Violence and Perimortem Signaling among Early Irrigation Communities in the Sonoran Desert

by James T. Watson and Danielle O. Phelps

Violence is common among small-scale societies and often stems from a combination of exogenous and endogenous factors. We suggest that socialization for violence and revenge as a motivation can encourage costly signaling by warriors and contribute to the creation of atypical burials in archaeological contexts. We characterize mortuary patterns among early irrigation communities in the Sonoran Desert of the southwest United States/northwest Mexico (Early Agricultural period: 2100 BC–AD 50) to define normative mortuary practices and identify atypical burials. One of the principle roles the performance of mortuary rituals fulfills is to publicly integrate a shared identity or reinforce social differences within a community. This postmortem negotiation of social identities was likely an important component to ease social tensions in early farming communities. However, atypical burials from these sites appear to represent acts of violence upon the corpse at, or after, the death of the individual that fall outside of the normative conformity to prescribed mortuary ritual. We propose that these cases represent perimortem signaling, a form of costly signaling conditioned as basal violent reactions, possibly stemming from socialization for violence.

Violence is common among small-scale societies and can result from a variety of both exogenous and endogenous factors (Allen and Jones 2014; Ember and Ember 1994). Intercommunity conflict, or warfare, is a commonly cited exogenous cause and is frequently manifest as raiding—for food, materials, or people (i.e., slaves or wives; Manson and Wrangham 1991). Many researchers offer environmental explanations for causes of warfare among both foraging and horticultural groups, citing variables such as high population densities, territoriality and contact between unrelated groups, and environmental and resource stress (Abbink 1998; Allen and Jones 2014; Knauft 1990; Nolan 2003; Richerson, Borgerhoff Mulder, and Vila 2001).

Endogenous causes are often more complex and can stem from a range of interpersonal interactions between community members. A few examples of these include punishment for social transgressions (especially witchcraft), domestic violence, rites of passage, religious factionalism, and ethnic tensions (Ember and Ember 1994). As a result of external stressors, tensions can build within a community and lead to a breakdown in social order.

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Beyond specific environmental causations, the form that violence takes is often controlled or sanctioned by internal (formal and informal) social systems. This signifies that not all forms of violence constitute social pathologies, as envisioned by Durkheim (Allan 2005). Recent considerations argue in favor of socially sanctioned mechanisms, such as socialization for violence (Ember and Ember 1994), or sociobiological bases, such as male status enhancement (Chagnon 1990; Otterbein 1970; Patton 2000). For example, achieved social status can be gained via numerous routes, and violence or "skill as a warrior" are common pathways to gaining status among many small-scale societies (Chagnon 1990; Ember and Ember 1994). However, when violence turns deadly, these behaviors often create cycles of revenge killings and blood feuds (Chagnon 1988).

In these contexts, violence can effect more than just the combatants, as community members can be witnesses, victims, or antagonists. Radcliffe-Brown (1964:85–86) describes how among the Andaman Islanders, women arbitrated for peace and could prolong hostility as long as their ire persisted. This example also illustrates the continuum from overt physical violence to hidden violence such as shunning or discrimination. Violence can be a powerful form of nonverbal communication between group members, which helps in the reinforcement and negotiation of social identities (Osterholtz 2013). Violent acts, therefore, provide a platform to secure social cohesion of a group, a form of social control. Osterholtz (2013) suggests that social control was the motivation behind torture and hobbling found on skeletal remains at the Pueblo I site of Sacred Ridge in Colorado—to relay the threat of violence to the entire group.

Mortuary features and the remains they contain have the potential to provide both contextual social and biological data and inform the study of violence in the past. But most mortuary research focuses on the normative practice of ritual and interpreting the material residues in the archaeological record (Arnold and Jeske 2014). In contrast, there are many cases in which violence on the body extends to the contexts of deposition (Baker 1990; Baustian et al. 2012; Billman, Lambert, and Leonard 2000a; Darling 1998; Margolis 2000; Martin, Harrod, and Pérez 2012; Osterholtz 2013; Potter and Chuipka 2010). Numerous studies have documented violence, warfare (LeBlanc 1999; Lekson 2002; Rice and LeBlanc 2001), and perhaps even cannibalism (Turner and Turner 1999) throughout the prehistoric southwest United States. These violent depositional events are often referred to as deviant burials in the archaeological literature (Aspöck 2008).

Deviant burials are defined as those that deviate from the normative burial practice of a respective period, region, and/or time (Aspöck 2008:19). Saxe (1970) first described these features as the result of mortuary practices designed to deal with the death and interment of "deviant social personae"—individuals that did not conform socially within a given group. Saxe contends that certain circumstances in life and death affect the obligations of the burying community toward the dead individual. As a result, the dead individual loses "the right to a normal funerary treatment" (Aspöck 2008:25).

Aspöck (2008) argues that the use of the term "deviant" in the Anglophone archaeological literature to describe nonnormative burials "has a negative and sexual connotation" that implies "that the burial itself was *perverse*" (29; italics added for emphasis). We therefore favor the use of the more neutral term "atypical burial" to refer to those we identify as deviating from the normative mortuary practice.

Similar to approaches to deviant social personae is the concept of a "bad death." Ethnographic examples of bad death are described as the unnatural, unplanned, and "evil" death of an individual (Kozak 1991). Individuals who experience a bad death are taken away suddenly and violently without preparations. They are thus stranded between the physical living world and the spiritual realm and often present a danger to the living. In order to appease victims of bad death, the living erect death memorials and perform additional mortuary rituals to ensure that the victims return to the locations of their demise and do not haunt or harm the living (Kozak 1991).

The problem is that these concepts represent multiple intersecting behaviors that need to be teased out of the archaeological data in order to separate the direct impacts of violence (versus the subtle variations) from the normative construction of mortuary features. From an archaeological perspective, however, treatment for a bad death still falls within the purview of mortuary performance. In these cases, the postmortem treatment of the dead continues to be part of the larger mortuary program performed by living members of the community and follows broader prescriptive norms, albeit contingent on the circumstances of death and, therefore, special (Aspöck 2008).

Mortuary Negotiation

The practice of normative mortuary rituals is an important element in the negotiation of identity within village communities and actively functions to reinforce social differences (Hodder 1982; Parker Pearson 1999; Rakita et al. 2005; Saxe 1970; Tainter 1978). This negotiation occurs in different social contexts than previous (living) interactions since it is facilitated by the relatives of the deceased in place of the individuals themselves. The remains of the deceased, therefore, present the opportunity for the living to utilize any social capital the deceased controlled to renegotiate interpersonal or community relationships for their own interests. Individuals in communities with a low degree of social integration would be more likely to aggrandize the deceased, signaling their importance and highlighting vertical social position. In contrast, individuals in communities with a high degree of social integration would be more likely to downplay vertical social position and celebrate the deceased in more subtle, personal ways. Individuals in the middle of this spectrum, such as those in small farming communities likely struggling with balancing household and community interests, might find the need to strike a balance in negotiating identity with the numerous characteristics of funerary customs that therefore bear out in resultant mortuary features.

Several researchers identify connections between corporate organization and private ownership of resources and the use of interment of the deceased to legitimate descent and inheritance (Goldstein 1976; Hodder 1982; Howell and Kintigh 1996; Morris 1991; Saxe 1970). It is additionally important to recognize that some facets of mortuary patterns reflect the social and religious values of those individuals who inter the deceased and who intentionally incorporate (signal) elements of group identity (Carr 1995; Parker Pearson 1999; Rakita et al. 2005; Tainter 1978). Therefore, identifying nuances in mortuary practices becomes a heuristic tool for examining identity, interaction, and inheritance in early farming village communities.

The normative practice of mortuary rituals among Early Agricultural period (ca. 2100 BC–AD 50) sites in the Sonoran Desert illustrates the active perimortem negotiation of these living social tensions. This period represents the earliest expression of permanent village settlement based in agricultural investment in the southwest United States and northwest Mexico—effectively, the Neolithic transition in the region. Irrigation is independently developed locally by 1500 BC and dramatically changes the adaptive strategies employed by these forager-farmer communities (Gregory et al. 2006; Hesse and Foster 2005; Huckell 1995; Mabry 2008; Wellman 2000). Mabry (2008) argues that "agricultural intensification through irrigation apparently occurred . . . in the absence of stresses on food resources from population pressure, territorial constriction, environmental deterioration, or social factors such as competition for social power" (iv). He further suggests that the combination of settlement-subsistence systems employed were likely associated

with the development of corporate organization, which would have included the development of social conventions such as the concept of private property ownership and inheritance and the continuity of household lineages (Mabry 2008:272). Households, identified as clusters of 3–6 residential pit structures with numerous associated extramural features (Whittlesey et al. 2010), likely reflect kin-based organization and segregation within these early farming settlements.

Early Agricultural period (EAP) sites span considerable distance (fig. 1) and demonstrate homogeneity in material culture that denotes continuity across communities and over considerable time (Mabry 2008). The EAP is divided into three phases based on material culture (unnamed phase: 2100–1200 BC; San Pedro phase: 1200–800 BC; Cienega phase: 800 BC–AD 50) but represents a general trend in increasing village settlement size and complexity (Mabry 2008; Whittlesey et al. 2010). Mabry (2008:271) has suggested that this was largely facilitated through sustained social interactions via a combination of exchange and marriage networks. However, there is considerable evidence for conflict and violence within and/or among these communities (Mabry 2008; Watson, Barnes, and Rohn 2010; Watson, Fields, and Stoll 2012). Evidence for violence between individuals not only includes traumatic skeletal lesions (McClelland 2010; Minturn and Lincoln-Babb 1995) but also irregularities in body placement and treatment in mortuary features from several sites (Watson, Barnes, and Rohn 2010; Watson, Fields, and Stoll 2012). Given an abundance of re-

sources and small populations, it is difficult to estimate whether violence would have centered on intercommunity or intracommunity conflict.

In this paper, we seek to identify how violence enacted on individuals may have been transmuted from death to the contexts of their burial. We propose that atypical burials have the greatest potential to demarcate this continuity of violence. Cross-cultural examination of the ethnographic literature presents several explanations for atypical burials, but these largely concentrate around treatment for a deviant social personae, bad death, or revenge killings (Boehm 1984; Boster, Yost, and Peeke 2003; Ginat 1997; Ko, Nelson-Becker, and Kwak 2015; Walker and Bailey 2013). We argue that atypical burials associated with interpersonal violent conflicts result in socialization for violence and a form of perimortem signaling, by which individuals are interred by perpetrators of that violence. In these cases, communication of identity by kin is usurped and replaced via signaling by the perpetrators. These cases lay in contrast to the traditional communication of identity and beliefs through the performance of mortuary ritual by the relatives of the deceased (or corporate group) to memorialize the dead. In order to identify atypical burials, we first define what constitutes normative patterns in mortuary features from the case study of the Early Agricultural period in the Sonoran Desert.

