern Rio Grande (NRG) of north-central New Mexico (Ortman 2012). This region was initially settled by farmers ca. A.D. 800, but its population grew dramatically as the CMV population decreased in the 1200s. By A.D. 1400 it housed the largest concentration of population in the Southwest (Hill et al. 2010). Together, the archaeological sequences of these two areas provide a millennium-long perspective on the role of violence in farming societies, ranging from very simple and small-scale communities to large and organizationally more complex polities.

Since the population sizes, chronologies, site distributions and characteristics, and paleoclimates of these two areas are known in considerable detail, they represent high-resolution cases for assessing the prevalence and causes of conflict in early farming societies worldwide. In this article we first summarize previous research on conflict in the CMV as seen through trauma preserved on

human bone (Cole 2012; Kohler et al. 2009). Then we develop a comparable dataset for the NRG (Supplemental Table 1) and compare these two records in their demographic, environmental, and organizational contexts. The windows into the CMV and NRG used here (Figure 1) correspond to the northern and southern study areas for the Village Ecodynamics Project II (VEPII; Kohler et al. 2012). As Figure 1 demonstrates, however, we include osteological samples near (but outside) these two areas to increase sample sizes. Hence there is a slight disjunction between the areas sampled for human remains, and those for which we developed estimates of population and potential maize production.

Our results are useful on four levels. First, they resolve the contradiction between archaeological studies that reveal episodes of extreme violence in the Pueblo past (e.g., Billman et al. 2000; Kuckelman 2002, 2010; and many others) and the rel-

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ative equanimity of Pueblo society emphasized in early twentieth-century ethnographies (e.g., Benedict 1934). Second, they allow us to put the levels of violence we document into a comparative perspective. How exceptional were the Pueblos with respect to the levels of violence they experienced? Third, the high temporal resolution of our conflict, population, and climate series allows us to make progress on the difficult problem of what motivates violence in societies of the scales examined here. Finally our analysis provides perspective on Pinker's (2011) contention that violence has declined markedly over the last five millennia around the world, and allows us to assess the extent to which the processes he holds responsible were at play in the Pueblo case.

Analyses at the scale we conduct here are necessarily coarse-grained. The large-scale patterns we identify should be investigated in more detail (e.g., with attention to age, sex, lethal vs. non-lethal trauma, nature of within-site provenience, and so forth) by others.² Possible sources of error and bias in these samples are discussed in more detail in Sample Characteristics (Supplemental Information).

Brief History of Research

Though there are exceptions (e.g., LeBlanc 1978; Linton 1944; Schulman 1950; Turner 1983; Woodbury 1959), prior to the 1990s Southwest archaeologists and anthropologists commonly ignored or downplayed evidence for violent conflict. In what some consider a "coming-out" paper legitimizing its study, Wilcox and Haas (1994) reviewed the early history of debate on conflict in the Southwest and catalogued sources of data in the archaeological record permitting inferences of violence. These include architecture (towers, palisades, "forts," hill-slope retreats such as trincheras, fortified villages and hamlets, guard villages), artifacts such as shields, burned sites, depictions of severed or flayed heads and warriors in rock art, no man's lands, and skeletal evidence such as points embedded in human bone, blunt trauma to the head, scalping, and highly processed sets of remains probably indicative of anthropophagy. (Lambert 2002:209–211 identifies similar categories of archaeological evidence for conflict in North America generally.) Although

alternative explanations are possible for each line of evidence in isolation, multiple lines of evidence coincide in identifying the last half of the thirteenth century as an especially violent period across broad portions of the Southwest (Lipe 1995).

Almost at the same time, Keeley (1996) published a very influential review of warfare in prehistory and in small-scale societies. Among his remarkable findings was the high death rate from warfare in recent small-scale societies, ranging up to 1.45 percent/year (Keeley 1996:Table 6.1). In these societies deaths from warfare commonly accounted for at least 5 percent and in one case almost 33 percent of all deaths (Keeley 1996:Table 6.2).

Shortly thereafter LeBlanc (1999; see also Turner and Turner 1999) published a comprehensive account of the evidence for warfare in the prehispanic Southwest (emphasizing the Pueblo region), dividing the sequence into three long periods: an Early period (Basketmaker and Pueblo I), a Middle period (Pueblo II and early Pueblo III), and a Late period (late Pueblo III and Pueblo IV).

The Early period is marked by considerable spatial and temporal variability in evidence for warfare, though overall, LeBlanc (1999) characterizes this period as subject to "endemic warfare." The famous assemblage of bodies in Cave 7 in southeastern Utah excavated by the Wetherills in the 1890s is interpreted by LeBlanc as the massacre of an entire group, though a recent intensive radiocarbon dating program suggested it accumulated over at least five centuries, and identified only about 20 percent of the bodies as showing evidence of perimortem trauma (Coltrain et al. 2012). Coltrain and colleagues infer a pattern of episodic raiding and intragroup male/male violence for the period during which they believe the Cave 7 deposits accumulated (roughly 100 B.C.–A.D. 400). This unique site continues to be debated, however. Geib and Hurst (2013), using a new suite of radiocarbon ages and a detailed reading of the cave's stratigraphy, characterize it as a single mass killing of about 58 individuals, including at least 35 adult males, sometime between cal. A.D. 20 and 80. Following a relatively calm late Basketmaker III and early Pueblo I, LeBlanc and some others (e.g., Orcutt et al. 1990) reconstruct a small increase in violence towards A.D. 900 as the Pueblo I villages, which began to appear in the mid-700s, were collapsing.

The Middle period, from A.D. 900–1150—roughly coinciding with the emplacement of the Chacoan system over much of the Pueblo Southwest—is marked, in LeBlanc’s reading, by a substantial decrease in evidence for most kinds of violence. He does however note the presence of processed human bone suggesting cannibalism, and more generally of an abundance of “badly treated bodies.” His (LeBlanc 1999:176–180) analysis suggests that such individuals are especially prevalent within Great House communities. Kuckelman et al. (2000) refer to this form of violence as episodes of “extreme processing” (EP). Lekson (2002:614) interprets these “EP events” as “group executions,” emphasizing their coercive role in inducing compliance with the Chaco hegemon (see also Turner and Turner 1999:477–483). Kohler and Turner (2006) interpret sex ratios significantly skewed towards females in the San Juan Basin (first in the Chaco area in the 1000s, and then in the Aztec area in the 1200s) and towards males in the northern San Juan in the 1200s, as evidence that the Chaco polity raided women from the north. Martin (1997) identifies a group of women in the La Plata valley of the northern San Juan region who were subjected to violence and whose bodies were often haphazardly deposited. In sum, it is not clear whether violence was indeed less common during this period, though it does appear that it changed in character.

LeBlanc’s Late period (1999; A.D. 1150–1600) was by his analysis marked by greatly increased conflict. Aggregation accelerated in many areas in the early 1200s, often in locations with defensive advantages or features, and in places where domestic water could be secured; aggregation continued progressively into the early 1300s. LeBlanc suggests this trend began in the northern Southwest and spread southward over time. The resultant large residential sites often seem to be organized into intervisible clusters that may represent alliances. Non-formally buried bodies, scalping, sex ratios skewed towards females, and (post-A.D. 1300) rock art and kiva murals all suggest increased conflict in the Late period. Kuckelman (2010) and colleagues (Kuckelman et al. 2002) document compelling evidence for massacres from recent excavations at two large late Pueblo III villages in the central Mesa Verde region. Lambert (2002:219–224) summa-

rizes evidence suggesting that warfare in the Southwest was most prevalent from A.D. 1250 to 1400. Interpretations of rock art in the Southwest generally find war iconography to be unusual prior to A.D. 1300 in ancestral Pueblo regions, but very common after that, particularly in the Rio Grande valley (Schaafsma 2000).

Given this large and fairly recent literature, why is another publication on this topic warranted? One reason is that our results refine the chronologies and in some cases revise arguments made in these earlier works. Just as important is the task of developing consistent, ratio-level measures of violence in prehistory. It is difficult to synthesize evidence of a burned structure here, or a possible defensive site placement there, into anything more than an ordinal-level representation (at best) of the prevalence of conflict through time, especially since categories of evidence may differ from region to region. Consequently we focus on one index—trauma to human bone—that is undeniably related to human suffering, can often be related to conflict, and can be counted relatively unambiguously. This allows us to assess levels of violence in a consistent fashion in two separate but historically related portions of the Southwest.

Causes of Conflict

Theories seeking to explain warfare are extremely diverse. Of course, not all the violence summarized here can be attributed to warfare, but some undoubtedly can. Drawing on perspectives developed in political science and economics, Levy (1989) classifies theories of warfare among nation-states over the last 500 years into three major groups. Most generally there are systemic theories that locate causation in the structural characteristics of the environment (including the political or economic environment) common to all the state actors. These include balance of power, expected utility of war, and game-theoretic approaches considering states as actors. A second group of theories attributes causation to the nature of particular states and societies; for example Marx and Lenin attributed all international conflict to the internal dynamics of capitalist systems, whereas Waltz’s (1979) theory of great power imperialism says that the greatest powers at any time build empires, and in the modern era those

have been mostly built by capitalist nations because of the efficiency of their economic systems. A third group of approaches—arguably out of the reach of archaeologists—emphasizes the nature of the decision-making processes followed by policy makers, especially during crises. Levy finds no one theory, or group of theories, entirely satisfactory, concluding that some seem to work under some conditions, others under other conditions, but that these conditions are never adequately specified.

Explanations for conflict in smaller-scale societies are scarcely more settled. Keeley (1996: Table 8.1) compiled cross-cultural data on the motives and causes for warfare in nonstate societies. Leading his list are revenge for killing, retaliation, defense, plunder, capture of women, and seizing of resources such as land, pigs, horses, and so forth. On the category of “subjugation and tribute” states and nonstate societies contrast extremely strongly; this motivation, though very common among states, is virtually absent in nonstate societies.

While acknowledging that a desire for vengeance and many other local and often proximate factors may contribute to specific outbreaks of violence, LeBlanc (2007:15; see also LeBlanc 1999) concluded that “much warfare in the past was [ultimately] over scarce resources” (arable land, water, hunting territories, or women in cases where scarcity might be caused by high rates of polygyny among elites). Resources may become scarce either as climate deteriorates (holding population and technology constant), or as population increases (holding climate and technology constant). This sort of explanation is a variant of Choucri and North’s (1975) lateral pressure theory of conflict—a systemic-level theory that emphasizes increasing population often accompanied by technological advances as stimulating demand for resources, generating pressure to expand spatially through force or alliance formation.

Turchin and Korotayev (2006:114) propose a dynamic variant on the resource-stress hypothesis that they suggest is applicable to internal warfare, defined as follows:

In small-scale stateless societies internal warfare occurs between culturally similar groups, and we expect that population dynamics will most directly affect this type of conflict. Exter-

nal war, by contrast, reflects the characteristics not only of the society studied, but also of its alien adversary... The external wars waged by empires appear to have been determined by causes rather different from population pressure. In fact, most historical empires were continuously involved in external warfare aimed at territorial conquest.

They suggest that the relationship between population and intensity of internal warfare in stateless societies can be represented by a simple nonlinear dynamical system in which population growth leads to increased warfare. Increased warfare in turn causes population numbers to decline.³ This expectation assumes that warfare is typically over limited resources, and that there is no structural change in resource availability (such as a change in technology, subsistence base, intensification, or productivity) within the period examined. In cases where this model applies, population and violence will cycle in a counterclockwise direction through time when graphed as a phase plot (Cole 2012:Figure 13.1). For this model to apply the system must be approximately closed; there can be no large population fluxes or contacts leading to external war.

A variant on the “resource stress” theme is that resource *unpredictability* leads to conflict. This is one of two causes for warfare proposed by Ember and Ember (1992, 1994) drawing on cross-cultural research, and their model was subsequently applied to the Southwest by Lekson (2002). Lekson used a composite dendrochronological series representing the Colorado Plateau as a whole (Dean 1988, 1996) to identify four periods of high temporal variability: A.D. 310–380, A.D. 750–1000, A.D. 1250–1560, and A.D. 1750–1825. He compared these with LeBlanc’s (1999) discussions of types and intensity of warfare. LeBlanc did not discuss Dean’s latest period, and Lekson found little data relevant to the 300s. Lekson however sees a match between the high climatic variability in the two middle periods and LeBlanc’s reconstruction of prevalent conflict in these two periods. Lekson also considers the low climatic variability between A.D. 1000 and 1250 to line up with a period of low conflict, except for the EP events mentioned above. These are elucidated by recourse to a second explanation for warfare by Ember and Ember (1992), for which they found less statistical

support: “socialization for fear.” Lekson (2002:618) suggests that the EP events were institutionalized violence emanating first from Chaco and then from Aztec to maintain political control through socialization for fear.

Although resource competition stimulated by population growth or climatic deterioration has dominated discourse on the causes for warfare in the Southwest and in precolumbian North America more generally (Lambert 2002:230), technological innovations have also sometimes been invoked as causes. The most obvious innovation to consider is the bow and arrow, a technology employed in both hunting and warfare. Reed and Geib (2013) note that some use of the bow and arrow may appear in the Southwest as early as A.D. 100, though they become widespread only during the fifth century A.D. (see also LeBlanc 1999:101; Reed 2010). These early weapons were simple (self) bows using compound arrows with reed main shafts (LeBlanc 1997). Their introduction thus postdated the famous massacre of Cave 7, but preceded by more than 400 years the rise of violence associated with the collapse of Pueblo I villages. It is therefore difficult to link the introduction of this technology to an immediate increase in conflict in the Southwest.⁴

A rival theory suggests that new weapons like the bow and arrow reduce the costs of punishing defectors within groups, allowing larger groups to emerge (Bingham 2000; Reed 2010). In the Southwest, these larger groups were likely more sedentary than earlier groups, and also grew more rapidly in size (Kohler et al. 2008). Therefore the bow and arrow might have had an indirect role in fostering between-group competition and eventually violence, but if so the causal path was apparently indirect, and the effect on violence, delayed.