Early Agricultural Period Mortuary Program

To date, more than 450 mortuary features containing the remains of nearly 500 individuals have been recovered from EAP components at more than 40 sites from across the Sonoran Desert. This is a substantial database with which we can examine patterns in mortuary behavior at the advent of farming in the region. However, these data present unique challenges in interpretation compared to similar large mortuary data sets in that the materials (sites, features, and individuals) are geographically and temporally distant from one another; they are separated by more than 150 linear miles and span more than 2,000 years of cultural development. In addition, due to local conditions and considerable antiquity, preservation of the human remains varies widely and limits the quantity and quality of biocultural information that we can gain from much of the sample.

Given these limitations, we have selected a subsample of EAP mortuary features to examine for subsequent analyses. First, we selected the three locations that have produced the largest EAP burial samples for consideration. We grouped mortuary features from several sites into settlement districts (table 1; fig. 1), as defined by Mabry (2008), based on the recognition that they likely represent the same settlement in prehistory but were excavated in several discrete segments and often received distinct site designations and numbers. From north to south, these include (1) the LCA settlement district, which includes the sites of Las Capas (AZ AA:12:111[ASM)]), Costello-King (AZ AA:12:503[ASM]), and Ina Road Landfill (AZ AA:12:130[ASM]); (2) the LPZ settlement district, which includes the sites of Los Pozos (AZ AA:12:91[ASM]) and
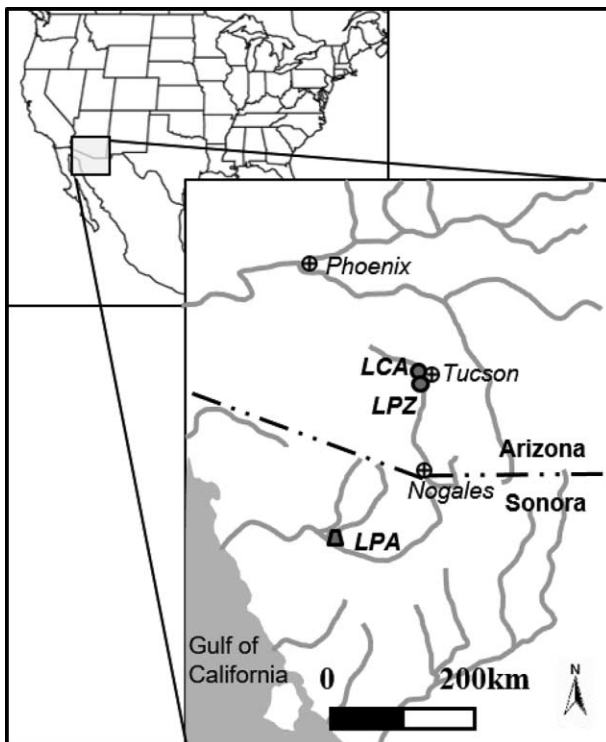

Figure 1. Location of the settlement districts utilized for this analysis within the Sonoran Desert of southern Arizona and northern Sonora, Mexico.

Table 1. Early Agricultural period mortuary sample

Settlement district, phase	Mortuary features	Individuals	Violent trauma
LCA:			
San Pedro	28	28	5
LPZ:			
Cienega	37	38	3
LPA:			
San Pedro	12	12	5
Cienega	26	28	5
Undated	66	66	10
Total	169	172	28

Note. LCA = Las Capas, Costello-King, and Ina Road Landfill; LPZ = Los Pozos and Wetlands; LPA = La Playa.

Wetlands (AZ AA:12:90[ASM]); and (3) the LPA settlement district, which includes only the site of La Playa (SON F:10:3 [ASM]) but is an expansive site that has largely been investigated evenly across its extent over the past two decades (Carpenter et al. 2015).

Next, we excluded mortuary features that were characterized by incomplete or poor preservation, including eroded or disturbed burial pits in which the interred remains were partially removed or modified. Although there is a significant amount of information that we can gain from these features, leaving gaps in the data has the potential to skew the results of our analyses. Finally, we also excluded mortuary features containing cremated remains because there are very few securely dated to the EAP, they could not be compared to inhumation features using the same set of variables, they represent very different mortuary processes, and their significance during the EAP has been considered elsewhere (Cerezo-Román 2013; Watson and Cerezo-Román 2010). This resulted in a subsample of 169 mortuary features containing the remains of 172 individuals. These remains correspond to a representative sample of the geographic and temporal extent of EAP settlements in the Sonoran Desert.

Methods

A series of 10 biocultural variables were identified from the database to characterize patterns in EAP mortuary behavior (table 2). These include (1) settlement district: LCA, LPZ, LPA; (2) archaeological phase: San Pedro, Cienega; (3) sex: male, female; (4) age group: infant (birth–3), child (3–12), adolescent (12–20), young adult (20–35), middle adult (35–50), old adult (50+); (5) burial context: primary, secondary; (6) feature construction: single, double, multiple; (7) body position: flexed, semiflexed, extended; (8) body placement: side (left/right), supine, seated, prone, head-in; (9) body orientation: north, south, east, west; (10) body treatment: none, mineral pigment; (11) associated funerary objects: absent, present; and (12) trauma: none, trauma, violent trauma. Not all individuals in the LPA sample could be assigned to an archaeological phase, but including the larger sample provides a more inclusive view of mortuary variability during the period. Variables 5–9 were selected to represent

the physical residues of mortuary performance, where variation in the expression of these manifestations has been shown to reflect components of social relationships and/or cosmological beliefs within cultures.

Nonparametric correlations were performed to identify relationships between variables that deserved further investigation. Frequencies were then compared for significant correlations using Pearson's χ^2 test of significance. These statistical analyses were conducted using SPSS Statistics for Windows, version 23.0.

Results

Results of the Spearman's test identified eight significant correlations between variables (table 3). Several correlations were identified with settlement district, including archaeological phase ($r_s = 0.471$, $n = 106$, $P < .01$), burial context ($r_s = -0.155$, $n = 172$, $P < .05$), body position ($r_s = 0.301$, $n = 172$, $P < .01$), body treatment ($r_s = 0.459$, $n = 172$, $P < .01$), and trauma ($r_s = 0.239$, $n = 172$, $P < .01$). The relationship between settlement district and archaeological phase is an important one for considering the rest of the variables, as LCA features date to the San Pedro phase, LPZ features date to the

Table 2. Characteristics of mortuary features in the Early Agricultural period sample

Feature, characteristic	n	%
Context:		
Primary	169	98.3
Secondary	3	1.7
Construction:		
Single	165	95.9
Double	4	2.3
Position:		
Flexed	125	72.7
Semiflexed	31	18.0
Extended	16	9.3
Placement:		
Side	92	53.5
Supine	49	28.5
Seated	12	7
Prone	14	8.1
Other	5	2.9
Orientation:		
North	57	33.1
East	22	12.8
South	51	29.7
West	33	19.2
Treatment:		
None	71	41.3
Pigment	101	58.7
AFOs:		
None	121	70.3
Present	51	29.7
Trauma:		
None	122	70.9
Trauma	22	12.8
Violent	28	16.3

Note. AFO = associated funerary object.

Table 3. Results of Spearman's correlation for biocultural variables

Category, variable	Phase	Sex	Age group	Burial context	Feature construction	Position	Placement	Orientation	Treatment	AFOs	Trauma
Settlement district:											
ρ	**.471**[a]	−.022	−.010	**−.155**[b]	.059	**.301**[a]	−.018	.052	**.459**[a]	−.036	**.239**[a]
N	106	145	172	172	172	172	172	163	172	172	172
Phase:											
ρ	…	.069	.189	.016	.191	−.012	.131	−.073	−.093	−.107	−.117
N	…	90	106	106	106	106	106	97	106	106	106
Sex:											
ρ	…	…	.047	−.007	.026	−.102	−.072	−.005	−.047	**.169**[b]	−.087
N	…	…	145	145	145	145	145	138	145	145	145
Age group:											
ρ	…	…	…	−.023	−.124	−.079	−.067	−.054	−.144	.047	.122
N	…	…	…	172	172	172	172	163	172	172	172
Burial context:											
ρ	…	…	…	…	−.027	.009	−.049	.113	−.069	.011	−.084
N	…	…	…	…	172	172	172	163	172	172	172
Feature construction:											
ρ	…	…	…	…	…	−.066	.024	.024	−.007	−.134	−.076
N	…	…	…	…	…	172	172	163	172	172	172
Position:											
ρ	…	…	…	…	…	…	**.410**[a]	.094	**.161**[b]	−.014	.156
N	…	…	…	…	…	…	172	163	172	172	172
Placement:											
ρ	…	…	…	…	…	…	…	.057	−.127	.005	.130
N	…	…	…	…	…	…	…	163	172	172	172
Orientation:											
ρ	…	…	…	…	…	…	…	…	−.063	.016	.004
N	…	…	…	…	…	…	…	…	163	163	163
Treatment:											
ρ	…	…	…	…	…	…	…	…	…	.027	.039
N	…	…	…	…	…	…	…	…	…	172	172
AFOs:											
ρ	…	…	…	…	…	…	…	…	…	…	−.053
N	…	…	…	…	…	…	…	…	…	…	172

Note. AFO = associated funerary object. Boldface indicates significant correlation.

[a] Correlation is significant at the 0.01 level (two-tailed).

[b] Correlation is significant at the 0.05 level (two-tailed).

Cienega phase, and LPA features date to both phases. But this allows us to examine the potential for changes in mortuary features over the duration of the EAP. The other correlations are reflective of differences in mortuary features between settlement districts: two secondary burials ($n = 2$) in the LPZ district ($\chi^2 = 7.704$, df $= 2$, $P = .021$), significantly more extended burials ($n = 15$) in the LPA district ($\chi^2 = 16.965$, df $= 4$, $P = .002$), a lot more individuals with pigment ($n = 83$) in the LPA district ($\chi^2 = 47.754$, df $= 2$, $P < .001$), and more cases of generalized trauma ($n = 22$) in the LPA district ($\chi^2 = 20.825$, df $= 4$, $P < .001$). A weak correlation was identified between sex and associated funerary objects ($r_s = 0.169$, $n = 145$, $P = .42$) as a greater proportion of females have objects (37.7%) compared to males in the sample (22.1%).