However, technological innovations may have influenced the character and/or intensity of warfare during the late prehispanic period. A recurved, sinew-backed bow with solid wood arrows was introduced to the Southwest sometime between A.D. 1200 and 1400 (LeBlanc 1997). The earliest archaeological example of a sinew-backed bow of which we are aware was found in Promontory Caves adjacent to Great Salt Lake (Steward 2009:17), in association with sub-Arctic-style moccasins recently AMS dated to the thirteenth century (Ives 2014; Steward 2009:69–70; Wilson

2011:227–230). These bows launched heavier projectiles at higher velocities and over longer distances, and thus represent a significant technological advance. Such bows are common in rock art and kiva mural art postdating A.D. 1325 (Schaafsma 2007), and depictions of large, decorated and fringed rawhide shields are also common in rock art and kiva murals from the 1300s and 1400s. Earlier shields are known, but these were generally of coiled basketry and lacked the large diameter, intricate decoration, and fringing of rawhide shields (LeBlanc 1997:263). LeBlanc suggests that rawhide, with its greater toughness, became preferred as more powerful recurved bows and solid wood arrows appeared. It is possible that these new technologies contributed to the spate of violence and population movements of the 1200s, depending on the dating of the recurved bow/solid wood arrow/hide shield complex.⁵

In the Supplemental Information we describe our methods for inferring levels of violence from human remains and for generating estimates of potential maize production and human population sizes through time. Below we use those series to evaluate several forms of the resource competition hypothesis in our two study areas. Finally, we discuss possible explanations for the large differences in the prevalence and structure of violence in the CMV and in the NRG documented here.

Results

Supplemental Table 1 summarizes the types and frequencies of violence reported in the literature we assessed for each region. The main qualitative difference between the two regions is the absence in the NRG of “extreme processing,” which is the most common type of trauma in the CMV. Cole (2007) found that in the CMV such trauma occurs primarily between A.D. 1020 and 1180, and that it was especially common in the mid-1100s—a conclusion also reached by Billman et al. 2000. However, additional instances occurred around A.D. 900 and 1000, and a final burst of this type of violence was prominent between A.D. 1260 and 1280. Overall, as the bottom rows in Supplemental Tables 2 and 3 demonstrate, the proportion of traumatized individuals is almost three times higher in the CMV than in the NRG.

Embedded projectile points or damage from

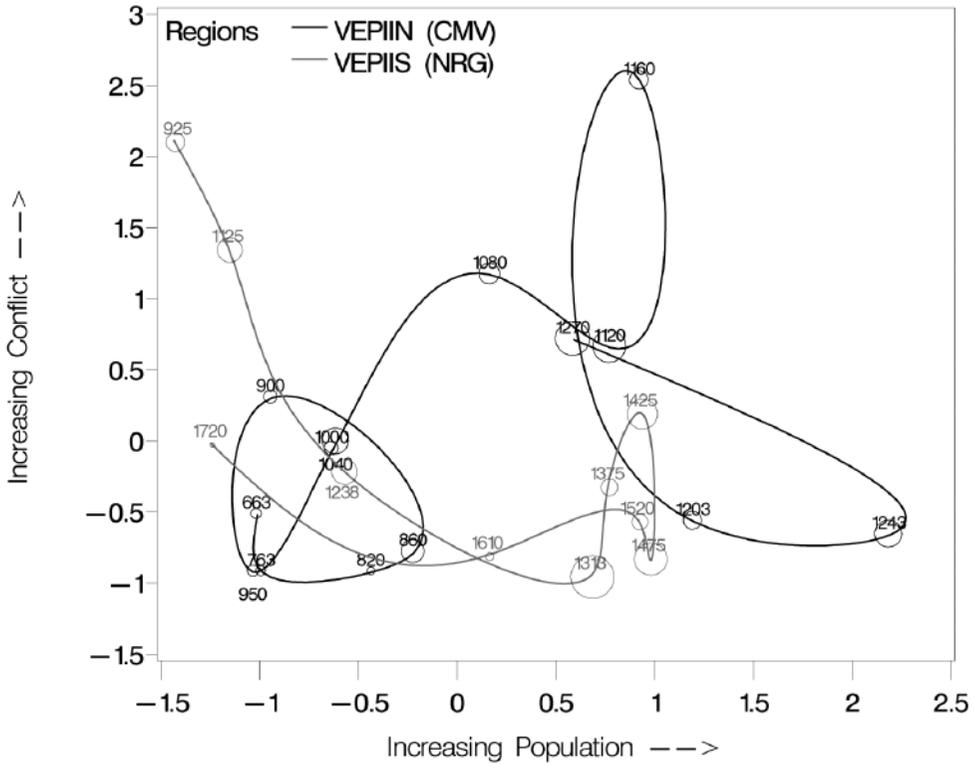


Figure 2. Trajectories through Conflict/Population Phase Space in the CMV and NRG. Years A.D. mark midpoints of periods. Conflict index (W) and population have been standardized separately for each region. Circle sizes at period midpoints are proportional to sample sizes of human remains.

projectiles are also noted in Table 1 but do not contribute much to the overall totals. Cole (2007) recorded only three instances of such damage in her sample of 621 individuals from the CMV (~.5 percent of the traumatized individuals). The chances of dying with a projectile point embedded in one's body were twice as high, though still absolutely low, in the NRG, where we noted 9 instances in a sample of 862 individuals (~ 1 percent).

Central Mesa Verde

Supplemental Table 2 reproduces Cole's (2007, 2012) results for the 14 periods between A.D. 600 and 1280 recognized by the Village Ecodynamics Project (VEP), to which we add a column containing the average potential maize production for each period based on our high-frequency Village Ecodynamic Project I (VEPI) reconstruction (Kohler 2012), divided by the average momentary population for each period, yielding potential maize production per capita for each period.

These values have been standardized to a mean of 0 and a standard deviation of 1. Figure 2 uses data from this table to plot the time trajectory of the conflict index (W) relative to regional population size in the CMV as a black line; periods are plotted on their midpoints and connected in phase space with a spline.

Figure 2 shows that in the CMV, both population and conflict were low during the first 400 years of occupation (A.D. 600 to the early/mid 1000s). They cycle through the phase space in a counter-clockwise fashion, as predicted by the Turchin-Korotayev model (this happens when population growth or decline leads to growth or decline in conflict.) This relationship breaks down in the late 1000s when both violence and population increased dramatically. From A.D. 1100–1140, additional increase in population was accompanied by a slight decrease in conflict, but there was no *pax Chaco* in the CMV. Then, between A.D. 1140 and 1180, in conjunction with

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the break-up of the Chacoan regional system, there was a very large increase in conflict in the context of stable population levels. Conflict declined dramatically during the next two periods, even as population increased, but spiked one last time between A.D. 1260 and 1280, as Mesa Verde society fell apart and the final depopulation took place.

Northern Rio Grande

Drawing on data from Supplemental Table 3, Figure 2 also plots the time trajectory of standardized *W* relative to the standardized regional population size in the NRG as a grey line, beginning in the upper left-hand corner with the midpoint of period 1 at 925. The standardization of *W* and the regional population size was done separately for each region, yielding a graph in which the trajectories track experiences local to each region. As revealed by this figure, the combination of high conflict and low population in the NRG has no counterpart in the CMV. Remarkably, and in contrast to the period of expansion of populations in the CMV from the late 1000s through the late 1100s, population growth in the NRG during the 1100s and 1200s was accompanied by a general *decline* in conflict, followed by a modest uptick in the first half of the 1400s. Levels of conflict apparently remained low until the end of our sequence, though sample sizes are small and likely not representative for the early historic periods (Supplemental Table 3).

The combination of high population and low conflict enjoyed in the NRG from the early 1300s through the late 1500s contrasts with a weak tendency for high population levels to be accompanied by violence in the CMV. However, the combination of low violence and high populations in the Classic period NRG does bear some similarities to conditions in the early and mid-1200s in the CMV. Glowacki and Ortman (2012; see also Lipe and Ortman 2000) document a series of architectural changes in community centers built during the last century of the CMV occupation. These include a more inwardly focused stance frequently centered on canyon rims and springs; increasing importance of plazas, which were more inclusive than the great kivas; the rise of multi-walled structures, possibly associated with specific sub-groups within sites; and a marked increase in enclosing walls and towers. It is possible

that these architectural changes were harbingers of the social changes that enabled dense populations to live in relative harmony in subsequent centuries in the NRG.

Discussion

Conflict and Population in Phase Space

Figure 2 demonstrates that high levels of violence were not stable in either area; extreme violence seems to have been sporadic and short-lived relative to the long-term trends. This suggests that although revenge may be an important motive for violence, the willingness to participate in violence eventually decays. It is interesting too that neither society spent significant time close to the average values for conflict and population size (that is, near the 0,0 coordinates on the graph). This emphasizes the highly dynamic and far-from-equilibrium character of these societies, and perhaps of human societies in general. The ethnographer's dilemma is therefore this: a student of these societies would draw entirely different conclusions about the nature and prevalence of violence, depending on when the data were collected. Although constant change was more the norm than stability, the early (A.D. 600–1020) societies in the north, and the Classic period (post-A.D. 1310 but prehispanic) societies in the south, represent relatively stable attractors in these dynamics. We suggest they represent two distinct and relatively stable forms of economy and society; the chaotic conditions separating them reflect the difficulty of transforming one into the other.

Conflict and Migration

There were two periods of population decline in the CMV: one from the late 800s through the mid-900s, and the second in the mid-to-late 1200s. Since violence posing a threat to personal safety is a factor in peoples' decisions about whether to leave an area—as suggested by a great deal of evidence from the modern world (e.g., Williams and Pradhan 2009)—it may be significant that both episodes of depopulation in the CMV took place during local peaks of violence. If emigrants decide where to go partly in response to prevalence of conflict in possible destinations, the NRG would have been an improbable choice

in the early 900s—when levels of violence there were high—but an attractive option in the 1200s. In fact, we know of no evidence for immigration from the CMV to the NRG in the 900s, whereas a substantial body of evidence argues for large-scale population movement from the CMV to the NRG during the 1200s (Ortman 2012).

Causes for Violence

The relatively good fit of the Turchin-Korotayev model to the first 400 years of the CMV series is evident from Figure 2 and has been explored in detail, and statistically, in Kohler et al. (2009) and Cole (2012). However, this model does not fit the final 300 years of the CMV sequence, nor does it fit the NRG series in any obvious way.⁶ The failure of this model for these later times may be due to a violation of its assumption of a closed system. Depending on one's point of view, the CMV was either overwhelmed by, or converted to, the Chacoan regional system in the mid-1000s. Some of us have suggested that the rise of violence in the later 1000s CMV reflects local resistance to this domination (Kohler et al. 2009). Likewise, the NRG was clearly not closed to immigration in 1200s, and was also intruded upon by the Spanish in the 1500s.

In both areas (though with greater authority in the CMV), we can assess another version of the Turchin-Korotayev model: that warfare is caused by resource shortages. For the CMV we regressed *W* on several different quantities, including average potential maize production in each period, standard deviation of potential maize productivity in each period, average potential maize production in the previous period, potential maize production per capita, potential maize production per capita in the previous period, current population, and population in the previous period. Remarkably, given the widespread opinion that warfare is related to production shortfalls, there is no linear relationship between average potential maize productivity and *W* across periods ($r^2 = .004$; $Pr > F = .94$). Nor is there a significant dependency of conflict on current population size ($r^2 = .08$; $Pr > F = .35$) or population in the previous period ($r^2 = .14$; $Pr > F = .22$). If the Turchin-Korotayev model pertained throughout this sequence, we would expect the relationship between *W* and lagged population to be stronger. The re-

lationship between population in the previous period and *W* is indeed stronger than it is for the current population and *W*, but neither relationship is significant.

There is however a weak and marginally significant relationship in the expected direction if one regresses *W* on measures of *per capita* potential production, both for the current period ($r^2 = .18$, $Pr > F = .14$) and for the previous period ($r^2 = .21$, $Pr > F = .12$). The second model is an alternative construal of the Turchin-Korotayev model that makes the implicit effects of population on resource availability explicit. There is no significant difference between these two models in their degree of fit. We illustrate the first of these statistical models in Figure 3. This figure shows that in the CMV there is a weak tendency for higher violence to be correlated with lower potential maize production per capita.

The strongest linear relationship we observed is for conflict to increase along with *variability* in potential maize production (Figure 4). This is a version of the model proposed by Ember and Ember (1992) who called this resource unpredictability (see also Lekson 2002). Here we quantify resource unpredictability as the standard deviation of the potential maize production in each period.

In Figure 3, eight of our 14 periods fall within the 95 percent confidence interval for the fit, shown by the dashed lines. Two periods, however (A.D. 1060–1100 and A.D. 1140–1180) are markedly more violent than their per capita resource production predicts. These periods correspond to the incorporation of the CMV into the Chacoan regional system, and its later collapse (or relocation), respectively. On the other hand, successive periods in mid-to-late Pueblo I (A.D. 800–840, A.D. 840–880) and mid-to-late Pueblo III (A.D. 1180–1225, A.D. 1225–1260) are markedly *less* violent than their per capita production predicts. One function of successful human organizations is to foster harmonious conditions. Ember et al. (1992), for example, have shown that polities with more internal political participation are less likely to engage in internal warfare. We suggest the conditions in these periods reflect the successful operation of *civitas* (using this word broadly, to imply a shared sense of community and a common purpose resulting

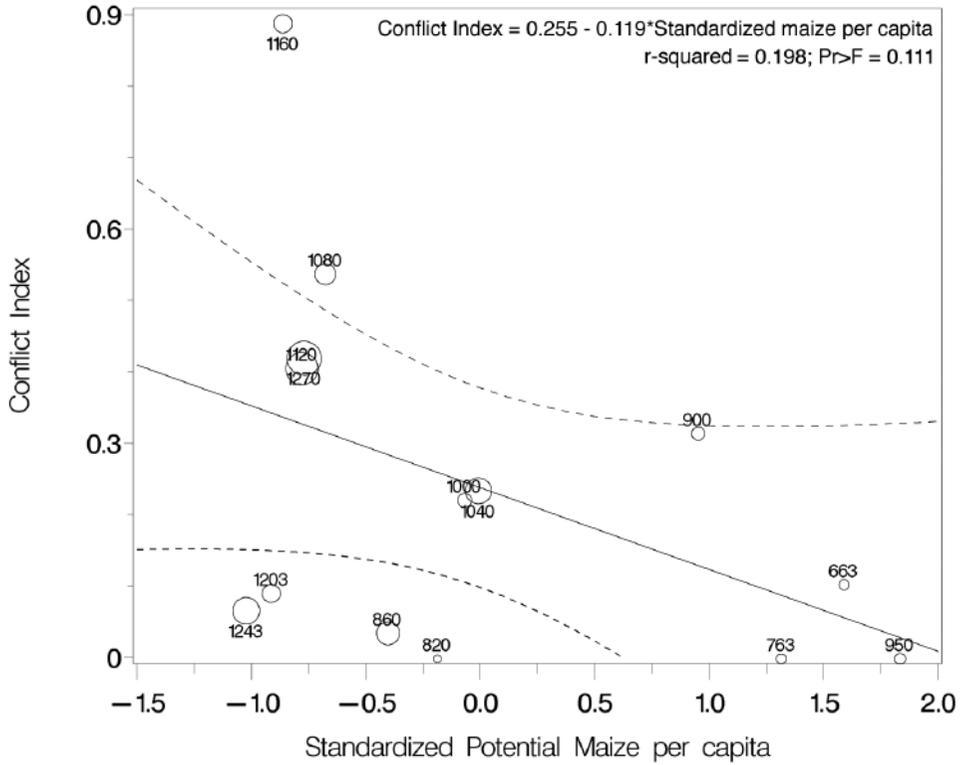


Figure 3. Regression of conflict index (W) on standardized potential maize per capita, CMV. 95-percent confidence interval for fit shown with dotted lines. Circle sizes are proportional to sample sizes of human remains (Supplemental Table 2).

from, or leading to, the successful operation of a polity and a ceremonial system). In these periods polities—communities—were able to override structural tendencies for violence to co-occur with low per capita resource availability.⁷ It is important to note however that the sample size for the A.D. 800–840 period is the smallest of the entire series ($n = 6$, Supplemental Table 2), and that an example of a large massacre dating to around A.D. 800, and interpreted as interethnic conflict, has recently been reported for the Durango area, just to the east of the CMV (Potter and Chuipka 2010). Another note of caution is that potentially defensive aggregation begins early in the 1200s in the CMV, and that some sets of human remains assigned to the A.D. 1260–1280 period show healed trauma possibly incurred in the previous period. Thus our W index may underestimate violence in the A.D. 1225–1260 period.⁸

Similar patterns are evident in Figure 4, where all periods from A.D. 600–980 (except A.D. 880–

920) are less violent than their resource variance would predict. On the other hand, four periods—A.D. 1020–1060, A.D. 1060–1100, A.D. 1140–1180, and A.D. 1260–1280—are more violent than their resource variance predicts. The first two of these may represent local resistance to the spread of the Chacoan regional system, as we have argued; the third, violence surrounding the breakup or redefinition of that system; and the last, the final depopulation.

It is interesting that the period of final depopulation—though marred by massacres of several villages—was not more violent than its per capita *production* would predict, though it was more violent than its resource *variance* predicts. The continual low productive potential of the landscape in conjunction with the still-numerous inhabitants may therefore have been a greater problem in the late 1200s than was variance in production. In light of the contrast with the previous two periods, however, it is possible

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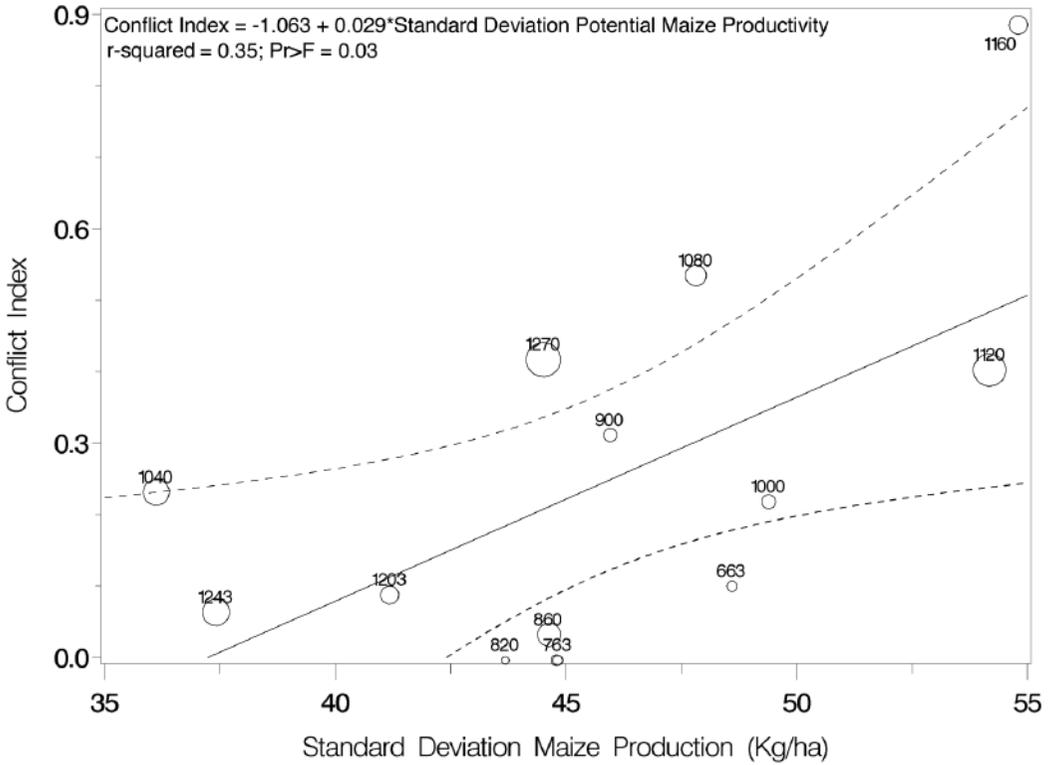


Figure 4. Regression of conflict index (W) on standard deviation potential maize production, CMV. 95-percent confidence interval for fit shown with dotted lines. Circle sizes are proportional to sample sizes of human remains (Supplemental Table 2).

to infer that this late increase in violence was also permitted by the failure of the political institutions in place earlier in the century.⁹

As explained in the Supplemental Information, we do not yet have a reconstruction of potential maize production for the NRG. We therefore developed a temporary proxy for production based on regional precipitation reconstructed from tree rings and repeated the analyses above, substituting this measure for the maize production estimates. As might be predicted from Figure 2, our results contrast in most cases with the results for the CMV. In the NRG, violence decreases as: (1) current population increases; (2) current production decreases; (3) production per capita decreases; (4) current variance in production decreases; (5) previous period population decreases; and (6) previous period production per capita decreases. Not all of these are significant, but all except (4), which is not significant, contrast in sign with results from the CMV. Figure 5 displays

the third relationship, which is both statistically significant and analogous to Figure 3. The positive relationship between the per capita production proxy and W is driven almost entirely by the Early Developmental (A.D. 800–1050) data point, in a wet period with low population but exhibiting a great deal of conflict, and its strong contrast with three late periods with low production per capita (A.D. 1680–1760, A.D. 1450–1500, and A.D. 1540–1680) that were also accompanied by relatively low violence.

Why Are the CMV and NRG So Different?

We think the tendency for violence to accompany conditions that were propitious for maize production in the NRG is largely fortuitous; it is an example of historical factors overriding structural tendencies. However, the precise order and relative importance of these historical factors has yet to be disentangled. The high violence during the Early Developmental expansion of farmers in the

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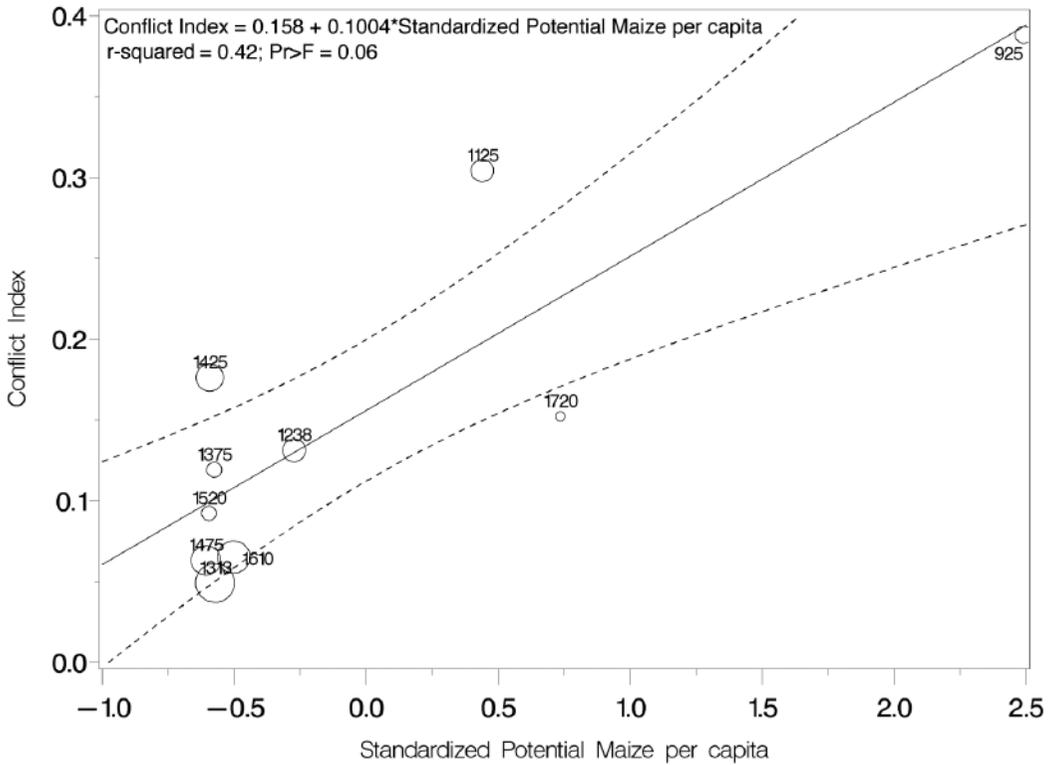


Figure 5. Regression of conflict index (W) on standardized potential maize per capita, NRG. 95-percent confidence interval for fit shown with dotted lines. Circle sizes are proportional to sample sizes of human remains (Supplemental Table 3).

NRG may be due to conflict between farmers and lingering foragers (Vierra and Ford 2007) or may reflect a highly disputatious process of claiming productive lands among the farmers themselves (we note however that the analogous periods in the CMV, the 600s and 700s, were marked by little conflict.)

There are numerous possible reasons why, beginning in the early 1300s through the arrival of the Spanish, conditions in the NRG were comparatively peaceful despite high population and poor productive conditions. First, in the NRG, surface water and precipitation were managed to a much greater extent than in the CMV through irrigation and run-off channels, cobble bordering of plots and gravel mulching (Duwe and Anschuetz 2013:103). Harvesting water from larger upslope catchments, capturing precipitation in cobble-bordered cells, and reducing evapotranspiration through mulching meant that NRG farmers were less sensitive to local precipitation fluctuations than were earlier farmers in the CMV,

who depended almost exclusively on local precipitation.

Second, NRG households identified with more inclusive levels of social organization than with their local kin groups, reducing a source of stress and potential conflict that must have been a constant irritant in the CMV. Lipe (1989) demonstrates that the social scale of protokivas and kivas in the CMV was quite small, restricted in most cases to one or a few economically cooperative households, and that the social scale of kiva use increased dramatically in the post-migration NRG (see also Steward 1937). Classic period NRG towns not only became much larger than CMV villages, but were also organized around very large plazas that provided public, participatory foci for large groups of people (Adams 1989; Chamberlin 2011; Graves and Van Keuren 2011). This plaza orientation and increasing social scale for kivas began in the Late Coalition period (A.D. 1275–1325; Kohler and Root 2004), apparently leading in time to many of the other factors that

differentiate the NRG from the CMV (see Lipe 2010 for more discussion).