Finally, two correlations were identified with body position: placement ($r_s = 0.410$, $n = 172$, $P < .01$) and treatment ($r_s = 0.161$, $n = 172$, $P = .035$). The relationship between body position and placement is a critical one in these analyses and is fundamentally integrated. The differences observed across the sample ($\chi^2 = 51.297$, df $= 8$, $P < .001$) are largely due to the dominance of individuals being placed in flexed positions on one side (48.8%). Whereas, for example, there is considerably more diversity in the placement of individuals in supine positions. The correlation between body position and treatment reflects a disproportionate amount of extended burials with pigment ($\chi^2 = 6.514$, df $= 2$, $P = .038$). All but two extended burials (87.5%) have pigment applied to, or placed with, the body compared to just over half of the flexed (54.4%) or semi-flexed burials (61.3%). But this pattern is also related to the higher frequency of extended and pigmented burials at LPA.

Common Mortuary Patterns

The EAP mortuary program is dominated by single primary inhumations, with the body placed in a flexed position on the side, often oriented north-south, with pigment applied to or placed with the body (table 2; fig. 2). Funerary offerings are generally uncommon and limited in quantity, but the analysis identified that they are more commonly placed with women at EAP sites. Commonly encountered objects included marine shell jewelry (beads and pendants), utilitarian grinding stones (*manos* and *metates*), and projectile points, but stone pipes, bone tools, and quartz crystals are also encountered. In addition, objects appear to have a gendered distribution, with shell beads and utilitarian ground stone implements associated with females and pipes (stone and ceramic) and projectile points associated with males.

The results of the analyses also demonstrated a greater proportion of individuals with mineral pigment in the LPA sample (78.3%) compared to the LCA (39.3%) and LPZ (17.9%) samples. But the use of pigment is also qualitatively different between the settlement districts. Although there are documented pigment sources around the Tucson Basin (Popelka-Filcoff et al. 2008), the LPA settlement district is located directly adjacent to a large source of specular hematite (McLaurin and Rehrer
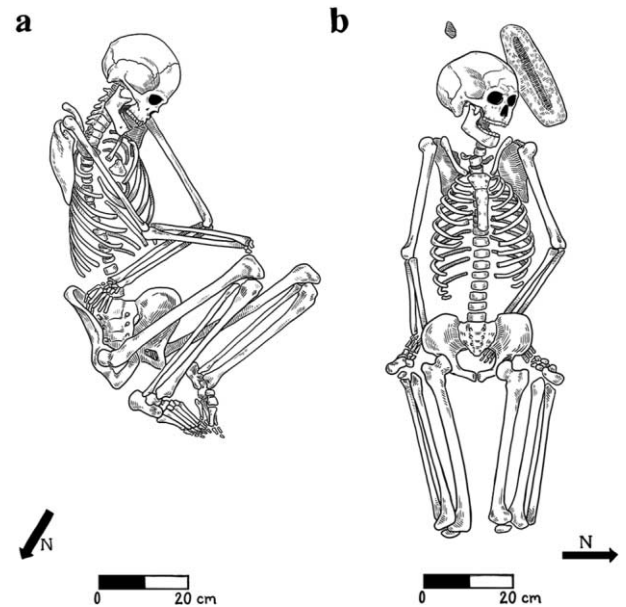

Figure 2. Examples of normative body placement from Early Agricultural period sites in the Sonoran Desert. *a*, Feature 313 from La Playa, an adult female inhumation placed in a flexed position on the left side with the left hand on the right hip and right hand under the right knee. *b*, Feature 547 from La Playa, an adult female placed in a flexed supine position with the hands placed under the feet with accompanying ground stone objects.

2008) that was applied broadly to humans and artifacts alike throughout much of the occupation history of LPA (Carpenter et al. 2015). The application of pigment to individuals in the Tucson Basin sites is more restricted to the face and pelvic area, or pigment is placed in the grave as processed "patties" (Mabry 2008; Thiel and Mabry 1997). However, this variability does not negate the importance of the use of pigment in mortuary context at EAP sites. There appear to be a similar proportion of artifacts recovered with pigment staining across all areas. Mabry (2005) argues that the placement and application of mineral pigment in mortuary contexts functioned to convey social identity and symbolized the continuity of life and death.

The results of the analyses demonstrate that there are a few important differences in mortuary patterns between settlement districts that reflect some of the variability inherent in EAP mortuary practices across space and time. In general, there is greater diversity in body position and placement in the LPA sample, which partially sets it apart from the other two settlement districts. However, this diversity is doubtless linked to an apparent increased variability in mortuary expression during the Cienega phase.

Part of this variability includes the appearance of mortuary features containing more than one individual during the Cienega phase. Double primary inhumations have been documented at several EAP sites, including La Playa (Carpenter, Rohn, and Montero 2003), Valley Farms (Wellman 2000), and Wetlands (Thiel and Mabry 1997). There appears to be no regularized combination to these features beyond the other-

wise normative characteristics of body placement and treatment. They are similar in every way to single primary inhumations, with the exception that there are two individuals buried in the grave. For example, the 11 double burials documented at the La Playa settlement complex are highly variable combinations (Carpenter, Rohn, and Montero 2003; Watson, Barnes, and Rohn 2006) consisting of male-male, female-female, male-female, male-child, female-child/infant, and infant-infant pairs. Most of these individuals were placed in flexed positions and painted with mineral pigment, and several were associated with objects. Although there was certainly something individually special about each of these interments, it appears that the construction of the mortuary feature followed a larger cultural prescriptive dictum.

In addition, secondary inhumations (including multiple individuals) have been documented in Cienega phase contexts at five separate EAP sites (Carpenter, Rohn, and Montero 2003; Huckell 1995; Mabry 2005; McClelland 2005; Thiel and Mabry 1997). Much like cremations, these secondary burials appear to represent an inherently different mortuary practice than the normative individual (or even double) primary inhumation. Mabry (2005:233) suggests that these may be linked to emergent concepts of ancestor worship among EAP communities. The best example of this is a multiple secondary burial from the Wetlands site (containing a large shell necklace) that included the partial remains of seven individuals: two mostly complete adults (one male, one female) and the partial remains of one adult and four children (between 5 and 16 years old). Thiel and Mabry (1997) suggest that the mostly desiccated remains of the partial individuals were exhumed from their original interments and deposited with the remains of more recently interred individuals. They also point out that a cranium and mandible and several long bones minimally represented each individual, whereas skeletal elements from the thoracic area and the extremities were little represented. This distribution of elements is most likely the result of a combination of differential preservation and cultural selection.

Atypical Burial

In addition to what we propose as typical variability observed in EAP mortuary features, eight burials from the LCA and LPA settlement districts stand out as atypical (table 4; fig. 3; Mabry 2008; Watson, Barnes, and Rohn 2010; Watson, Fields, and Stoll 2012). These individuals were placed vertically, head-first, into deep pits or thrown prone and haphazardly into pits with an apparent disregard for formal positioning of the body. None of these individuals had any signs of burial treatment (i.e., mineral staining or associated objects), and several had significant perimortem injuries, suggesting a very different process and significance in "placement" of the body. Elsewhere, we have referred to these cases as body disposals (Watson, Barnes, and Rohn 2010; Watson, Fields, and Stoll 2012), signifying that the body was placed without regard for the normative mortuary treatment and, perhaps, even reflecting some degree of desecration of the individual in the process of interment.

One of the earliest examples of these atypical EAP burials is a head-in placement of an older male from the Las Capas site (feature 592). The individual was situated in a large, oval, straight-walled pit, with the upper body on the floor, the pelvis laid against the wall, and the legs folded back over the torso and skull. The position suggests that the individual had been dumped in without regard for placement. The excavators additionally noted water-lain sediments filling part of the pit and suggested that perhaps the body had been exposed after being deposited (Mabry 2008:124). There were no associated funerary objects, and mineral pigment had not been applied to the body. The other early atypical burial from Las Capas (feature 9015) was a young male buried in a prone and sprawled position at the base of a large (1.75-m-diameter, 1.1-m-deep) bell-shaped pit (Price-Steinbrecher et al. 2014). There were four Empire points found with the body, likely associated with his violent death. Two were encountered in the thorax, possibly having entered the body from the back (based on the orientation of the point tips), and the other two at the pelvis and femur, possibly having entered from the front of the body. The individual also lacked associated funerary objects or body treatment. This burial was associated with stratigraphy placing it within the early San Pedro phase (ca. 1220–1000 BC).

Only two of the atypical burials from La Playa are dated, both associated with the late Cienega phase (800 BC–AD 50). These include a young male (feature 292) who was buried supine and splayed with a San Pedro point embedded in his back between the first and second ribs and a young female (feature 316) buried head-in to a large pit. The remaining atypical burials from the site, which could conceivably span much of the EAP, included an older female (feature 369), who was prone and splayed and exhibited charring on the face and side of the cranium, and three vertical, head-in bodies of one young (feature 461) and two older (features 367 and 501) males. The young male also had a San Pedro point embedded in the thorax. None of these individuals were encountered with associated funerary objects or body treatment with mineral pigment.

Taphonomy

We further considered the possibility that undocumented taphonomic processes could have contributed to these atypical body positions. Little attention has been paid to formally documenting the impact of taphonomy on human burials. One exception to this oversight is the work of Duday (2009), whose approach focuses on recording the position and relationships of individual skeletal elements to reconstruct burial taphonomy and how decomposition of soft tissue can help reconstruct body placement and grave construction by considering the effects of gravity, soil compaction, and weight and the rate and course of decomposition in the burial feature. Decomposition creates space that soft tissues once occupied. Soil eventually fills most of these voids. If decomposition is slow and largely matched by soil replacement, then individual elements are more likely to remain in their original position (progressive filling).

Table 4. Atypical burials from Early Agricultural period sites

Site, feature no.	Phase	Sex	Age	Position	Evidence of violence	Reference
LCA:						
592	San Pedro	Male	45–50	Vertical (head-in)	None observable	Mabry 2008
9015I	San Pedro	Male	20–25	Prone and splayed	4 Empire points	Mabry 2008
LPA:						
292	Cienega	Male	20–25	Supine and splayed	San Pedro point	Watson, Barnes, and Rohn 2010
316	Cienega	Female	20–25	Vertical (head-in)	None observable	Watson, Barnes, and Rohn 2010
367	...	Male	40–50	Vertical (head-in)	None observable	Watson, Barnes, and Rohn 2010
369	...	Female	40–50	Prone and splayed	Burning on cranium	Watson, Barnes, and Rohn 2010
461	...	Male	20–25	Vertical (head-in)	San Pedro point	Watson, Barnes, and Rohn 2010
501	...	Male	45–50	Vertical (head-in)	None observable	Watson, Barnes, and Rohn 2010

Note. LCA = Las Capas, Costello-King, and Ina Road Landfill; LPA = La Playa.

Fast decomposition and/or slow soil replacement is more likely to create active space or voids in which skeletal elements can move via gravity or soil movement (delayed filling). The analysis presented here considers variables that reflect decomposition processes.