Third, and intimately linked to the previous point, religious and ceremonial innovations and stylistic shifts strongly differentiate post-A.D. 1310 NRG practices from earlier practices in the CMV. These include contrasts in the frequency, placement, and content of rock art (Munson 2011);¹⁰ the much greater abundance and changed content of kiva murals (Newsome and Hays-Gilpin 2011); imagery on and technology of ceramics that seem connected to regional developments extending well to the west (Crown 1994; Van Keuren and Glowacki 2011; Ware and Blinman 2000); changes in religious discourse embedded in Pueblo languages (Ortman 2011); and the inter-Pueblo circulation favored by periodic large public performances linking adjacent pueblos and their populations into complex networks of interaction and dependency (Ford 1972a). A key element in these changes was the development of pan-Rio Grande sodalities in which prospective initiates journeyed to communities where the sodality originated for training and installation before returning to their home pueblo (Ortiz 1994). Another element likely involved the spread of the Katsina religion. Although some commentators suggest that the spread of the Katsinam caused conflict with preexisting sodalities and societies, and that it may have weakened the power and prestige of women in ceremonial practice, most archaeologists conclude that these new practices had an “extraordinary ability to bridge divisions of ethnolinguistic identity and create new forms of trans-community identification” (Brooks 2013:751). A final element was the increasing importance of moieties as nonexogamous, dual tribal sodalities that structured community ritual and leadership. Moieties probably existed in some form prior to the final migrations from the CMV (Bernhart and Ortman 2014; Lipe and Ortman 2000), but a case can be made that their functions expanded and importance increased in the immediate post-migration period. Fowles (2005), for example, argues that moieties are visible by the late 1200s in the ancestral northern Tiwa site of Pot Creek (T’aitōna). He (Fowles 2005:43) cites Taos oral history linking moiety identification with the acceptance by the Summer People of the Winter People “as a lower-status

group” into the pueblo, a process he connects with concurrent in-migration to the NRG.

Fourth—and likewise linked to the previous point—the economic system of the NRG seems to have been undergoing a shift from the kin-based productive system characteristic of earlier periods to a more community-based system with significant village-level specialization and regularized intercommunity exchange (Cordell and Habicht-Mauche 2012; Ford 1972b; Kohler, Herr, and Root 2004). One symptom of this is the rise of craft economies and production for exchange in cotton, obsidian, and ceramics and possibly tobacco, maize, and deer products; another is the much greater volume and spatial span of exchange (Curewitz 2008:469–533), including dramatic increases in the volume of exchange with Plains peoples (Baugh 2008; Blakeslee and Hawley 2006; Brosowske and Bevitt 2006; Habicht-Mauche 1987; Leonard 2006; Spielmann 1983, 1991; Vehik 2002, 2006). Incipient markets may have been linked to periodic religious performances and likely used the same plaza spaces. These changes likewise created complex dependencies that crosscut households, moieties, pueblos, and (sometimes) linguistic groups (Ford 1972b). As Spielmann (2004:142) points out, the large quantities of bulky goods like ceramic bowls that were moving long distances in the PIV Southwest suggest relatively pacific conditions, as “hostile landscapes strongly curtail exchange.”

Fifth, although individual pueblos have a fiercely independent streak today, there nevertheless seems to have been some spatial clustering of Classic period pueblos, with vacant lands between clusters, suggesting cooperation among the pueblos within a cluster (Wilcox 1981:382–389). Spielmann (1994) proposed that these represent confederacies in which individual pueblos coordinated their actions with nearby friendly pueblos via inter-Pueblo councils of elderly males—a model in keeping with most of the available ethnohistoric documentation. Warfare, then, may have been largely confined to struggles between confederacies, spatially removing most members of most pueblos from conflict most of the time. Towns likely competed for ceremonial and economic prominence within clusters determined by ethnolinguistic similarity and proximity, but their leaders developed ways to defuse conflict within

these clusters. By contrast, with the exception of the Chacoan years (A.D. 1080–1140/1180)—which as we have seen had their own problems—it is unclear whether the villages of the CMV ever developed political systems of a scale that could deter intervillage conflict. Kohler and Varien (2010) used rank-size graphs and the data on violence organized by Cole (2007) and summarized above to suggest that in the A.D. 1180–1260 interval portions of the CMV may have been organized into confederacies. If so, such systems appear to have been short-lived in comparison with the stable settlement clusters apparent in the NRG.

Extra-Regional Comparisons

In this study we do not try to separate lethal and nonlethal trauma. We can be quite certain however that the type of violence we coded as “human modification and disarticulation in the form of extreme processing” was always lethal. Making the extremely conservative assumption that *only* this type of violence was lethal, we can calculate that at least 21.9 percent (136/621) of all deaths (for which we have remains) in the CMV were due to lethal conflict. If we pool these two populations, we calculate an overall minimum death rate from violence of about 9.2 percent for a period spanning about 1,200 years. The CMV rate exactly ties that tabulated by Keeley (1996:Table 6.2) for the Yanamamo-Shamatari, which is second only to the Jivaro who at 32.7 percent suffered the highest percentage of deaths by violence among the 11 ethnographic samples collected in this table. Of the 14 prehistoric societies in the same table, the CMV ranks fifth of 14 societies tabulated, after the Qadan burials in Nubia of 10,000 B.C. (21.4 percent) and before Illinois in A.D. 1300 (16.3 percent).

Somewhat more comparable to our data is the incidence of adult cranial trauma tabulated for the prehispanic Andes by Arkush and Tung (2013), where 20.5 percent of all adults exhibited antemortem or perimortem skull trauma. They found that intensity of conflict was highly variable across space and through time with some concentration in two periods (~400 B.C.–A.D. 100, and ~A.D. 1000–1450). The first of these represents the Final Formative, a period of emerging social stratification and elite rivalry, accompanied

by a failure of previous political systems. The second encompasses the violent collapse of the Wari and Tiwanaku states and the chaotic interregnum preceding the rise of the Inka empire.

If we sum our cranial trauma and our “human modification and disarticulation in the form of extreme processing” to create an index that is roughly comparable to that computed by Arkush and Tung (2013), we find that across both regions and all periods about 16.9 percent (253/1483) of the Pueblo population evidenced cranial trauma. This is somewhat lower than the overall frequency for the prehispanic Andes. For just the CMV, the rate of such trauma is about 29.7 percent; for the NRG, it is about 7.9 percent.

Summary and Conclusions

Across time and space, the more peaceable societies also tend to be richer, healthier, better educated, better governed, more respectful of their women, and more likely to engage in trade. It's not easy to tell which of these happy traits got the virtuous circle started and which went along for the ride... [Pinker 2011:xxii].

Overall, the records of conflict we collected show low levels of violence until around A.D. 900–1000. As early as we can compute W indices from both areas, the CMV and NRG were already on divergent paths. A trend towards reduced violence through time in the south contrasts with a surge in violence from the late 1000s through the late 1200s in the north, interrupted by a calm early-to-mid 1200s.

In the CMV between A.D. 600 and 1280 there was a weak tendency for decreases in per capita production to lead to increased violence, tenuously supporting much recent thinking by archaeologists about the causes of warfare. A propensity for periods with high variance in production to have increased violence is also evident in the CMV. Both tendencies however were regularly overridden by historical political events, especially the expansion of the Chacoan regional system (A.D. 1060–1140), which appears to have been resisted in some quarters, and the collapse or relocation of this system during the A.D. 1140–1180 period, which precipitated levels of violence that are hard to comprehend. More positively, the

surprising nonviolence of the early and mid-Pueblo I, and mid- and late Pueblo III (till A.D. 1260) in this area might be attributed to the successful operation of *civitas*. It is possible that Pueblo III villages during this period were linked in confederacies that contributed to the apparent absence of intervillage strife. The final collapse of these societies was marked by an environmental crisis and a failure of normal sociopolitical process, with violent results.

Overall, the central Mesa Verde ranks among the most violent societies studied by anthropologists or archaeologists. The Chaco polity, with its tendencies towards expansion, subjugation, and apparent coercive use of violence intensified but did not create the use of group-level extermination, which was already part of the northern San Juan tradition by Pueblo I times (Potter and Chuiyka 2010) and quite possibly earlier, as the Cave 7 evidence suggests.

By the mid-to-late 1200s many survivors of the final collapse of the CMV ended up in the northern Rio Grande where they integrated with indigenous residents. Perhaps the new arrivals were determined not to repeat their experience in the CMV; certainly they brought practices developed earlier in the CMV that contributed to the rapid changes in NRG society of the late 1200s and 1300s. In any case, the immigrants contributed to and probably accelerated the emergence of a new way of living that included changes in subsistence practices, social identity, religious practice, economic structure and interaction, and architectural forms at the household, town, and landscape levels.

The common threads uniting these changes is that they signal that households were identifying with larger and more diverse groups and operating on a much wider social canvas, and that households were increasingly dependent on the correct operation of a broad range of other households and institutions whose activities were more complementary than redundant. So far as we can tell, the earliest of these changes involved the disappearance of the household-level kiva and the construction of small public plazas such as we see at Late Coalition sites like Burnt Mesa Pueblo on the Pajarito, and the more-or-less simultaneous appearance of moieties at sites like Pot Creek Pueblo. But it is difficult to isolate the many

changes mentioned above from each other. For example, recent research at the Burnt Corn community in the Galisteo Basin indicates that a variety of “place-making” practices were in place by the very late 1200s, including probable shrines of cupuled boulders and grinding slicks that speak, simultaneously, to strong community-level identification and probable realignment of ritual practices (Snead and Allen 2011).

Our documentation of a substantial decline in violence in these records—at least from the late 1200s through the arrival of the Spanish—has interesting parallels with portions of Pinker’s argument for a recent worldwide decline in violence and his understanding of its causes. He (Pinker 2011:42, 680–682) suggests that violence strongly declined beginning with the rise of the state (“the Leviathan”), since states attempt to suppress violence within their borders and remove rewards for crime. Our results here are mixed. One expansive polity (Chaco) seems to have encouraged conflict that was unleashed with full force in the immediate aftermath of its collapse. On the other hand, the stable confederacies we have suggested for the Classic period NRG may well have had a pacifying effect.

By Pinker’s (2011:77) analysis (rooted in the liberal economic tradition of Adam Smith, David Ricardo, and Montesquieu) the rise of commerce in the late Medieval period in Europe also created a positive-sum game, reducing violence by allowing people to redefine others as useful exchange partners rather than as competitors. This makes Pinker’s (2011:682–684) “gentle commerce” a pacifying force—an effect that seems to be strong in the records reviewed here, at least for the NRG.

Pinker does not reconstruct the secular decline of violence as a simple linear process; it had local reversals. In fact this is also true for the NRG, where the massacre of a number of young people, all or mostly males, in a kiva at Te’ewi recalls the well-known incident at Awatovi and results in an elevated W index for the early 1400s. For example, Pinker argues that the three-decade increase in violence in the United States, Canada, and Europe beginning in the mid-1960s, which he calls a “decivilizing” period, can be attributed not only to demography (the surge of baby boomers) but also to a profound change in atti-

tudes and values in that generation. Thus social norms and values may play a role in violence or its suppression. Is there any plausible archaeological evidence bearing on the degree to which norms were followed in the NRG? Perhaps. It has been noted that ceramics made in one Late Coalition plaza pueblo bear design motifs that are more similar to each other than were designs made in the same tradition, in the same area, in previous decades (Kohler, VanBuskirk, and Ruscavage-Barz 2004). The authors take this to be evidence of high conformity in this domain, and quite possibly symptomatic of conformity in other domains as well.

It is easier to demonstrate norm-following than it is to determine the content of norms. Yet, in light of the simultaneous decline in violence noted here, Benedict (1934:64–65) may have captured the Classic Period NRG ethos when she emphasized “sobriety and inoffensiveness” and “no anger” as Pueblo (Zuni) norms. And there is other supportive evidence for this view. Graves and Van Keuren (2011:264) note that large plaza-oriented pueblos began appearing across the Southwest in the late 1200s. In their view this new “panoptic” layout reflected “deep-seated changes in structural power relations” signaling “disciplinary power through which the practices of individuals and groups” could be constantly mutually monitored. Ware and Blinman (2000) argue that Koshare (clowns) were likely present in the NRG shortly after A.D. 1300, at least among the Keres, where their existence prior to the arrival of the Katsinam is suggested by the fact that the Koshare “manage” the Katsinam. Ortman (2012) presents evidence from oral tradition that Tewa clown societies were established during the period of migration to the NRG. This is significant because “the latent function of clowns cross culturally is social control and conformity maintenance” (J. Ware, personal communication 2013; see also Ortiz 1994:303). War captains (or war priests) were also zealous guardians of custom (Ellis 1951). So it may well be that the pacifist character of recent Pueblo societies actually took shape as a response to prior collective experience of a much more violent world. This is an encouraging thought.

In closing, this research demonstrates the utility of developing quantified measures of violence in prehistory, and the desirability of contextual-

izing these measures in demographic, political, and economic settings. We find remarkable differences in levels of violence through time within our two areas, and central tendencies in each are also markedly different. The central Mesa Verde emerges as a society in which violence, its threat, or its memory, was *omnipresent*. The process of settling farming societies in the northern Rio Grande from the 800s through the 1100s also appears to have been violent, but by the 1200s levels of violence there had declined considerably, and remained relatively low throughout the remainder of the sequence.