We closely examined the contextual information and employed an expanded approach to burial taphonomy to estimate that these burials were most likely placed in these pits and quickly buried, which helped preserve the position of the body. All but one of the atypical burials (LPA 292) had preserved anatomical articulations (table 4; fig. 3). This included all of the head-in burials, which were largely oriented in a vertical position with the legs extended up the edges of the pit and often well above the head. It is extremely unlikely that these acrobatic positions would have been maintained over even short periods of time (after rigor mortis releases) if the body was exposed in the pit with active space and delayed filling.

Anatomical articulations were similarly preserved among the prone and splayed individuals, indicating a similarly progressive filling process associated with atypical EAP burials. The exception was a supine, splayed individual with a pro-jectile point embedded in the back of the neck. Both sets of shoulder (scapula/humerus) and hip (os coxa/femur) articulations were dislocated, but all of the other articulations—both axial and appendicular—maintained anatomical positioning. This indicates that the body certainly shifted in postdepositional contexts. However, the preservation of elbow and knee anatomical articulations in this individual also indicates that there was likely significant pressure on the shoulder and hip joints. They would have dislocated under pressure from in-filled sediment as the joint capsules (specifically, their more durable ligamentous attachments) decomposed and released the articulation. These results indicate that these individuals were actively buried prior to decomposition—at or near the time of death. In addition, they were buried without many of the normal signifiers of identity, which functioned to devalue their personhood but not deny it entirely.

Trauma and Violence during the EAP

Nearly one-third (29.1%) of the EAP sample exhibits some form of trauma evident on the skeletal remains. This includes a
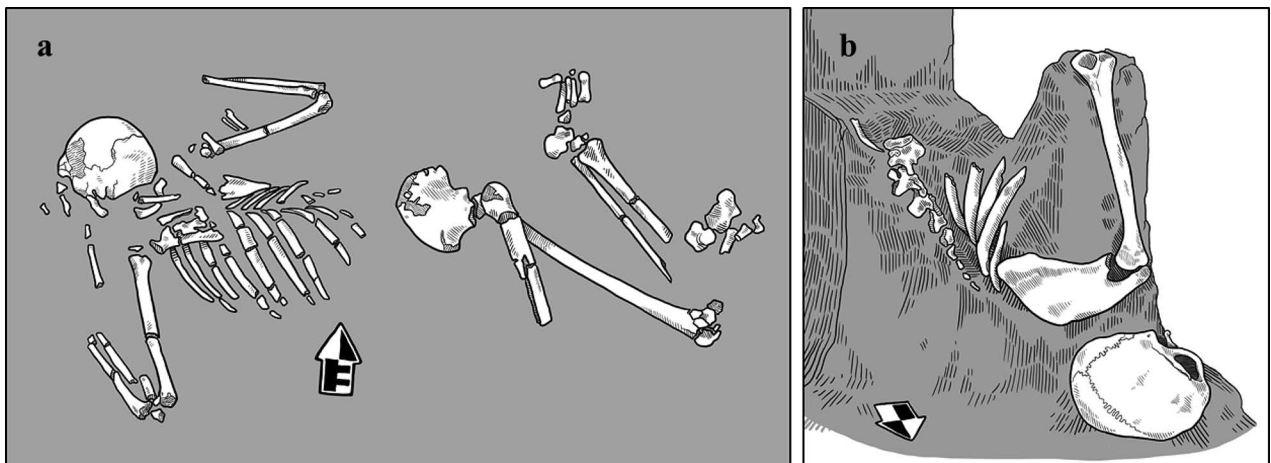

Figure 3. Examples of atypical burials from Early Agricultural period sites in the Sonoran Desert. *a*, Feature 369 from La Playa, an adult female placed prone and splayed with evidence of burning on the cranium. *b*, Feature 413 from La Playa, an adult male placed head-in (no apparent trauma).

variety of healed and perimortem fractures, dislocations, projectile trauma, and blunt-force trauma. However, it is also likely that as part-time foragers, accidents related to subsistence practices can contribute many traumatic injuries. The potential, therefore, exists that trauma related to accidents could obscure or be mistaken for violent trauma, and vice versa.

We thus separated the more secure or likely evidence for violent trauma in the sample by focusing on projectile and blunt-force trauma (table 2). This produces an average frequency of 16.3% individuals that experienced violent trauma in the sample, although table 3 demonstrates that it fluctuates considerably by settlement district and time. Although it appears that there are higher frequencies of violence within the LPA sample, this pattern is more likely the result of a larger, better-preserved sample. What is also evident is that there are higher frequencies of violence during the San Pedro phase than the later Cienega phase.

More importantly, there were nearly equal proportions of individuals that displayed healed cranial blunt-force traumas as those that had perimortem cranial blunt-force traumas and embedded projectiles. This is indicative of repetitive violence among these communities. One older male from LPA (feature 503) displayed a healed depression fracture on the posterior left parietal and an embedded fragment of chert (projectile point tip) within a healed shallow depression on the posterior right parietal. These violent traumas are also equally common among females at EAP sites, indicating that a variety of community members could become victims of this violent trauma.

As previously mentioned, several of the individuals we identify as atypical burials display signs of violent trauma, however, not all victims of violent death resulted in an atypical burial. The burial of an adult male (35–45 years old) from the Wetlands site with four embedded Cienega projectile points represents an individual who certainly suffered a violent death (Thiel and Mabry 1997:109) but was evidently interred by relatives and afforded the prescribed mortuary rites. The body was placed in a flexed seated position (probably bound) and covered with mineral pigment. All of the normative elements of the EAP mortuary program were present with this individual (primary inhumation, flexed, seated, pigment) despite the fact that the individual died from being shot numerous times with projectile points.

The Performance of Mortuary Ritual

In the preceding analyses, we identify several patterns that are common across most burials in the case study. These patterns represent the material residues of the prescriptive performance of mortuary rituals within these communities. Performance of the mortuary ritual in a given community can begin as early as the recognition of a terminal illness in an individual and continue well after the deceased has been buried (Hertz 1960; Metcalf and Huntington 1991; Schiller 2001). But most important to archaeologists are those material residues of the performance that preserve and are recovered as part of the

mortuary feature. This largely includes the construction of the feature, the interment of the individual and treatment of the body, associated material remains, and any postinterment treatments (i.e., secondary funerary treatments). As part of the larger social practice of transformation or one of the major rites of passage (van Gennep 1960), the process of interment itself often represents a performance that visually expresses combinations of perceived or actual social roles, life history, or cultural cosmology/worldview.

The performance of mortuary rituals is significant in archaeology because these rituals have the potential to preserve the residues of the living, negotiating, displaying, masking, or even transforming social relationships with the deceased (Rakita et al. 2005). Performances—and, in turn, the mortuary rites that accompany them—largely follow a formal prescribed social tradition (Pader 1982). They also function to communicate social mores, to reinforce social distinctions, and/or strengthen social relationships (Inomata and Coben 2006). Mortuary rituals are primarily focused on the rite of passage that death marks—which separates the living from the dead. Ethnographic studies of mortuary ritual (e.g., Hertz 1960; Metcalf and Huntington 1991; Schiller 2001) suggest that participation in these rituals allows for "the communicating and assessing of group and individual identities" (Chesson 2001:4). The formation of identity is crucial in understanding how people view themselves and others.

We consider the performance of mortuary ritual to be an essential component of the transition for the body and soul of the individual as well as community participants (Hertz 1960; van Gennep 1960) and employ it here as a de facto approach to interpreting the residues of mortuary behavior in the archaeological record. The tangible elements of performance are essential components in the transition from one social state to another during rites of passage (van Gennep 1960). The culturally contingent timing of social death means that mortuary performances can occur as part of the preliminal rites (separation), liminal rites (transition), or postliminal rites (reincorporation) or can be protracted throughout the continuum. The key to the performance is the participation of the audience—if even as passive observers—so that mourners and community members move through the simultaneous process of transition during the mortuary rite (Hertz 1960). The ritualized communication of mortuary performance is imbued with intentionality, following prescriptive cultural traditions, and is distinguished from reactive and spontaneous behavior found in the following consideration of costly signaling theory and perimortem archaeological deposits.

Costly Signaling Theory and Perimortem Archaeological Deposits

The preceding analyses also identified several cultural deposits that we classify as atypical burials, which lack evidence of normative mortuary performance and instead display evidence

of violence and irregular positioning. Building on the work of Sosis, Kress, and Boster (2007), we employ a framework of costly signaling theory (CST) to interpret these atypical burials and their potential as a by-product of evolutionary-based behavior ultimately designed to offer advantages to the individual and, perhaps, their community. Signaling theory developed independently in the fields of economics and biology but has only recently been applied to anthropology and archaeology (Glatz and Plourde 2011; Neiman 1997; Palmer and Pomianek 2007; Smith and Bliege Bird 2000; Sosis and Alcorta 2003).

CST is a subset of signaling theory from evolutionary biology, which is based on the assumption that individuals communicate (signal) information that is intended to influence or manipulate, rather than inform, other organisms (Cronk 1994; Palmer and Pomianek 2007; Smith and Bliege Bird 2000). A central question of signaling theory is how "honest" the signals being communicated are, although there are benefits to producing deceptive signals (Palmer and Pomianek 2007:269). CST takes this a step further and identifies that signaling comes at significant cost to the signaler but allows the receiver to identify that a signal is honest. The signal (a physical or behavioral characteristic) is hard to fake because it involves strategic costs, often referred to as handicaps, which provide valuable information to receivers of the signals (Cronk 2005).

Evolutionary biologists often apply signaling theory to sexual selection (Darwin 1859) for conspicuous traits among animals to trace the relationship between the cost of a signal and its honesty. Animals of greater biological fitness signal this status to potential mates through "handicapping" behavior or morphology (apparently "wasteful" characteristics such as bright plumage), which results in a lowered level of biological fitness (Zahavi 1975). Zahavi (1975:207) suggests that sexual selection is effective in the terms of natural and mate selection. Both parties benefit, with the selecting sex being assured of the quality of its mate and the selected sex benefiting from better advertising. However, both sexes also lose in several ways. Males tend to invest more heavily in advertising their qualities, while females will lose by not having as much help from their partners and "bearing sons which are less fit to stand the pressure of natural selection" (Zahavi 1975:207). Richerson, Borgerhoff Mulder, and Vila (2001) hypothesize that "if [human] culture is a means of evading information costs, decision making forces will be weak, [and] selection and other forces acting on cultural factors can [then] favor traits that are maladaptive from the genes' point of view" (525). Cultural factors are, therefore, forms of signals.

Anthropologists have used Zahavi's (1975) handicap as a jumping board into the more complex issues of CST, including approaching issues of religious ritual and commitment (Smith and Bliege Bird 2000, 2005; Sosis and Alcorta 2003; Sosis, Kress, and Boster 2007). Sosis and colleagues (Sosis and Alcorta 2003; Sosis, Kress, and Boster 2007) have argued that participation in religious ritual can serve as a costly signal of commitment (i.e., time, resources, personal risks) for the col-

lective good. Other ethnographic accounts of, or arguments for, CST revolve around cases of apparent altruistic reciprocity or "wasteful" subsistence practices that function to provide status or preferential access to resources. Bliege Bird and Smith (2005) discuss a variety of cases from Melanesia, from the management of social capitol resulting from creating elaborate funeral feasts to gaining social status from growing a single (or a few) giant yam(s). In addition, several authors highlight the importance of high-risk hunting strategies as a form of costly signaling (Smith and Bliege Bird 2000, 2005; Sosis 2000) as well as costly initiation and puberty rites such as scarification and tattooing (Low 1979; Ludvico and Kurland 1995; Singh and Bronstad 1997).

Roscoe (2009) proposes that the organization of small-scale societies (based on ethnographic records of tribal New Guinea) is primarily concerned with biological and social reproduction, subsistence optimization, and defense, which created the need for a segmented social structure and social signaling. He argues that warfare figured prominently in precontact New Guinea and affected several aspects of social structure but specifically created the need for signaling (displaying) military strength. He reasons that "signaling benefits everyone, even losers, because, in addition to sidestepping the physical costs of dangerous fighting, it secures the benefits of collective action— benefits that could not be realized by individuals or individual subgroups acting alone" (Roscoe 2009:72).

A few archaeologists have used CST as an explanatory framework for the expression of material forms of communication in the archaeological record. McGuire and Hildebrandt (2005) follow a number of the ethnographic examples and suggest that big-game hunting and food sharing during the Middle Archaic period in the western Great Basin was a form of male costly signaling. They link an increase in big-game fauna in the archaeological record over time to signaling and the manipulation of prestige to increased fitness. Plourde (2008) argues that prestige goods such as objects of personal adornment present costly signals that convey the quality of an individual (manufacturer or consumer) to others and similarly manipulate social relationships to their benefit. Waguespack et al. (2009) suggest that all flaked stone projectile technology (in lieu of wooden projectiles) may be representative of costly signaling strategies—the cost being in procurement of raw materials and the time and skill in manufacture—that express identity and could be used to manipulate social relationships. Monumental architecture in several areas of the world, such as Maya pyramids or European Late Bronze Age stone structures, has been associated with the advertisement of wealth and control of labor (Glatz and Plourde 2011; Neiman 1997). The ability to display (at considerable economic cost) these symbols sends very clear messages to be consumed within and between groups (Smith and Bliege Bird 2000).

Signaling theory has yet to be applied to mortuary behaviors. Burials can convey messages not only about the deceased individual but also about the living community. Signaling in mortuary behavior could be interpreted from acts as simple as

different positioning of the body from normative practices or as complex as an individual being drawn, hanged, and quartered, such as found in fourteenth-century England (Lewis 2008). Any variations of these types of signals are direct communications to observers about the signalers. In the archaeological record, burials are the one place where signaling could be directly visible, especially with regard to conflict and violence. Costly signaling theory is applicable to examining mortuary features for evidence of violence because it provides information about "circumstances in which there are broad conflicts of interests between categories of signalers and receivers but [also] *confluences* of interest between particular signalers and particular receivers" (Cronk 2005:612).

We propose that the atypical burials from EAP sites in the Sonoran Desert represent a form of signaling facilitated at the time of death and deposition of the individual, which we refer to as perimortem signaling. This qualifier is important to designate that the act of burial or final disposition of the body occurs at or around the time of death; thus, the act of interment is the signal. Perimortem signaling may be considered a form of "costly signaling theory of reassurance" that relies on the sending and receiving of costly signals (Kydd 2000). Costly signals, in this context, are signals designed to persuade the other side that one is trustworthy by virtue of the fact that they are so costly that "one would hesitate to send them if one were unworthy" (Kydd 2000:326). Signaling, thus, can be viewed as a form of cooperation and reciprocity/reassurance (Gil-White and Richerson 2003). Humans as cooperative groups depend on reciprocity and signaling, which allows for the formation of emotional attachments to social norms. When an individual deviates from the norm, it generates a need by the group to punish the individual to stabilize the society (Gil-White and Richerson 2003). This function is especially important in kin-group communities. Kin-groups tend to lack a central authority and depend on their own abilities to defend themselves and to carry out violent acts in order for outside individuals to conform to the social norms (Knauft et al. 1987). Violent acts are specific forms of communicating the social norms of one group (or individual) to another (Abbink 1998).

In contrast to performative acts, which require the participation of a public audience, costly signals need only to be displayed to one other individual, such as a peer warrior, who can attest to the honesty of the signal. In the case of violent interactions, perpetrators would recognize that by killing and disposing of an individual (which would be the signal), they would be inviting reprisals from kin or community members (a reassurance of not exact retaliation but some type of cost). But the benefit of such costly behavior may be significant for both the group as well as the individual (Smith and Bliege Bird 2005). The killer may benefit from prestige gained from such acts of bravery or from demonstrating their ability as a warrior, which signals their fitness and may assist in mate selection by females. The group benefits in that the killer demonstrates their commitment to the groups' defense or execution of their interests (e.g., in warfare). Sosis, Kress, and Boster (2007) sug-

gest that these same mechanisms create costly male rituals as an adaptive response among communities that engage in warfare to reduce free riding and promote cooperation. The enactment of, or participation in, violence and costly male rituals functions to create male solidarity—a form of commitment to the larger community. Several cross-cultural studies have identified a relationship between socialization for aggression and the frequency of warfare (Chick and Loy 2001; Ember and Ember 1994).

In many nonindustrialized societies, vengeance and revenge are characterized as legitimate motives for killing, which, in turn, are manifestations of individual conflicts of interest over material and reproductive resources (Chagnon 1988). Although Chagnon's work and interpretations among the Yanomami have been criticized (i.e., Albert 1989), his observations and theoretical applications—that revenge killings can lead to the development of blood feuds—are still valid suppositions, have been demonstrated in other ethnographic cases (i.e., Beckerman et al. 2009; Boehm 1984), and may, in fact, be quite common in tribal societies (Ember 1982; Ember and Ember 1994). Chagnon (1988) identifies that blood feuds result from "retaliatory killings in which an initial victim's close kinsmen conduct a revenge raid on the members of the current community of the initial killer" (985). His primary conclusion that more violent males gain more wives and have more offspring is an explicitly sociobiological explanation. However, reexamining his argument through CST provides a similar explanation. In this case, both ritual violence and warfare function to provide honest signals of an individuals' fitness in a group socialized for violence, which results in a pattern of mate selection that increases the individuals' fitness by producing more offspring.

Some researchers caution against a strictly biological approach toward understanding the cultural expressions of violence because they lack full explanatory power for understanding the increase and variability of violence in the archaeological record (Codding and Jones 2007). Evolutionary processes, however, do provide a biocultural basis for understanding the origins (ultimate causation) of violence in humans. As violence and aggression become part of a social pattern, aggressive acts can become deeply infused with cultural meaning. Thus, in order to gain a broader perspective on the cultural construction and enactment of violence, bioarchaeological studies need to consider the symbols and rituals that legitimize aggressive acts as culturally appropriate (Sosis and Alcorta 2003).

Sosis, Kress, and Boster's (2007) cross-cultural examination of costly male rituals identified that warfare (presence and frequency) was the unique predictor. They specifically distinguish that nonstratified foraging societies regularly engaging in warfare sustained the costliest male rituals. They additionally found that cooperative production, food sharing, and socialization for cooperation were not significant predictors of variance in ritual costs. In other ethnographic studies, horticultural groups in particular were demonstrated to have higher rates of warfare (Ember 1982). Among the Gebusi of New

Guinea, sudden lethal and unrestrained acts of violence are necessary, culturally sanctioned events to expunge hostilities and return the community to stability (Knauft et al. 1987). Abbink (1998) suggests that the Chai-Suri of southern Ethiopia use violence as a means to symbolically construct group identity. Both groups use signaling through an act of violence independent from economic factors such as cooperative production of food; rather, it is a way to control the group and reinforce collective identity. In both examples, however, the death of an individual resulting from these violent acts can invite reprisal from relatives of the deceased and has the potential to spark blood feuds. Of course, there are several classic ethnographic cases documenting the dynamics of blood feuds developing through cycles of revenge killings (e.g., Boehm 1984; Chagnon 1988; Robarchek and Robarchek 1998; Rosaldo 1989) as well as historical and contemporary cases among industrialized groups (e.g., Alther 2012; Mustafa and Young 2008).

Revenge as a Causative Agent for Violence

The link between war and interpersonal violence is one of the most encompassing cross-cultural factors demonstrated to contribute to violence in societies (Ember and Ember 1994). Ember and Ember (1994) suggest that the specific mechanism for this connection and high rates of interpersonal violence lie in socialization for aggression. Their results reveal that, cross-culturally, societies that regularly engage in aggressive and violent conflicts, such as war, tend to encourage more aggressive behavior among its members. This is particularly true among males across societies and provides support for Sosis, Kress, and Boster's (2007) work suggesting that costly signaling in ritual activity is common for males in societies in which warfare is frequent. Chagnon (1988) considers revenge as the major factor that promotes violence in societies, but he also posits that the original impetus for violence is competition for resources (land and wives). We push his argument a bit further to suggest that revenge killings constitute a form of costly signaling. Of course, the variability and unpredictability of ecological resources have also long been cited as strongly linked to the presence and regularity of warfare (Ember 1982).

Ethnological research highlights connections to violence from ecology, evolutionary biology, and social structures—which are also not mutually exclusive. Specific social structures identified include regularity of warfare, socialization for aggression, paternal presence, and revenge. All of these variables, with the exception of revenge, have been defined through quantitative cross-cultural ethnographic comparisons. Chagnon's (1988) statements on revenge are more qualitative in nature and deserve further consideration since they have important implications for our concept of perimortem signaling.

We employ a small set of variables from the Standard Cross-Cultural Sample (SCCS)—186 societies, a representative and independent sample of all geographic regions and cultural clusters (Murdock and White 1969)—to test for relationships

with revenge as a causative agent for violence cross-culturally. The variables tested include (1) principal subsistence categories, (2) community size, (3) social stratification, (4) community integration, (5) prominent community ceremonials, (6) ritual warfare, (7) internal warfare, (8) external warfare, (9) prestige of warriors, and (10) revenge-related norms. We compared the variables using a Spearman's rank order correlation (a nonparametric test) to investigate the variation in the relative frequency of revenge among the other variables (table 5). Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity, and homoscedasticity. These statistical analyses were also conducted using SPSS 23.0.