Secondly our results demonstrate that *both* deep-seated structural tendencies, and higher-frequency historical factors, must play a role in our descriptions of what happened in prehistory, and why. The structural element “determines the set of physically possible worlds within which the actual universe finds itself”; the historical element “determines which of these physically possible worlds, and in what order of succession, the universe comes to instantiate in its development” (McAllister 2002:46). In the CMV, per capita resource availability and resource variance played important structural roles in increasing or decreasing the likelihood of conflict. These tendencies were often overwhelmed by events in the CMV, and by sometime in the 1200s in the NRG these tendencies had been successfully suppressed. This—not the impressive buildings of downtown Chaco, built at costs we are just beginning to glimpse—was the greatest achievement of Pueblo societies.

Over 600 years after the new societies of the Late Coalition in the northern Rio Grande began to emerge, doing what any ethnographer would do and reporting the Pueblo world as she saw it, Ruth Benedict (1934) charmed her Depression-era audience with an apparently timeless story of pure Integration (see also Lekson 2008:55–56). Only archaeology can overcome the social anthropological metaphysics to describe and explain the processes and wrenching history by which Pueblo societies arrived at that point.

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Supplemental Materials. Supplemental materials are linked to the online version of the paper, which is accessible via the SAA member login at www.saa.org/members-login. Supplemental Table 1. Sites Used to Estimate Proportions of Human Remains with Trauma, Northern Rio Grande. Supplemental Table 2. Summary Data for Prevalence of Conflict in the Central Mesa Verde Region through Time. Supplemental Table 3. Summary Data, Sample Proveniences, Sizes, Prevalence of Conflict, and Production Estimates in the Northern Rio Grande Region through Time.

References Cited

- Adams, E. Charles
1989 Changing Form and Function in Western Pueblo Ceremonial Architecture from A.D. 1000 to A.D. 1500. In *The Architecture of Social Integration in Prehistoric Pueblos*, edited by William D. Lipe and Michelle Hegmon, pp. 155–160. Occasional Papers No. 1. Crow Canyon Archaeological Center, Cortez, Colorado.
- Arkush, Elizabeth, and Tiffany A. Tung
2013 Patterns of War in the Andes from the Archaic to the Late Horizon: Insights from Settlement Patterns and Cranial Trauma. *Journal of Archaeological Research* 21:307–369.
- Baugh, Timothy G.
2008 The Anthropologies of Trade and Exchange: An Essay on Kirikir'i*s and Southern Plains Political Economy. *Plains Anthropologist* 53:415–430.
- Benedict, Ruth
1934 *Patterns of Culture*. Houghton Mifflin, New York.
- Bernhart, Robert, and Scott G. Ortman
2014 New Evidence of Tewa-style Moieté Organization in the Mesa Verde Region, Colorado. In *Astronomy and Ceremony in the Prehistoric Southwest Revisited: Collaborations in Cultural Astronomy*, edited by Gregory E. Munson, Todd W. Bostwick, and Tony Hull, pp. 87–100. Anthropological Papers No. 9. Maxwell Museum of Anthropology, Albuquerque, New Mexico.
- Billman, Brian R., Patricia M. Lambert, and Banks L. Leonard
2000 Cannibalism, Warfare, and Drought in the Mesa Verde Region during the Twelfth Century AD. *American Antiquity* 65:145–178.
- Bingham, Paul M.
2000 Human Evolution and Human History: A Complete Theory. *Evolutionary Anthropology* 9:248–257.
- Blakeslee, Donald J., and Marlin F. Hawley
2006 The Great Bend Aspect. In *Kansas Archaeology*, edited by Robert J. Hoard and William E. Banks, pp. 165–179. University Press of Kansas, Lawrence.
- Bowles, Samuel
2009 Did Warfare among Ancestral Hunter-Gatherers Affect the Evolution of Human Social Behaviors? *Science* 324:1293–1298.
- Brooks, James F.
2013 Women, Men, and Cycles of Evangelism in the Southwest Borderlands, A.D. 750 to 1750. *American Historical Review* 118:738–764.
- Brosowske, Scott D., and C. Tod Bevitt
2006 Looking South: The Middle Ceramic Period in Southern Kansas and Beyond. In *Kansas Archaeology*, edited by Robert J. Hoard and William E. Banks, pp. 180–205. University Press of Kansas, Lawrence.
- Cater, John D.
2012 *Who Are These Dead? The Anthropology of Violence, Pit Structures, Power and Symbolism: Death in the Anasazi Culture of the American Southwest*. British Archaeological Report S2382. Archaeopress, Oxford.
- Chamberlin, Matthew A.
2011 Plazas, Performance and Symbolic Power in Ancestral Pueblo Religion. In *Religious Transformation in the Late Pre-Hispanic Pueblo World*, edited by Donna M. Glowacki and Scott Van Keuren, pp. 130–152. University of Arizona Press, Tucson.
- Choucri, Nazli, and R. C. North
1975 *Nations in Conflict*. Freeman, San Francisco, California.
- Cole, Sarah M.
2007 Population Dynamics and Sociopolitical Instability in the Central Mesa Verde Region, A.D. 600–1280. Unpublished Master's thesis, Department of Anthropology, Washington State University, Pullman.
2012 Population Dynamics and Warfare in the Central Mesa Verde Region. In *Emergence and Collapse of Early Villages: Models of Central Mesa Verde Archaeology*, edited by Timothy A. Kohler and Mark D. Varien, pp. 197–218. University of California Press, Berkeley.
- Coltrain, Joan Brenner, Joel C. Janetski, and Michael D. Lewis
2012 A Re-assessment of Basketmaker II Cave 7: Massacre Site or Cemetery Context. *Journal of Archaeological Science* 39:2220–2230.
- Cordell, Linda S., and Judith A. Habicht-Mauche (editors)
2012 *Potters and Communities of Practice: Glaze Paint and Polychrome Pottery in the American Southwest, A.D. 1250–1700*. Anthropological Papers No. 75. University of Arizona, Tucson.
- Crown, Patricia L.
1994 *Ceramics and Ideology: Salado Polychrome Pottery*. University of New Mexico Press, Albuquerque.
- Curewitz, Diane C.
2008 *Changes in Northern Rio Grande Ceramic Production and Exchange, Late Coalition through Classic (A.D. 1250–1600)*. Ph.D. dissertation, Department of Anthropology, Washington State University, Pullman.
- Dean, Jeffrey S.
1988 Dendrochronology and Paleoenvironmental Reconstruction on the Colorado Plateau. In *The Anasazi in a Changing Environment*, edited by George J. Gumerman, pp. 119–167. Cambridge University Press, Cambridge.
1996 Demography, Environment, and Subsistence Stress. In *Evolving Complexity and Environmental Risk in the Prehistoric Southwest*, edited by Joseph A. Tainter and Bonnie Bagley Tainter, pp. 25–56. Addison-Wesley, Reading, Massachusetts.

- Duwe, Samuel, and Kurt F. Anschuetz
2013 Ecological Uncertainty and Organizational Flexibility on the Prehispanic Tewa Landscape: Notes from the Northern Frontier. In *From Mountaintop to Valley Bottom: Understanding Past Land Use in the Northern Rio Grande Valley, New Mexico*, edited by Bradley J. Vierra, pp. 95–112. University of Utah Press, Salt Lake City.
- Ellis, Florence Hawley
1951 Patterns of Aggression and the War Cult in Southwestern Pueblos. *Southwestern Journal of Anthropology* 7:177–201.
- Ember, Carol R., and Melvin Ember
1992 Resource Unpredictability, Mistrust, and War. *Journal of Conflict Resolution* 36:242–262.
1994 War, Socialization, and Interpersonal Violence: A Cross-Cultural Study. *Journal of Conflict Resolution* 38:620–646.
- Ember, Carol R., Melvin Ember, and Bruce Russett
1992 Peace between Participatory Polities: A Cross-Cultural Test of the “Democracies Rarely Fight Each Other” Hypothesis. *World Politics* 44: 573–599.
- Ford, Richard I.
1972a An Ecological Perspective on the Eastern Pueblos. In *New Perspectives on the Pueblos*, edited by Alfonso Ortiz, pp. 1–17. School for American Research Press, Santa Fe, New Mexico.
1972b Barter, Gift, or Violence: An Analysis of Tewa Intertribal Exchange. In *Social Exchange and Interaction*, edited by Edwin N. Wilmsen, pp. 21–45. Anthropological Papers No. 46. Museum of Anthropology, University of Michigan, Ann Arbor.
- Fowles, Severin M.
2005 Historical Contingency and the Prehistoric Foundations of Moiety Organization among the Eastern Pueblos. *Journal of Anthropological Research* 61:25–52.
- Fry, Douglas P., and Patrick Söderberg
2013 Lethal Aggression in Mobile Forager Bands and Implications for the Origins of War. *Science* 341:270–273.
- Geib, Phil R., and Winston B. Hurst
2013 Should Dates Trump Context? Evaluation of the Cave 7 Skeletal Assemblage Radiocarbon Dates. *Journal of Archaeological Science* 40:2754–2770.
- Glowacki, Donna M., and Scott G. Ortman
2012 Characterizing Community-Center (Village) Formation in the VEP Study Area, A.D. 600–1280. In *Emergence and Collapse of Early Villages: Models of Central Mesa Verde Archaeology*, edited by Timothy A. Kohler and Mark D. Varien, pp. 219–246. University of California Press, Berkeley.
- Graves, William M., and Scott Van Keuren
2011 Ancestral Pueblo Villages and the Panoptic Gaze of the Commune. *Cambridge Archaeological Journal* 21:263–283.
- Habicht-Mauche, Judith A.
1987 Southwestern-style Culinary Ceramics on the Southern Plains: A Case Study of Technological Innovation and Cross-Cultural Interaction. *Plains Anthropologist* 32:175–189.
- Hill, J. Brett, Jeffrey J. Clark, William H. Doelle, and Patrick D. Lyons
2010 Depopulation of the Northern Southwest: A Macrorregional Perspective. In *Leaving Mesa Verde: Peril and Change in the Thirteenth-century Southwest*, edited by Timothy A. Kohler, Mark D. Varien, and Aaron M. Wright, pp. 34–52. University of Arizona Press, Tucson.
- Ives, John W.
2014 Resolving the Promontory Culture Enigma. In *Archaeology in the Great Basin and Southwest: Papers in Honor of Don D. Fowler*, edited by Nancy J. Parezo and Joel C. Janetski, pp. 149–162. University of Utah Press, Salt Lake City.
- Keeley, Lawrence
1996 *War Before Civilization*. Oxford University Press, New York.
- Kohler, Timothy A.
2012 Modeling Agricultural Productivity and Farming Effort. In *Emergence and Collapse of Early Villages: Models of Central Mesa Verde Archaeology*, edited by Timothy A. Kohler and Mark D. Varien, pp. 85–111. University of California Press, Berkeley.
- Kohler, Timothy A., R. Kyle Bocinsky, Denton Cockburn, Stefani A. Crabtree, Mark D. Varien, Kenneth E. Kolm, Schaun Smith, Scott G. Ortman, and Ziad Kobti
2012 Modelling Prehispanic Pueblo Societies in their Ecosystems. *Ecological Modelling* 241:30–41.
- Kohler, Timothy A., Sarah M. Cole, and Stanca Ciupe
2009 Population and Warfare: A Test of the Turchin Model in Puebloan Societies. In *Pattern and Process in Cultural Evolution*, edited by Stephen Shennan, pp. 277–295. University of California Press, Berkeley.
- Kohler, Timothy A., Matt Pier Glaude, Jean-Pierre Bocquet-Appel, and Brian M. Kemp
2008 The Neolithic Demographic Transition in the U.S. Southwest. *American Antiquity* 73:645–669.
- Kohler, Timothy A., Sarah Herr, and Matthew J. Root
2004 The Rise and Fall of Towns on the Pajarito. In *Archaeology of Bandelier National Monument: Village Formation on the Pajarito Plateau, New Mexico*, edited by Timothy A. Kohler, pp. 215–264. University of New Mexico Press, Albuquerque.
- Kohler, Timothy A., and Matthew J. Root
2004 The Late Coalition and Earliest Classic on the Pajarito Plateau. In *Archaeology of Bandelier National Monument: Village Formation on the Pajarito Plateau, New Mexico*, edited by Timothy A. Kohler, pp. 173–214. University of New Mexico Press, Albuquerque.
- Kohler, Timothy A., and Kathryn K. Turner
2006 Raiding for Women in the Pre-Hispanic Northern Puebloan Southwest? A Pilot Examination. *Current Anthropology* 47:1035–1045.
- Kohler, Timothy A., Stephanie VanBuskirk and Samantha Rusca-Barz
2004 Vessels and Villages: Evidence for Conformist Transmission in Early Village Aggregations on the Pajarito Plateau, New Mexico. *Journal of Anthropological Archaeology* 23:100–118.
- Kohler, Timothy A., and Mark D. Varien
2010 A Scale Model of Seven Hundred Years of Farming Settlements in Southwestern Colorado. In *Becoming Villagers: Comparing Early Village Societies*, edited by Matthew S. Bandy and Jake R. Fox, pp. 37–61. University of Arizona Press, Tucson.
- Kuckelman, Kristin A.
2002 Thirteenth-Century Warfare in the Central Mesa Verde Region. In *Seeking the Center Place: Archaeology and Ancient Communities in the Mesa Verde Region*, edited by Mark D. Varien and Richard H. Wilshusen, pp. 233–253. University of Utah Press, Salt Lake City.
2010 Catalysts of the Thirteenth-century Depopulation of Sand Canyon Pueblo and the Central Mesa Verde Region. In *Leaving Mesa Verde: Peril and Change in the Thirteenth-century Southwest*, edited by Timothy A. Kohler, Mark D. Varien, and Aaron M. Wright, pp. 180–199. University of Arizona Press, Tucson.