The results of the Spearman's test identified the singular significant correlation for revenge to be a moderate negative correlation with internal warfare ($r_s = -0.290$, $n = 49$, $P < .05$). Although this was not among the strongest statistically significant correlations in the test (table 1), most of the other correlations were predictable. Strong relationships were identified between prestige of warriors and external warfare ($r_s = -0.696$, $n = 43$, $P < .01$), subsistence and community size ($r_s = 0.500$, $n = 185$, $P < .01$), subsistence and social stratification ($r_s = 0.465$, $n = 96$, $P < .01$), and prestige of warriors and ritual warfare ($r_s = 0.449$, $n = 41$, $P < .01$). Moderate correlations were identified between social stratification and community size ($r_s = 0.390$, $n = 96$, $P < .01$), social stratification and community integration ($r_s = 0.350$, $n = 96$, $P < .01$), internal warfare and external warfare ($r_s = 0.308$, $n = 82$, $P < .01$), community size and prestige of warriors ($r_s = -0.292$, $n = 75$, $P < .05$), community size and external warfare ($r_s = 0.279$, $n = 84$, $P < .05$), community size and community integration ($r_s = 0.287$, $n = 185$, $P < .05$), and subsistence and prestige of warriors ($r_s = 0.262$, $n = 75$, $P < .05$). A weak correlation was identified between subsistence and community integration ($r_s = 0.171$, $n = 84$, $P < .05$).

Of specific concern to this study, the results identify that the acceptance or prescription of revenge as a legitimate act varies across societies by the frequency of internal warfare. The SCCS (Murdock and White 1969) defines internal warfare as warfare between communities of the same society, whereas external warfare is defined as warfare with other societies. Table 6 demonstrates that revenge is more common in societies that experience frequent internal warfare and is less common in societies in which internal warfare is rare. Frequent internal warfare is thus a potential contributing factor to revenge killings. The results of these analyses also reveal that revenge is present in many societies independent of other potentially controlling factors such as community size or social stratification. These comparisons provide some support for Chagnon's (1988) suppositions that revenge can be a significant factor contributing to violence within communities. In addition, although beyond the scope of our considerations here, the fact that the strongest correlation identified was between prestige of warriors and external warfare deserves further attention. Chagnon (1988) also quantifies a direct link between numbers of individuals killed, prestige, and reproductive suc-

Table 5. Results of Spearman's correlation

Category, variable	Community integration	Community ceremonials	Ritual warfare	Internal warfare	External warfare	Subsistence	Social stratification	Prestige of warriors	Revenge
Community size:									
ρ	.287[a]	−.019	.076	−.069	−.279[b]	.500[a]	.390[a]	.292[b]	−.015
N	185	185	82	85	84	185	96	75	80
Community integration:									
ρ	1	.078	−.163	.051	−.034	.171[b]	.350[a]	0	.170
N	186	186	82	85	84	186	96	75	80
Community ceremonials:									
ρ	...	1	.207	.173	.117	−.137	−.029	.089	−.050
N	...	186	82	85	84	186	96	75	80
Ritual warfare:									
ρ	...	...	1	−.105	−.261	−.054	−.125	.449[a]	.107
N	...	...	82	51	51	82	50	41	47
Internal warfare:									
ρ	...	...	...	1	.308[a]	−.124	−.075	−.202	−.290[b]
N	...	...	...	85	82	85	54	41	49
External warfare:									
ρ	...	...	...	...	1	−.155	−.097	−.696[a]	−.188
N	...	...	...	...	84	84	54	43	49
Subsistence:									
ρ	...	...	...	...	...	1	.465[a]	.262[b]	−.061
N	...	...	...	...	...	186	96	75	80
Social stratification:									
ρ	...	...	...	...	...	...	1	.056	−.217
N	...	...	...	...	...	...	96	73	77
Prestige of warriors:									
ρ	...	...	...	...	...	...	...	1	.208
N	...	...	...	...	...	...	...	75	66

Note. Boldface indicates significant correlation.
[a] Correlation is significant at the 0.01 level (two-tailed).
[b] Correlation is significant at the 0.05 level (two-tailed).

cess (number of wives)—although this is not the case in other violent societies (Beckerman et al. 2009).

Discussion

We argue that the evidence for violence during the EAP indicates that intercommunity conflict was pervasive. Several researchers have demonstrated that horticultural groups have higher rates of warfare, especially resulting in homicides, compared to hunting-and-gathering communities (Abbink 1998; Knauft 1990; Knauft et al. 1987; Nolan 2003; Richerson, Borgerhoff Mulder, and Vila 2001). Nolan (2003) further notes

that more acts of violence occur among horticulturalists that have above-average population densities, linking violence to environmental and resource stress. Others have noted that the number of violent acts also increase with increasing quantities of unrelated people living in a given location (Richerson, Borgerhoff Mulder, and Vila 2001). Both of these circumstances exist during the EAP. Although Mabry (2008) suggests there is little evidence of competition for resources among these communities, he fails to consider competition for reliable water and irrigable land. EAP sites on the floodplain are located in very restricted niches, exploiting geologic and physiographic features that concentrate water at the surface of the normally perennial

Table 6. Distribution of societies across revenge-related norms and frequency of internal warfare

	Frequent		Common		Occasional		Rare or never	
Revenge-related norms	n	% (n row)	n	% (n row)	n	% (n row)	n	% (n row)
Revenge is forbidden	2	25.0	0	.0	1	12.5	5	62.5
Revenge is neither forbidden nor prescribed	2	16.7	4	33.3	2	16.7	4	33.3
Revenge is prescribed, compensation by payment	4	30.8	2	15.4	2	15.4	5	38.5
Revenge is prescribed	6	75.0	0	.0	1	12.5	1	12.5
Revenge is prescribed, retaliation is allowed	3	37.5	2	25.0	1	12.5	2	25.0

Note. Boldface indicates highest values per frequency of internal warfare.

rivers of the Sonoran Desert to facilitate canal irrigation (Nials, Gregory, and Hill 2011). In addition, there is clear evidence for increases in population densities over the course of this period, and they were probably growing in diversity. Recent craniometric comparisons between EAP communities by Byrd (2014) identified a significant amount of within-group diversity between EAP sites, which she argues is a pattern observed among groups that practice matrilocal postmarital residence. If this were the case, nonlocal males marrying into a given community could have been a source of more aggression and conflict.

In several cases, violent trauma within these early farming villages extended from acts on the living body to acts upon the corpse. We argue that some, not all, victims of violent death were interred by the perpetrators of that violence in the place of kin or community members. As a result, they were never afforded the traditional mortuary performance associated with death rites, which is reflected in the presence of perimortem trauma and body position and treatment that differs considerably from the normative mortuary patterns. In these cases of atypical burial, we further argue that the perpetrators functioned outside of the performance of death rituals and the public display of asymmetrical power relationships or the reinforcement of moral integration of community identities to basal behavioral responses and costly signaling that could have invited reprisals and the development of blood feuds (Chagnon 1988). The continued act of violence—from causing death to disposing of the body in a violent manner—is part of a reactive chain of behavior that additionally functioned to signal the fitness of the perpetrator(s). It simultaneously demonstrates the individuals' commitment to the group, promoting solidarity, and likely confers some level of prestige that can be capitalized on to manipulate social circumstances and increase inclusive fitness, such as that seen among the Yanomami.

Rosaldo (1989) argues that the focus on mortuary ritual in anthropological analyses devalues or ignores the expression of deep emotion in the face of events as traumatic as the death of a loved one. Of course, Rosaldo's critique relates to the conflation of ritual practice with bereavement, but deep emotion plays a significant role in the perpetration of violence as well. In fact, Rosaldo's (1989) celebrated essay "Grief and a Headhunter's Rage" ties the immense grief experienced from death to the desire to commit violence, which he refers to as the "emotional force" of death. He paraphrases what motivates Ilongot men to headhunt, stating that "rage, born of grief, impels him to kill his fellow human beings" (Rosaldo 1989: 167). Among the Ilongot, this grief-rage-violence progression creates cycles of revenge killings, a phenomenon that has been observed among several tribal societies with socialized violence (Chagnon 1988; Robarchek and Robarchek 1998). Although among the Ilongot, revenge was not the primary motivating factor, it certainly could become a vehicle of direction.

Chagnon (1988) cites that the most common explanation for warfare (or raids among the Yanomami) is revenge for a previous killing. Our cross-cultural examination of revenge as a causative agent for violence indicates that acts of revenge are more likely to occur to an interloper of a group rather than a kin member. Intercommunity conflict—whether warfare or blood feuds—is more likely to result in the deaths of any exposed community member.

Additional explanations for violence among these communities and atypical burials include raiding from local foraging groups for stored food or between village communities for wives (as Chagnon [1988] observes among the Yanomami). Both of these explanations appear less convincing given the extensive evidence for continued foraging and long-distance trade and the possibility that these communities may have been structured around matrilocal residence (Byrd 2014). The presence of numerous healed traumatic skeletal lesions indicates that, accidents aside, violence was a regular component of village life. If community integration was facilitated for males through ceremonialism and warfare, as argued by Mabry (2005), then costly male rituals could have been a plausible part of the larger social complex (Sosis and Alcorta 2003).

Another possible explanation for atypical burials is the prescribed treatment for a bad death (Aspöck 2008), in which case intentionality is employed but varies a considerable degree from the normative practice. However, we find this to be a less parsimonious explanation given that characteristics of these burials are quite variable. Although most of these individuals apparently suffered a violent death, mortuary treatment for a bad death is likely to take a more regularized form (Aspöck 2008).

Finally, another possible explanation for atypical interment is sacrifice (Manson and Wrangham 1991). Atypical mortuary practices associated with violent deaths similar to those found at EAP sites are also known from Archaic sites in the eastern United States (Claassen 2015:162). A variety of burial postures are found at these sites; however, atypical burials such as head-first, facedown, or twisted-body interments suggest violent deaths and possible sacrifice. Claassen (2015) believes that these different burial postures showcase diverse causes of death, though the individuals may have likely been captured not for revenge killings but as sacrifices to appease a deity/deities. These examples from the eastern Archaic could similarly represent perimortem signaling, whereby the act of sacrifice extended the continued devaluation of the identity of the individual into internment. A sacrificial explanation is not out of the question for the cases of atypical burials from the Sonoran Desert, but taphonomic evidence from a couple of these individuals would suggest a hasty burial and argues against conditions of formal sacrifice.

Conclusions

There is considerable evidence for violence among small-scale societies, and it is plausible that achieved status through violence and signaling could have created cycles of blood feuds that are partially preserved in the archaeological record as atypical burials. In the case study presented here, we suggest that atypical burials represent the deposition of an individual by those who perpetrated their death and constitute a form of

costly signaling, in that these actions present great personal risk and could invite reprisal from the kin of the victim. Revenge is a common explanation for warfare among nonindustrialized communities and has been additionally linked to internal social forces like achieved status. Achieving status for individuals in many communities requires some form of signaling and commonly requires costly signals to be sent. This has especially been shown to be the case among groups that socialize violence and engage in warfare regularly.

Additional possibilities for atypical burials include mortuary treatment for bad death, capital punishment from within the community, sacrifice, and raiding. We argue that these explanations appear less convincing given the nature and diversity of burials from the case study presented here. Instead, we contend that violent acts upon the individual can continue into the burial as a way to further devalue their identity. Traditional communications of identity and beliefs are found through the performances of mortuary ritual by relatives of the deceased to memorialize the dead. In contrast, we present perimortem signaling as a new approach to interpreting the role that biological response and emotional force may have in violence and the creation of mortuary (burial) features in the archaeological record. Perimortem signaling offers an alternative explanatory framework in which to examine other archaeological cases of atypical burial.

Acknowledgments

Comments

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Watson and Phelps look at mortuary practices as a form of communication, and I think that their introduction of costly signaling theory to explain the mechanisms at work is an important contribution to mortuary archaeology. (High) investment in mortuary performance may be instrumental to making survivors believe that whatever information is being signaled is true. For the nine mortuary deposits with informal posi-

tioning of the body from the Sonoran Desert, the authors argue that "investment" took the form of violence during killings and, later, upon the corpse. What remains somewhat unclear, however, is the content of the signal—what was it that was communicated during the killing and disposal of the nine individuals? If revenge as part of blood feuds was the driver for the killings, this action would be in return for another killing. Would the information have been the existence (or new establishment) of a blood feud between the perpetrators' and the victim's groups? It is difficult to see how revenge killings as part of blood feuds would have worked to communicate social norms after individuals deviated from the norm, which the authors mention elsewhere.

The interpretational model for the nine mortuary deposits as evidence for revenge killings is based on a cross-cultural approach and statistical analysis of ethnographic reports. It is a shame that, in their article, the authors did not provide more information about the archaeological context of the nine mortuary deposits and the cemeteries. How have the nine deposits been located in relation to other graves and archaeological and natural features? Were they in marginal or isolated positions? How were they constructed and oriented? The location of archaeological mortuary deposits has elsewhere been an important factor for their interpretation (e.g., Reynolds 2009), and ethnographic reports frequently mention different places of disposal for different types of dead individuals or types of deaths.

A positive feature of the study is that the authors carried out taphonomic analysis of the nine mortuary deposits (Duday 2009), showing that the unusual body positions were not the result of movement of body parts as part of processes of decay. The analysis further showed that the bodies were not left exposed but were instead covered with sediment shortly after deposition of the bodies—with one exception (592), where water-lain sediment suggests exposure. However, formation of water-lain sediment has elsewhere been related with fluids from the decay of the body in hollow spaces in graves (Aspöck and Banerjea, forthcoming).

I am concerned whether one interpretation fits nine mortuary deposits found over such a large distance (150 linear miles) and time span (2,000 years). If cycles of blood feuds and revenge were an important feature of life in these societies, would we then not expect to find more evidence for such killings (and not one every couple hundred years or so)? Also, while the nine mortuary deposits have in common that the bodies were not positioned the same way as in other inhumations of the period and region, the group is quite heterogeneous in other respects (table 4). From the three female individuals, two women aged 40–50 years at death were buried in prone and splayed position, one with evidence of burning on the cranium (369) and the other with a tibia removed (791). Four out of five male individuals were buried in (head-in) vertical position, and only male individuals were found with evidence of violent death in the form of points and, in two cases, with fractured femora. This could mean that there were

rules to the revenge killings but also that the nine mortuary deposits result from different phenomena. Maybe the burning on the skull (369) and the removal of the tibia (791) indicate more complex practices of the treatment of the body, maybe even after burial (791) in case the grave was reopened? In very rare cases of deaths (or rare types of dead individuals), the traditional rules for mortuary performance may not have been as well known to the community and may have required more negotiation (e.g., sacrifices) to determine how to proceed, thus accounting for greater variability in the archaeological evidence of infrequent practices (Aspöck 2009).

Finally, some theoretical comments related to general problems with terminology and concepts in mortuary archaeology (e.g., Knüsel 2014, 2015). Mortuary practices of any community have different norms for different dead individuals (Aspöck 2009). Within the range of mortuary practices, it might be useful to distinguish funerary and nonfunerary (e.g., sacrificial) ones (Weiss-Krejci 2011). Some practices may be more elaborate and perceived more positively than others, while some could be ambiguous and perhaps not associated with ideas of a passage—or, at least, not a successful one. In any case, in dualistic approaches to the archaeological mortuary evidence— whether they distinguish between normal and deviant, typical and atypical, regular and irregular, and so on—mortuary deposits do not correspond to the variability of mortuary treatment documented in ethnographic and archaeological evidence (Aspöck 2009). While the nine mortuary deposits stand out within the group of inhumations, it is not clear why they would be atypical in the context of the variability of mortuary treatment evident in the Sonoran Desert 2100 BC–AD 50: there are cremations, three different types of inhumations (or four, if multiple inhumations form another group), and evidence for exhumations. Watson and Phelps do not mention which were their criteria for classifying cremations, exhumations, and certain types of inhumations as "typical" mortuary deposits. Also, cremations and exhumations are only a small number of mortuary deposits, and the authors argue that these "appear to represent an inherently different mortuary practice than the normative individual (or even double) primary inhumation." So why have they been categorized as typical? In ethnographic reports, we find that different types of deaths (including "bad deaths") may have led to performance of entirely different mortuary practices (e.g., cremation instead of inhumation; Aspöck 2009). Hence, these "totally different" mortuary processes are important if we want to discuss reactions to bad deaths and the variety of traditional mortuary behavior in this time and region.

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Within the past few years, a number of scholars have begun to focus on the presence of violence in the archaeological record and how much detail we can determine from osteological remains and contextual data. As techniques are improved and theory develops, we can craft increasingly detailed narratives of what may have happened in past societies.

Watson and Phelps focus their analysis on Early Agricultural period (EAP) sites in the Sonoran Desert in the U.S. Southwest and bordering areas of Mexico. Specifically, they first characterize the large sample of excavated burials and then focus on atypical burials because, they argue, these may represent acts of violence on the corpse after death and outside the normal mortuary ritual. They specifically suggest that these burials represent perimortem signaling, "possibly stemming from socialization for violence."

This article differs a bit from other analyses of violence since it does not reanalyze or reconsider the osteological remains themselves, nor is it based on a new scientific method. Instead, Watson and Phelps use costly signaling theory (CST), wherein (to paraphrase the authors) people's behavior is used to signal in order to influence or manipulate, rather than just inform, others. CST is seen as potentially being a by-product of evolutionary-based behaviors used to offer advantages to individual(s). CST has not been applied much in anthropology or archaeology, and my comments do not focus on the concept itself. While I am not necessarily a fan of evolutionary explanations for complex behavior, I think that there is little question that signaling occurs; the question is why people are signaling, for what purpose, and in what context. Any specific patterned behavior can be viewed as signaling in one or more senses, and in this case, seeing the pattern required a larger, regional scale of data collection.

The authors are to be commended for their thorough review of the data—they carefully explain and discuss their sample and its limitations, look to research in cultural anthropology and ethnography, and examine a set of variables from the Standard Cross-Cultural Sample (SCCS) of the Human Relation Area Files to test ideas of reasons for violence. They use a small set of biocultural variables to evaluate their hypotheses, and I think that all of this makes sense and is probably as well done as possible without going back to the actual bones and the detailed records; the variables used are quite general and the number of variables limited. However, the point they are making may not require more at this time. They demonstrate a pattern in the atypical burials when seen across several different sites and geographic areas, and they propose a deliberate reason and motive behind these burials. They suggest that the individuals in these atypical burials likely died of violence, but they also carefully note that not all victims of violence have atypical burials, nor are all atypical burials necessarily victims of violence. I certainly agree with the authors' comment that "violent acts upon the individual can continue into the burial"—keeping the individual from the regular mortuary ritual hurts the dead and the living.

My only reservation about this study, and it is more a wish than a reservation, is that I would have liked to know more about the context of the atypical burials and, in particular, the

spatial relationships between these burials and other burials, the habitation portions of the sites, and so on. How close are these atypical burials to other burials? Is there a pattern to their spatial distribution? If Watson and Phelps are correct about what these burials represent, it would be especially interesting and necessary to know where on the site these outside-community members disposed of these individuals. I think that the importance of spatial relationships in these contexts can provide key understanding of what happened. It may add to their view that these burials were done by those outside the community. Perimortem signaling likely does happen, especially for atypical burials, and using this framework may well help us to understand a broader range of mortuary features. This study is important for its approach and its regional scale.

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This paper is of great interest and represents a contribution in several ways. The article discusses and offers an interesting explanation about atypical burials in the Sonoran Desert during the Early Agricultural period (EAP; 2100 BC–AD 50). To achieve this goal, Watson and Phelps conduct a thorough description of the typical burials from the area and consider postdepositional factors that may have contributed to the generation of the atypical pattern before making interpretations, a fundamental methodological step rarely applied in a systematic way in other studies of this kind. Also, the authors take into account transcultural information considering important ethnographic databases. This allows them to discuss archaeological data from this perspective and establish correlations between a number of selected variables.

As a result, this is a solid, comprehensive, and detailed work of great relevance and interest. Due to limited space, I will make my comment in relation to a particular topic: the selected theoretical framework. The authors propose explanation of the atypical burials in the Sonoran Desert area during the EAP, basing their work on costly signaling theory (CST), which I found to be an excellent and interesting point from which to think about the causes and consequences of conflict in small-scale societies in evolutionary terms.

I understand that the application of the CST in etology has a component at least conditioned by the genetic configuration of populations, as suggested by some of the examples cited by the authors (e.g., the presence of bright plumage in terms of sexual selection, though it may represent a reproductive disadvantage). In this context, it is postulated that war can be disadvantageous for individuals but advantageous to the whole community, since this conceptual framework incorporates culture as a means to reduce certain costs. In this regard, I ask myself,

on the one hand, what is the place of decision making without evolutionary consequences? In my opinion, an adaptive trait, although costly in the short term, should show persistence over time, something that remains to be studied more deeply in this case study. While the analyzed sample is large, I do not see the frequencies of atypical burials substantially altered over time. However, the fragmentary nature of the archaeological record allows for the incorporation of new cases in the future. This is mentioned by the authors and worth a move in that direction because I think the proposal is very interesting. Also, a portion of atypical burials do not exhibit signs of violence, so it is unclear precisely what is being signaled. On the other hand, if CST has the potential to explain behaviors that are beyond what is expected, even when they are maladaptive or highly costly behaviors, is it a theory that could explain all behaviors? If this were the case, the explanatory power of the theory would be reduced because all human conducts have (or should have) an adaptive explanation—a view that, personally, I do not share. In this sense, there are behaviors that are part of decisions that do not imply evolutionary consequences given by the lack of local consistency (i.e., high frequency of a trait) and persistence over time (Odling-Smee, Laland, and Feldman 2003).