- Kuckelman, Kristin A., Ricky R. Lightfoot, and Debra L. Martin
 2000 Changing Patterns of Violence in the Northern San Juan Region. *Kiva* 66:147–165.
 2002 The Bioarchaeology and Taphonomy of Violence at Castle Rock and Sand Canyon Pueblos, Southwestern Colorado. *American Antiquity* 67:486–513.
- Lambert, Patricia M.
 2002 The Archaeology of War: A North American Perspective. *Journal of Archaeological Research* 10:207–241.
- LeBlanc, Steven A.
 1978 Settlement Patterns in the El Morro Valley, New Mexico. In *Investigations of the Southwestern Anthropological Research Group: The Proceedings of the 1976 Conference*, edited by Robert C. Euler and George J. Gumerman, pp. 45–51. Museum of Northern Arizona, Flagstaff.
 1997 Modeling Warfare in Southwestern Prehistory. *North American Archaeologist* 18:235–276.
 1999 *Prehistoric Warfare in the American Southwest*. University of Utah Press, Salt Lake City.
 2007 Why Warfare? Lessons from the Past. *Daedalus* 133:13–21.
- Lekson, Stephen H.
 2002 War in the Southwest, War in the World. *American Antiquity* 67:607–624.
 2008 *A History of the Ancient Southwest*. School for Advanced Research Press, Santa Fe, New Mexico.
- Leonard, Kathryn
 2006 Directionality and Exclusivity of Plains-Pueblo Exchange during the Protohistoric Period, AD 1450–1700. In *The Social Life of Pots: Glaze Wares and Cultural Dynamics in the Southwest, AD 1250–1680*, edited by Judith A. Habicht-Mauche, Suzanne L. Eckert, and Deborah L. Huntley, pp. 232–252. University of Arizona Press, Tucson.
- Levy, Jack S.
 1989 The Causes of War: A Review of Theories and Evidence. In *Behavior, Society and Nuclear War*, Vol. 1, edited by Philip E. Tetlock, Jo L. Husbands, Robert Jervis, Paul C. Stern, and Charles Tilly, pp. 209–333. Oxford University Press, New York.
- Linton, Ralph
 1944 Nomad Raids and Fortified Pueblos. *American Antiquity* 10:28–32.
- Lipe, William D.
 1989 Social Scale of Mesa Verde Anasazi Kivas. In *The Architecture of Integration in Prehistoric Pueblos*, edited by William D. Lipe and Michelle Hegmon, pp. 53–72. Occasional Papers No. 1. Crow Canyon Archaeological Center, Cortez, Colorado.
 1995 The Depopulation of the Northern San Juan: Conditions in the Turbulent 1200s. *Journal of Anthropological Archaeology* 14:143–169.
 2010 Lost in Transit: The Central Mesa Verde Archaeological Complex. In *Leaving Mesa Verde: Peril and Change in the Thirteenth-century Southwest*, edited by Timothy A. Kohler, Mark D. Varien, and Aaron M. Wright, pp. 262–284. University of Arizona Press, Tucson.
- Lipe, William D., and Scott G. Ortman
 2000 Spatial Patterning in Northern San Juan Villages, A.D. 1050–1300. *Kiva* 66:91–122.
- McAllister, James W.
 2002 Historical and Structural Approaches in the Natural and Human Sciences. In *The Future of the Sciences and Humanities*, edited by Peter Tindemans, Alexander Verrijn-Stuart, and Rob Visser, pp. 19–54. Amsterdam University Press, Amsterdam.
- Martin, Debra L.
 1997 Violence Against Women in the La Plata River Valley (A.D. 1000–1300). In *Troubled Times: Violence and Warfare in the Past*, edited by Debra L. Martin and D. W. Frayer, pp. 45–75. Gordon and Breach, Amsterdam.
- Munson, Marit K.
 2011 Iconography, Space, and Practice: Rio Grande Rock Art, AD 1150–1600. In *Religious Transformation in the Late pre-Hispanic Pueblo World*, edited by Donna M. Glowacki and Scott Van Keuren, pp. 109–129. University of Arizona Press, Tucson.
- Newsome, Elizabeth A., and Kelley A. Hays-Gilpin
 2011 Spectatorship and Performance in Mural Painting, AD 1250–1500: Visuality and Social Integration. In *Religious Transformation in the Late Pre-Hispanic Pueblo World*, edited by Donna M. Glowacki and Scott Van Keuren, pp. 153–174. University of Arizona Press, Tucson.
- Orcutt, Janet D., Eric Blinman, and Timothy A. Kohler
 1990 Explanations of Population Aggregation in the Mesa Verde Region prior to A.D. 900. In *Perspectives on the Prehistoric Southwest*, edited by Paul E. Minnis and Charles Redman, pp. 196–212. Westview Press, Boulder, Colorado.
- Ortiz, Alfonso
 1994 The Dynamics of Pueblo Cultural Survival. In *North American Indian Anthropology: Essays on Society and Culture*, edited by Raymond J. DeMaille and Alfonso Ortiz, pp. 296–306. University of Oklahoma Press, Norman.
- Ortman, Scott G.
 2011 Bowls to Gardens: A History of Tewa Community Metaphors. In *Religious Transformation in the Late Pre-hispanic Pueblo World*, edited by Donna M. Glowacki and Scott Van Keuren, pp. 84–108. University of Arizona Press, Tucson.
 2012 *Winds from the North: Tewa Origins and Historical Anthropology*. University of Utah Press, Salt Lake City.
- Pinker, Steven
 2011 *The Better Angels of Our Nature: Why Violence Has Declined*. Allen Lane, London.
- Potter, James M., and Jason P. Chuipka
 2010 Perimortem Mutilation of Human Remains in an Early Village in the American Southwest: A Case for Ethnic Violence. *Journal of Anthropological Archaeology* 29:507–523.
- Reed, Charles A.
 2010 The Implications of Coalitional Enforcement and the Adoption of the Bow and Arrow in the Prehispanic Southwest. Unpublished Master's Thesis, Department of Anthropology, Washington State University, Pullman.
- Reed, Paul F., and Phil R. Geib
 2013 Sedentism, Social Change, Warfare, and the Bow in the Ancient Pueblo Southwest. *Evolutionary Anthropology* 22:103–110.
- Schaafsma, Polly
 2000 *Warrior, Shield, and Star: Imagery and Ideology of Pueblo Warfare*. Western Edge Press, Santa Fe, New Mexico.
 2007 The Pottery Mound Murals and Rock Art: Implications for Regional Interaction. In *New Perspectives on Pottery Mound Pueblo*, edited by Polly Schaafsma, pp. 137–166. University of New Mexico Press, Albuquerque.
- Schulman, Albert
 1950 Pre-Columbian Towers in the Southwest. *American Antiquity* 15:288–297.

- Snead, James E., and Mark W. Allen
2011 *Burnt Corn Pueblo: Conflict and Conflagration in the Galisteo Basin A.D. 1250–1325*. Anthropological Papers No. 74. University of Arizona Press, Tucson.
- Spielmann, Katherine A.
1983 Late Prehistoric Exchange between the Southwest and Southern Plains. *Plains Anthropologist* 28:257–272.
1994 Clustered Confederacies: Sociopolitical Organization in the Protohistoric Rio Grande. In *The Ancient Southwestern Community: Models and Methods for the Study of Prehistoric Social Organization*, edited by W. H. Wills and Robert D. Leonard, pp. 45–54. University of New Mexico Press, Albuquerque.
2004 Clusters Revisited. In *The Protohistoric Pueblo World A.D. 1275–1600*, edited by E. Charles Adams and Andrew I. Duff, pp. 137–143. University of Arizona Press, Tucson.
- Spielmann, Katherine A. (editor)
1991 *Farmers, Hunters, and Colonists: Interaction Between the Southwest and the Southern Plains*. University of Arizona Press, Tucson.
- Steward, Julian
1937 Ecological Aspects of Southwestern Society. *Anthropos* 32:87–104.
2009 *Ancient Caves of the Great Salt Lake Region*. Reprinted. University of Utah Press, Salt Lake City. Originally published 1937, Bulletin No. 116, Bureau of American Ethnology, Smithsonian Institution, Washington, D.C.
- Turchin, Peter, and Andrey V. Korotayev
2006 Population Dynamics and Internal Warfare: A Reconsideration. *Social Evolution & History* 5:112–147.
- Turner, Christy G., II
1983 Taphonomic Reconstruction of Human Violence and Cannibalism based on Mass Burials in the American Southwest. In *Carnivores, Human Scavengers, and Predators: A Question of Bone Technology*, edited by Genevieve M. LeMoine and A. Scott MacEachern, pp. 219–240. Archaeological Association of the University of Calgary, Alberta.
- Turner, Christy G., II, and Jacqueline A. Turner
1999 *Man Corn: Cannibalism and Violence in the Prehistoric American Southwest*. University of Utah Press, Salt Lake City.
- Van Keuren, Scott, and Donna M. Glowacki
2011 Studying Ancestral Pueblo Religion. In *Religious Transformation in the Late pre-Hispanic Pueblo World*, edited by Donna M. Glowacki and Scott Van Keuren, pp. 1–22. University of Arizona Press, Tucson.
- Vehik, Susan C.
2002 Conflict, Trade and Political Development on the Southern Plains. *American Antiquity* 67:37–64.
2006 Wichita Ethnohistory. In *Kansas Archaeology*, edited by Robert J. Hoard and William E. Banks, pp. 206–218. University Press of Kansas, Lawrence.
- Vierra, Bradley J., and Richard I. Ford
2007 Foragers and Farmers in the Northern Rio Grande Valley, New Mexico. *Kiva* 73:117–130.
- Waltz, Kenneth N.
1979 *Theory of International Politics*. Addison-Wesley, Reading, Massachusetts.
- Ware, John A., and Eric Blinman
2000 Cultural Collapse and Reorganization: The Origin and Spread of Pueblo Ritual Sodalities. In *The Archaeology of Regional Interaction*, edited by Michelle Hegmon, pp. 381–409. University Press of Colorado, Boulder.
- Wilcox, David R.
1981 Changing Perspectives on the Protohistoric Pueblos, A.D. 1450–1700. In *The Protohistoric Period in the North American Southwest*, edited by David R. Wilcox and W. Bruce Masse, pp. 378–409. Anthropological Research Papers No. 24. Arizona State University, Tempe.
- Wilcox, David R., and Jonathan Haas
1994 The Scream of the Butterfly: Competition and Conflict in the Prehistoric Southwest. In *Themes in Southwest Prehistory*, edited by George J. Gumerman, pp. 211–238. School of American Research Press, Santa Fe, New Mexico.
- Williams, Nathalie, and Meeta S. Pradhan
2009 Political Conflict and Migration: How has Violence and Political Instability Affected Migration Patterns in Nepal? *Population Studies Center Research Report* 09-677. Institute for Social Research, University of Michigan, Ann Arbor, <http://www.psc.isr.umich.edu/pubs/pdf/rr09-677.pdf>, accessed June 27, 2014.
- Wilson, Joseph A. P.
2011 *Material Cultural Correlates of the Athapaskan Expansion: A Cross-Disciplinary Approach*. Ph.D. Dissertation, Department of Anthropology, University of Florida, Gainesville.
- Winship, George Parker
1922 *The Journey of Coronado, 1540–1542, from the City of Mexico to the Grand Cañon of the Colorado and the Buffalo Plains of Texas, Kansas and Nebraska, as Told by Himself and His Followers*. Allerton, New York.
- Woodbury, Richard B.
1959 A Reconsideration of Pueblo Warfare in the Southwestern United States. *Actas del XXXIII Congreso Internacional de Americanistas* II:124–133. San José, Costa Rica.
- Wrangham, Richard
2004 Killer Species. *Daedalus* 133:25–35.

Notes

1. All dates are A.D. (CE) unless otherwise specified.
2. See for example Cater (2012), of which we became aware only as this article was in its final submission.
3. This extremely simple model assumes no inherently strong demographic growth of the sort we believe these societies were in fact undergoing.
4. In fact, in the Mogollon area, defensive hilltop sites were abandoned just about the time the bow arrived in the area, ca. A.D. 550 (Steven LeBlanc, personal communication 2013).
5. Steven LeBlanc (personal communication 2013) now believes that the recurved bow was introduced into the Southwest after the intensive conflict of the 1200s.
6. In fact, in the NRG an “anti-Turchin” cycle (in which the trajectory through phase space as constructed in Figure 2 is clockwise) seems to characterize the three centuries from the early 1300s to the early 1600s.
7. The claim that differences in sociopolitical organization can lead to differences in the frequency or intensity of warfare is an example of the second type of warfare theory in Levy’s (1989) taxonomy.
8. For the regression of W on standardized potential maize per capita in the previous period, which is not graphed, the periods A.D. 1060–1100 and A.D. 1140–1180 remain significantly more violent than predicted by the regression, and three of the four periods (A.D. 840–880, A.D. 1180–1225, and A.D.

1225–1260) that were outliers in Figure 3 are still significantly less violent than predicted by the average relationship across the dataset. However, the period from A.D. 800–840 is no longer an outlier. The fact that per capita production in the current and in the previous period seems to contribute equally to current violence suggests that favorable (or unfavorable) long-term conditions are especially effective incubators of peace (or violence).

9. Ortman (2012) suggests the uptick in violence at the end of the CMV occupation is related to the migration process itself, rather than an unfavorable balance of population and resources.

10. A fascinating problem left open by our analysis here is the disjunction between the increase in conflict-related iconography in the NRG after A.D. 1300 and the concomitant decline

in trauma on human bone. Perhaps violence became partially encapsulated within ritual systems, leaving less scope for its use in inter-Pueblo disputes. However, there is also no doubt that Coronado's expedition observed heavily fortified pueblos in 1540–1542, many with defensive towers and loopholes and lacking ground-level entries (Castañeda in Winship 1922). Nor is there any doubt that Pueblo societies retain a great deal of structural evidence of the past importance of warfare (see for example Ellis' 1951 review, based largely on ethnography of the late nineteenth and early twentieth century).

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Supplemental Information

Sample Characteristics

We recognize that sample sizes are small for certain times and places and point out cases where additional data may lead to changed interpretations. We also recognize that the spatial coverage for each period is uneven, that a variety of taphonomic/formation processes might make sites whose occupations ended in violence more likely to be excavated, and that the excavated contexts from which we derive our indices are not probabilistic samples of the settlement system in any region or period. We acknowledge that other analysts might make different decisions about what types of trauma to include or exclude in summary measures such as our conflict index (W). For example, some small percent of what we call cranial trauma is probably not due to interpersonal violence. Finally, we recognize that any sample derived from the literature, as ours is here, will contain some errors and will reflect variable biases and training of the original analysts. It seems far better to us to tolerate these sources of “noise” than to simply ignore these unique and literally irreplaceable samples. Our hope is that all these factors, which clearly matter at a finer scale of analysis, essentially come out in the wash when one summarizes a large volume of archaeological research at the scales of regions and centuries. In short, we assume our sample is reasonably representative, even though we know that it is not comprehensive. Further research, and archaeological source criticism in the several senses developed by Kristiansen (1978), should improve upon the reading of the record of violence in the Pueblo past that we develop here.

Conflict Index

Debate over the presence of conflict in the pre-hispanic Southwest is bound up with the defini-

tions used to categorize violence. Here we develop an index of violence based on trauma to human bone, trying to exclude trauma due to accidental injury to the extent possible. The trauma we track may be due to any combination of warfare (“organized, purposeful group action, directed against another group that may or may not be organized for similar action, involving the actual or potential application of lethal force” [Ferguson 1984:5]), raids, ambushes, massacres, violent resistance, feuding, and intracommunity and possibly ritualized violence such as the execution of suspected witches (Palkovich 2012 discusses a possible example for the NRG).¹ Presumably much but certainly not all of this violence was in fact between independent communities or polities.

We do not believe the trauma preserved on human bone can always be assigned unambiguously to some specific source, such as interpersonal violence vs. intergroup hostility, though Arkush and Tung (2013:Table 2) note some general tendencies. These authors also argue that inter- and intragroup violence tend to be strongly correlated in any case, and Ember et al. (1992) demonstrate cross-cultural correlations between war and other forms of violence. For this reason we consider our index of trauma to be an index of *both* interpersonal violence and warfare; we will generally use the terms “conflict” and “violence” interchangeably. We consider the term “conflict” to be slightly more fundamental, since violence (including domestic or ritualized violence) stems from conflict in every case we can imagine. It is worth keeping in mind however that violence and conflict are secondary inferences derived from what can be directly observed on the bones, which is trauma.

Fractures to the radius or ulna most likely result from a blow to an arm raised in defense and

are commonly attributed to intergroup conflict (Judd 2008). These are often referred to generally as “parry fractures,” though Judd argues that four criteria must be met in order to properly identify such a fracture. We followed her guidelines to the extent possible, though available site reports and gray literature do not always contain the needed detail.² We acknowledge that such injuries can sometimes be sustained by blocking a fall.

Cranial fractures are also complicated, as they may result from accidental falls in the elderly or in children; here we consider only nonfacial cranial fractures to be conflict related. Intentional and systematic dismemberment and breakage of bone, often referred to as “extreme processing,” is also coded as violence, following criteria developed by Turner and Turner (1999:24) and also employed by Kuckelman et al. (2000, 2002). Skeletal remains must be complete enough to reliably determine the presence or absence of violence. We would not code trauma as either present or absent for any individual unless we had at least a cranium and a radius or ulna represented. Contextual evidence of violence reported by excavators, such as informal or haphazard deposits of bodies, could be used to alter these coding rules where that seemed sensible. In general, we consider the decisions we made in coding trauma as violence to be conservative. All information was obtained from library research, including as much gray literature as we could access. In many cases the remains from which our data derive have been repatriated and are no longer available for study.

Using these data, we define W as the proportion of sets of human remains exhibiting trauma as defined above for each period in each region. Given appropriate conditions of preservation and sample size, we think this index is the best *single* indicator of the relative frequency of conflict available to us in the archaeological record. But it is of course imperfect. People can suffer much violence that is not osteologically visible. Likewise, architecture, site placement, and several other possible indicators of conflict enrich our understanding of the type and level of violence. We offer the line of research developed here as a step towards systematizing the archaeological record of violence to allow interregional comparisons, not as an attempt to channel all future

discussion of violence in the archaeological record of the Southwest.

Population Size and Paleoproduction

Our methods for obtaining the momentary population size estimates through time for the CMV region are presented by Ortman et al. (2007) and by Varien et al. (2007) and were applied to the VEPI area, constituting the central portions of the VEPIIN area shown in Figure 1. Population estimates for the NRG are drawn from Ortman (2012:77–78) and were generated as described there (Ortman 2012:57–86). We emphasize variability in maize production in this paper, rather than climate variability *per se*, since we strongly agree with Harrod and Martin (2014) that the relationship between climate variability and violence needs to be examined through the lens of those aspects of environmental variability that directly affect people. Derivation of potential maize production estimates for the CMV is explained in Kohler (2012) and the series is graphed in Varien et al. (2007:Figure 3). As these references explain, our production estimates begin from the same Mesa Verde Douglas fir ring-width index series graphed by Dean and Van West (2002, Figures 4.1–4.3) but also employ a paleotemperature record derived from bristlecone pine ring-width index series, soil characteristics, and historic-period maize production to estimate potential maize productivity in prehistory. The tree-ring records provide *climate* series that are turned into a *productivity* series by this additional work. Production estimates (means and standard deviations) are then derived from this production series for the periods we can recognize archaeologically, rather than for climatically distinct periods, as done by Dean and Van West.

Paleoproduction estimates derived from similar methods have not yet been developed for the NRG, so we have developed a preliminary series here, building from the assumption that the most important variable affecting maize production in the NRG is precipitation. We extracted the first principal component from three new tree-ring-derived precipitation reconstructions (Arroyo Hondo, Jemez, and Chama) that spatially bracket our NRG study area and are reported in Towner and Salzer (2013). We used this signal to create a first-order estimate of what the potential maize

production in the NRG might have been if dry farming (rain-fed farming) dominated their production systems. The resultant estimates have the same mean and standard deviation as the CMV production series.

Of course, even though maize constituted some 80 percent of Basketmaker and Pueblo diets (Coltrain et al. 2006), other resources were important. Models exist for estimating the productivity of some of these other resources in the CMV (e.g., Johnson and Kohler 2012), but we do not yet have comparable models for the NRG. However, precipitation is a main factor in maize production in the CMV model, and the only factor in the provisional NRG model, and one would expect it to have an effect on all resources in these semiarid environments. So there is some basis for suggesting that our maize production models can serve as proxies for overall net primary productivity in our study areas.

Supplemental References Cited

- Akins, Nancy, Susan Moga, Pamela McBride, Mollie Toll, Jessica Badner, and Richard Holloway
2010 *Excavations along NM 22: Agricultural Adaptation from AD 500 to 1900 in the Northern Santo Domingo Basin, Sandoval County, New Mexico*. Office of Archaeological Studies, Museum of New Mexico, Santa Fe.
- Arkush, Elizabeth, and Tiffany A. Tung
2013 Patterns of War in the Andes from the Archaic to the Late Horizon: Insights from Settlement Patterns and Cranial Trauma. *Journal of Archaeological Research* 21:307–369.
- Boyer, Jeffrey L., James L. Moore, Steven A. Lakatos, Nancy J. Akins, C. Dean Wilson, and Eric Blinman
2010 Remodeling Immigration: A Northern Rio Grande Perspective on Depopulation, Migration, and Donation-Side Models. In *Leaving Mesa Verde: Peril and Change in the Thirteenth-century Southwest*, edited by Timothy A. Kohler, Mark D. Varien, and Aaron M. Wright, pp. 285–323. University of Arizona Press, Tucson.
- Coltrain, Joan Brenner, Joel C. Janetski, and Shawn W. Carlyle
2006 The Stable and Radio-isotope Chemistry of Eastern Basketmaker and Pueblo Groups in the Four Corners Region of the American Southwest. In *Histories of Maize: Multidisciplinary Approaches to the Prehistory, Linguistics, Biogeography, Domestication, and Evolution of Maize*, edited by John Staller, Robert Tykot, and Bruce Benz, pp. 275–287. Elsevier, Amsterdam.
- Cordell, Linda S.
1977 *The 1976 Excavation of Tijeras Pueblo: Final Field Report, Cibola National Forest, New Mexico*. USDA Forest Service, Archaeological Report No. 17, Southwestern Region, Albuquerque.
- Dean, Jeffrey S., and Carla R. Van West
2002 Environment-Behavior Relationships in Southwestern Colorado. In *Seeking the Center Place: Archaeology and Ancient Communities in the Mesa Verde Region*, edited by Mark D. Varien and Richard H. Wilshusen, pp. 81–99. University of Utah Press, Salt Lake City.
- Dick, Herbert
1976 *Archaeological Excavations in the Llaves Area, Santa Fe National Forest New Mexico 1972–1974*. USDA Forest Service, Southwestern Region, Albuquerque, New Mexico.
- Ember, Carol R., Melvin Ember, and Bruce Russett
1992 Peace Between Participatory Polities: A Cross-Cultural Test of the “Democracies Rarely Fight Each Other” Hypothesis. *World Politics* 44: 573–599.
- Ferguson, Cheryl
1977 Skeletal Remains from 1975 Excavations. In *The 1975 Excavations of Tijeras Pueblo Cibola National Forest*, edited by Linda Cordell, pp. 50–79. USDA Forest Service, Southwestern Region, Albuquerque, New Mexico.
- Ferguson, R. Brian
1984 Introduction: Studying War. In *Warfare, Culture, and Environment*, edited by Brian R. Ferguson, pp. 1–81. Academic Press, Orlando, Florida.
- Harrod, Ryan P., and Debra L. Martin
2014 *Bioarchaeology of Climate Change and Violence: Ethical Considerations*. Springer, New York.
- Hooton, Earnest Albert
1930 *The Indians of Pecos Pueblo: A Study of their Skeletal Remains*. The Yale University Press, New Haven, Connecticut.
- Johnson, C. David, and Timothy A. Kohler
2012 Modeling Plant and Animal Productivity and Fuel Use. In *Emergence and Collapse of Early Villages: Models of Central Mesa Verde Archaeology*, edited by Timothy A. Kohler and Mark D. Varien, pp. 113–128. University of California Press, Berkeley.
- Judd, Margaret
2008 The Parry Problem. *Journal of Archaeological Science* 35:1658–1666.
- Judge, James
1974 *The Excavation of Tijeras Pueblo 1971–1973: Preliminary Report Cibola National Forest, New Mexico*. USDA Forest Service, Southwestern Region, Albuquerque, New Mexico.
- Kohler, Timothy A.
2012 Modeling Agricultural Productivity and Farming Effort. In *Emergence and Collapse of Early Villages: Models of Central Mesa Verde Archaeology*, edited by Timothy A. Kohler and Mark D. Varien, pp. 85–111. University of California Press, Berkeley.
- Kristiansen, Kristian
1978 The Application of Source Criticism to Archaeology. *Norwegian Archaeological Review* 11:1–5.
- Kuckelman, Kristin A., Ricky R. Lightfoot, and Debra L. Martin
2000 Changing Patterns of Violence in the Northern San Juan Region. *Kiva* 66:147–165.
2002 The Bioarchaeology and Taphonomy of Violence at Castle Rock and Sand Canyon Pueblos, Southwestern Colorado. *American Antiquity* 67:486–513.
- Lange, Charles H.
1968 *The Cochiti Dam Archaeological Salvage Project*. Museum of New Mexico Press, Santa Fe.
- Lentz, Stephen C.
2011 Ogapoge, the White Shell Water Place: The Prehistoric Component at El Pueblo de Santa Fe (LA 1051). *Archaeology Notes* No. 410. Office of Archaeological Studies, Museum of New Mexico, Santa Fe.
- Niskanen, Markku
1989 Appendix: Human Remains from 2 x 2 m unit 144S

- 136E, Area 2. In *Bandelier Archaeological Excavation Project: Summer 1989 Excavations at Burnt Mesa Pueblo*, edited by Timothy A. Kohler, pp. 155–157. Reports of Investigations No. 62. Department of Anthropology, Washington State University, Pullman.
- Ortman, Scott G.
2012 *Winds from the North: Tewa Origins and Historical Anthropology*. University of Utah Press, Salt Lake City.
- Ortman, Scott G., Mark D. Varien, and T. Lee Gripp
2007 Empirical Bayesian Methods for Archaeological Survey Data: An Application from the Mesa Verde Region. *American Antiquity* 72:241–272.
- Palkovich, Ann M.
1980 *Puebloan Population and Society: The Arroyo Hondo Skeletal and Mortuary Remains*. School of American Research Press, Santa Fe, New Mexico.
2012 Community Violence and Everyday Life: Death at Arroyo Hondo. In *The Bioarchaeology of Violence, Bioarchaeological Interpretations of the Human Past: Local, Regional, and Global Perspectives*, edited by Debra L. Martin, Ryan P. Harrod, and Ventura R. Pérez, pp. 111–120. University Press of Florida, Gainesville.
- Reed, Eric K.
1953 Human Skeletal Material from Te'ewi. In *Salvage Archaeology in the Chama Valley, New Mexico*, by Fred Wendorf, pp. 104–18. Museum of New Mexico, Santa Fe.
- Rhine, Stanley
1974 Human Remains from Tijeras Pueblo. In *The Excavation of Tijeras Pueblo 1971–1973: Preliminary Report Cibola National Forest, New Mexico*. USDA Forest Service, Southwestern Region, Albuquerque, New Mexico.
- Robertson, Ian
1999 Spatial and Multivariate Analysis, Random Sampling Error, and Analytical Noise: Empirical Bayesian Methods at Teotihuacan, Mexico. *American Antiquity* 64:137–152.
- Seaman, Timothy J.
1976 *Archaeological Investigations on the San Juan-to-Ojo 345KV Transmission Line for the Public Service Company of New Mexico. Excavation of LA 11843: An Early Stockade Settlement of the Gallina Phase*. Museum of New Mexico, Santa Fe.
- Stodder, Ann L. W.
1990 *Paleoepidemiology of Eastern and Western Pueblo Communities in Protohistoric New Mexico*. Ph.D. dissertation, Department of Anthropology, University of Colorado, Boulder. University Microfilms, Ann Arbor.
- Towner, Ronald H., and Matthew W. Salzer
2013 Dendroclimatic Reconstructions of Precipitation for the Northern Rio Grande. In *From Mountaintop to Valley Bottom: Understanding Past Land Use in the Northern Rio Grande Valley, New Mexico*, edited by Bradley J. Vierra, pp. 54–65. University of Utah Press, Salt Lake City.
- Turner, Christy G., II, and Jacqueline A. Turner
1999 *Man Corn: Cannibalism and Violence in the Prehistoric American Southwest*. University of Utah Press, Salt Lake City.
- Varien, Mark D., Scott G. Ortman, Timothy A. Kohler, Donna M. Glowacki, and C. David Johnson
2007 Historical Ecology in the Mesa Verde Region: Results from the Village Ecodynamics Project. *American Antiquity* 72:273–299.
- Williams, Heather Susan
2005 A Re-Analysis of Tijeras Pueblo: Another Look at Developmental Defects in the Prehispanic Southwest. Unpublished Master's Thesis, Department of Anthropology, University of Colorado, Boulder.
- Whitley, Catrina D. B.
2009 *Body Language: An Integrative Approach to the Bioarchaeology and Mortuary Practices of the Taos Valley*. Ph.D. dissertation, Department of Anthropology, Southern Methodist University, Dallas, Texas. University Microfilms, Ann Arbor.

Notes

1. This example also illustrates some of the problems with studying the bioarchaeology of violence in the ancient Southwest based on the literature. In her authoritative 1980 monograph on the human remains from Arroyo Hondo, Palkovich noted two instances of violence (a projectile wound, and some broken teeth) among the 120 burials analyzed. But Palkovich (2012:12) mentions 12 individuals from Arroyo Hondo subjected to “acts of violence or post-mortem manipulation.” Here we have used the data in the original monograph, since we could not judge the completeness of the remains or the component to which they belonged from the more recent publication. We likewise encountered disagreements in inferred violence when the same skeletal remains were analyzed by more than one researcher.

2. If the reports or literature did not contain enough detail on individuals to determine the presence/absence of trauma to the radius or ulna, and the cranium, the individual was removed from the sample. For example, we removed seven individuals from the Te'ewi sample due to the fragmentary nature of the remains.

Supplemental Table 1. Sites Used to Estimate Proportions of Human Remains with Trauma, Northern Rio Grande.

Period	Dates (A.D.)	Period Name	Sites	References	x (total with conflict-related trauma)	Total <i>n</i> human remains
1	800–1050	Early Developmental	Nogales Cliff House (LA 649)	Dick 1976	8	16
			Pena Blanca (LA 265)	Akins et al. 2010	2	6
			Pena Blanca (LA 6169)	Akins et al. 2010	2	7
			Pena Blanca (LA 6171)	Akins et al. 2010	1	2
			Pena Blanca (LA 115862)	Akins et al. 2010	0	4
			LA 103919	Akins et al. 2010	3	6
2	1050–1200	Late Developmental	North Bank Site (LA 6462)	Lange 1968	1	13
			Taos Composite Valdez (TA 1 + 5 others)	Whitley 2009	12	36
			Pena Blanca (LA 249)	Akins et al. 2010	1	1
			Pena Blanca (LA 6169)	Akins et al. 2010	2	3
			LA 11850	Seaman 1976	1	4
			Kinslow (LA 11843)	Seaman 1976	0	2
			LA 11841	Seaman 1976	1	1
			Pojoaque (LA 391)	Akins p.c. 2013	2	6
			LA 103919	Akins p.c. 2013	2	6
3	1200–1275	Early Coalition	Tijeras Pueblo	Ferguson 1977; Judge 1974; Rhine 1974; Williams 2005	4	40

			Pecos Pueblo B/w (LA 53684)	Hooton 1930	2	15
			Pena Blanca (LA 265)	Akins et al. 2010	0	1
			Pena Blanca (LA 6169)	Akins et al. 2010	2	3
			El Pueblo de Santa Fe (LA 1051)	Lentz 2011	2	15
			Burnt Mesa (LA 60372)	Niskanen 1989	0	1
4	1275–1350	Late Coalition/ Earliest Classic	Pot Creek Pueblo (TA 1)	Whitley 2009	5	60
			Arroyo Hondo (LA 12 Comp. I)	Palkovich 1980	2	104
			Pecos Pueblo (LA 53684 B/w or I)	Hooton 1930	1	4
			San Cristóbal (LA 80)	Stodder 1990	3	49
5	1350–1400	Early Classic	Arroyo Hondo (LA 12 Comp. II)	Palkovich 1980	0	11
			Pecos Pueblo (LA 53684 Glaze I)	Hooton 1930	4	22
6	1400–1450	Middle Classic	Alfred Herrera (LA 6455)	Lange 1968	5	62
			Te'ewi (LA 581)	Reed 1953; Turner 1999	12	21
			Pecos Pueblo (LA 53684 Glaze II)	Hooton 1930	2	14
			El Pueblo de Santa Fe (LA 1051)	Lentz 2011	0	10

7	1450–1500	Late Classic	Pecos Pueblo (LA 53684 Glaze III)	Hooton 1930	2	31
			Pecos Pueblo (LA 53684 indet. date)	Hooton 1930	3	14
			San Cristóbal (LA 80)	Stodder 1990	3	79
8	1500–1540	Terminal Classic	Pecos Pueblo (LA 53684 Glaze IV)	Hooton 1930	2	30
9	1540–1680	Contact & Colonial	San Cristóbal (LA 80)	Stodder 1990	1	130
			Pecos Pueblo (LA 53684 Glaze V)	Hooton 1930	7	20
10	1680–1760	Revolt & Reconquest	Pecos Pueblo (LA 53684 Glaze VI)	Hooton 1930	2	13

Supplemental Table 2. Summary Data for Prevalence of Conflict in the Central Mesa Verde Region through Time.

VEP Period	Dates (A.D.)	Pecos period	Mean momentary population ^a	x (total with conflict-related trauma)	Total <i>n</i> human remains	Raw W (<i>x/n</i>)	Final W ^b	Average per capita potential maize production ^c
6	600–725	Late Basketmaker III	1,826	2	11	.182	.104	1.5898
7	725–800	Early Pueblo I	1,955	1	10	.100	.000	1.314
8	800–840	Mid-Pueblo I	5,013	0	6	.000	.000	-.187
9	840–880	Late Pueblo I	6,181	3	55	.055	.036	-.403
10	880–920	Terminal Pueblo I	2,223	6	18	.333	.315	.952
11	920–980	Incipient Pueblo II	1,733	0	13	.000	.000	1.833
12	980–1020	Early Pueblo II	3,917	5	20	.250	.222	-.068
13	1020–1060	Mid-Pueblo II	4,028	17	70	.243	.235	-.008
14	1060–1100	Late Pueblo II	8,307	24	45	.533	.539	-.677
15	1100–1140	Terminal Pueblo II	11,641	44	108	.407	.407	-.779
16	1140–1180	Early Pueblo III	12,465	30	35	.857	.889	-.862
17	1180–1225	Mid-Pueblo III	13,958	4	34	.118	.092	-.913
18	1225–1260	Late Pueblo III	19,404	6	75	.080	.067	-1.023
19	1260–1280	Terminal Pueblo III	10,622	51	121	.422	.421	-.769
Total or mean				193	621	.311		

Note: For complete listing of sites used, see Cole (2012:Table 13.3).

^a From Varien et al. (2007:Table 4). Assumes six people/household.

^b We used Bayes' theorem to generate an improved estimate of W from the observed sample proportion, as explained in Cole (2007). See also Robertson (1999) for discussion of this method.

^c Standardized ratio of average potential maize production in each period from the high-frequency reconstruction to average momentary population in each period.

Supplemental Table 3. Summary Data, Sample Proveniences, Sizes, Prevalence of Conflict, and Production Estimates in the Northern Rio Grande Region through Time.

Period ^a	Dates (A.D.)	Period Name	Site with largest sample, <i>n</i>	Key References	Mean Momentary Population ^b	<i>x</i> (total with conflict-related trauma)	Total <i>n</i> human remains	Raw <i>W</i> (<i>x/n</i>)	Average score on PC 1 ^c	Average per capita potential maize production ^d
1	800– 1050	Early Developmental	Nogales Cliff House (LA 649), 16	Dick 1976	1277	16	41	.39	.089	.147
2	1050– 1200	Late Developmental	Taos-Valdez (TA 18), 8	Whitley 2009	3340	22	72	.31	.033	.076
3	1200– 1275	Early Coalition	Tijeras Pueblo, 40	Cordell 1977; Judge 1974	7691	10	75	.13	-.003	.033
4	1275– 1350	Late Coalition/Earlie st Classic	Arroyo Hondo (LA 12 Comp. I), 104	Palkovich 1980	17,099	11	217	.05	-.008	.015

5	1350– 1400	Early Classic	Pecos Pueblo (LA 53684 Glaze I), 22	Hooton 1930	17,749	4	33	.12	.201	.015
6	1400– 1450	Middle Classic	Alfred Herrera (LA 6455), 64	Lange 1968	18,994	19	107	.18	.147	.014
7	1450– 1500	Late Classic	San Cristóbal, 87	Stodder 1990	19,313	8	124	.07	-.287	.013
8	1500– 1540	Terminal Classic	Pecos Pueblo– Glaze IV, 30	Hooton 1930	18,897	2	30	.09	-.007	.013
9	1540– 1680	Contact and Colonial	San Cristóbal, 130	Stodder 1990	13,199	8	150	.07	-.060	.019
10	1680– 1760	Revolt and Reconquest	Pecos Pueblo– Modern, 13	Hooton 1930	2,672	2	13	.15	-.054	.094
Total or mean						102	862	.12		

Note: For complete listing of sites, see Supplementary Table 1.

^a Due to small sample sizes, we combined two sets of periods distinguished by Ortman (2012:Table 4.8): 1540–1600 has been combined with A.D. 1600–1680; A.D. 1680–1700 has been combined with A.D. 1700–1760.

^b Ortman’s period 1 begins at A.D. 900. Several of the sites in our period 1 date to around A.D. 800 and are slightly south of Ortman’s area. Hence, for our period 1 estimate we have averaged the estimate from Boyer et al. (2010:Table 12.1) for the A.D. 800–900 period (804) with Ortman’s estimate for the A.D. 900–1050 period (1,749).

^c Score of 1st principal component extracted from three reconstructions of precipitation in the NRG, derived from tree rings, by Towner and Salzer (2013). Positive scores mark wetter conditions. The PCA is computed on the 775 years between A.D. 985 and 1760. PC 1 “explains” 82 percent of the variance in the three data series.

^d Ratio of average production per period in kg/ha to the average momentary population in each period. After standardization the numbers in this column form the x-axis in Figure 5.

Note: The following table was accidentally omitted from the published version. It should have been located on p. 450.

Table 1. Types and Frequencies of Skeletal Trauma Inferred to be Evidence for Conflict, central Mesa Verde and northern Rio Grande regions. ^a Column percentages (as a percentage of all trauma) shown in parentheses.

Type of Trauma	Count, CMV	Count, NRG
Fractures of the radius	5 (2.5)	5 (4.5)
Fractures of the ulna	10 (5)	12 (10.8)
Non-facial cranial trauma	49 (24.1)	68 (61.3)
Human modification and disarticulation in the form of extreme processing	136 (67)	0 (0)
Embedded projectile points or point damage	3 (1.4)	9 (8.1)
Other	0 (0)	17 (15.3)

^a Some sets of human remains exhibited more than one type of trauma. Therefore, the counts here sum to more than the total numbers for x in Tables 2 and 3.