From my point of view, an adaptive explanation in evolutionary terms has greater support and evidence for the presence of conflict rather than a costly signaling perimortem. As it was clearly expressed by Keeley (1996), relations of interpersonal violence and/or conflict should not only be seen from a negative perspective but also from a positive one. In general, conflicts develop between group members that often exchange information, goods, and people. In this sense, the relationships are through alliances, such as marriage and conflicts—two alternative ways to get the same things and benefits. Therefore, an evolutionarily adaptive explanation relates the conflict, in part, with the strengthening of social and biological ties. This feature has also been detected by primatologists, who suggest that aggression is one more way to link community members and communities within the complex network of causal relationships that would have been part of the evolution of cooperation of the groups (e.g., de Waal 2000). This perspective is considered and developed by the authors of the article and, in my opinion, is the crucial point at which an evolutionary framework finds its best expression (i.e., the presence of conflicts in small-scale societies). As is indicated by Watson and Phelps, it is a clear form of nonverbal communication. I am not so sure that a form of differential perimortem signaling that does not exhibit a significant persistence and does not increase over time has evolutionary consequences in the terms proposed by the CST.

My comment is not a criticism of the proposal of the authors, whose application I found very interesting and novel, but rather the manifestation of a series of doubts and questions triggered by my reading of the article. Undoubtedly, this reflects the relevance of evolutionary perspectives for the understanding of interpersonal violence in small-scale societies and how much remains to be discussed and learned.

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The image that comes to mind when I think of costly signaling in Native American warfare is that of a young warrior flaunting his locks in the face of an enemy bent on taking his scalp, his return home from battle signaling his fighting prowess (and mate-worthiness). Another provocative signal I recall, from the archaeological record of the Southwest, is a coprolite containing human flesh deposited by a human in the hearth of a residential pithouse in Cowboy following an episode of violent cannibalism (Billman, Lambert, and Leonard 2000*b*). Clearly, signaling theory has an important place in the study of prehistoric violence, and I concur with the authors that it is a theoretical concept we should include in our consideration of the meaning of mortuary behavior. That said, it is important to carefully elucidate the contexts in which costly signaling may be indicated, ruling out alternative hypotheses that might account for "atypical" behaviors and developing a theoretically robust approach to identifying and interpreting behaviors that clearly do signal this type of adaptive trade-off.

In this study, Watson and Phelps consider how prehistoric warriors (killers) may have used mortuary contexts for social signaling, usurping the authority of their victims' kin to memorialize the dead and instead performing rituals signaling their ability and willingness to kill in the interest of their own group. More specifically, the authors argue that such acts may have contributed to the construction of social identity and facilitated socialization for violence during the Early Agricultural period in the Sonoran Desert of the southern Southwest. Their analysis focuses on 169 well-preserved mortuary features (172 individuals) from three locations. In order to differentiate normal from the atypical mortuary features that are the focus of the investigation, the authors characterize burials according to 10 variables describing the nature of postmortem treatment of the body and features of the individual (age, sex, and traumatic injury). Of greatest relevance to the research question are burials showing signs of violent trauma ($n = 28$) and burials lacking indicators of formal or respectful treatment ($n = 9$), especially where these intersect ($n = 3$). Unfortunately, the latter and most important category is quite small, making it difficult to identify a pattern or tradition of mortuary signaling behavior.

An important omission in the paper is the absence of tabulated data on different types of trauma by age and sex, as these data would help to characterize levels and types of violence during the EAP and thus set the stage for generating predictions about perimortem signaling. Some types of conflict that may result in skeletal injuries are meant to resolve disputes without killing (cf. Chagnon 1996), and these contexts would not be expected to lead to perimortem signaling. In the Santa Barbara Channel area of California, for example, the most common injuries attributable to violence were depressed cra-

nial vault fractures, primarily sustained by males in a form of sublethal, face-to-face conflict that provided a live arena for social signaling and dispute resolution. Violence with lethal intent was primarily conducted with projectile weapons (Lambert 1997), and thus it is projectile injuries that one would expect to be linked with mortuary rituals. This appears to hold true for Sonoran EAP mortuary contexts as well, as the only identifiable violent injuries in atypical burials (table 4) are imbedded projectiles in three male victims. This sex bias in lethal injuries is not a surprising finding (see Lambert 2012), though it is seemingly at odds with the authors' conclusion that "violent traumas are also equally common among females." Because detailed data are not provided, however, gender distinctions in patterns of violence that would help to characterize the social environment in which the atypical burials took place are not observable—at least to the reader.

The spatial context of the EAP burials could also provide important insights into atypical burials, and plots showing the spatial relationship of atypical burials to each other and to "typical" burials, with and without lethal injuries, would be helpful in this regard. Were atypical individuals "ostracized" spatially by their placement in sites/cemeteries, or were they integrated into the community of the dead and, possibly, once members of the living community? A recent paper by Jelmer Eerkins and colleagues (2014) illustrates the potential significance of burial location for the interpretation of atypical mortuary features as well as the complexities of trying to establish the cultural identity of victims relative to possible perpetrators in a fluid social landscape. In this case, the remains of three men killed by projectile weapons were buried in an isolated and atypical grave in the Yolo Basin of Central California. The grave was not associated spatially with archaeological settlements in the region, suggesting either a lack of affiliation with locals—possibly the killers—or perhaps the expedient burial of decaying bodies following discovery by kinfolk. Stable isotopes ultimately revealed the victims to be nonlocals (though they had apparently lived in the region earlier in life), lending credence to the hypothesis that these men were killed by people in the Yolo Basin.[1] In my reading of the evidence, I see no indicators of costly signaling, though this seems a likely context for such behavior. Rather, a case can be made for concealment, perhaps to reduce the likelihood of retaliation. Similar motivations cannot be ruled out for the EAP atypical internments, though admittedly unusual positions do convey a negative sentiment that could have reaffirmed alliances or served to enforce a code of behavior for those witnessing the burial act.

This is a thought-provoking paper, and though I am not totally convinced of the argument for costly signaling as an explanation for these atypical burials, I think it is an important contribution to the literatures on costly signaling and mortu-

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1. Napoleon Chagnon (1996) describes how Yanomami men who once lived in the same village can find themselves on opposite sides later in life as alliances shift.

ary behavior. Perhaps, in their response, the authors can provide additional data and insights to make their case.

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The idea of applying the costly signaling theory (CST) to analysis of the reasons for atypical (i.e., deviant) mortuary behavior is very appealing. While it contributes to possible interpretations for different treatments of the dead, it also needs to be considered as simply one of the possibilities and verified carefully on the basis of the available archaeological and anthropological data. The article by Watson and Phelps is an excellent example of this type of research. However, I would like to present some remarks that came to mind while reading this very interesting piece of work.

The phenomena of deviant burials became a hot topic in archaeological research over the past two decades or so (Murphy 2008 is an excellent collection of articles on the subject). The traditional approach of mortuary archaeology—which concentrated on analyses of commonalities as the baseline for the reconstruction of burial rites and customs (burial patterns) and, ultimately, of the religious life of the society—becomes gradually replaced by a more individual approach. Identifying burials that do not necessarily follow the burial pattern in their localization, in body treatment, and in the organization and type of grave goods is not only very informative, allowing the reconstruction of individual life (and death) stories, but it also contributes a great deal of information to the traditional approach to the reconstruction of past societies' rituals and beliefs. Atypical interments draw a lot of attention to the scholarly world, which views them as a divergence from the usual, typical burial practices, but they also reflect deliberate choice—just as the burials that follow the pattern do—and therefore also inform the meaning of funeral behavior, only in these cases reserved to unique and precisely defined persons or situations, different from the common (see Murphy 2008). To me, there is no need to avoid the term deviant, as the authors suggest, since in this regard, the deviance is understood as the atypical, nonregular way of treatment of the body (or bodies) and the creation of its (their) context that differs substantially from the usual mortuary practice performed by the given society. More importantly, and as indeed pointed out by the authors, the reason for such deviancy may have different sources, which are often possible to reconstruct through careful analysis of the funeral context and its content. Often this is based on the perception of the deceased within the society to which he or she originally belonged. People who looked different, behaved differently, or who came from the outer world, and so on, may be treated differently both while alive as well as after their death (Tsaliki 2008).

Personally, I am always looking for the easiest possible interpretation. There is a very interesting, yet a bit forgotten, theory that might be of interest here. Developed in the 1970s by René Girard on the basis of some earlier thought (Girard 1989), it explains a great deal about the socialization of violence and the role it plays in the creation of social identity and group consolidation (from a certain point of view, obviously). The group defines itself usually by the differences that divide it from the other group(s) (e.g., language, religion, or access to resources), and the sense of community is often threatened by the violence (of either inter- or intragroup origin). The imbalance then produces the need to look for the responsible agent and often turns against either the stranger (as alien for the community) or the different (as alien within the community; e.g., a social outcast). The balance is then achieved by the sacrifice of the suspected responsible agent and is perceived as a momentary revision to the arising chaos, re-creating in effect the original, balanced, system. The sacrificial victim and the sacrifice itself furnish the community with the sense of collectiveness and intergroup identity (Kearney 1999). It is possible that deviant burials such as those described in the article could have been a result of such social mechanisms, containing the remains of such victims. It would relate to both the funerary rite (the sacrificial victim is not treated as a member of the group) and the social meaning of violence (and would also explain the presence of the perimortem trauma, in some cases). And, to be honest, it would also relate (to some extent) to the CST, where the actual sacrificial event, including the creation of an unusual burial, would become a signal, functioning on many levels of society.

In this light, the interpretation proposed by Watson and Phelps, while both possible and extremely interesting, may also be slightly overstated. It is true that during transitional periods—such as the transition from foraging to farming, in this case—the violence tends to be more visible than in times of relative peace. And it is true as well that in a lot of societies at this stage there are costly male rituals present. In particular, we know that violence can play a very important role in relieving social tensions that arise especially during times of limited access to the resources necessary for subsistence. But I think there is not enough information in the sample from the Sonora Desert to make a definitive statement that the deviant burials found there were created as a part of the signaling process under the definition of CST as proposed. However, I must admit that, to some extent, almost all elements related to the funerary behavior associated especially with the unusual and atypical forms of burial would have the component of a signal in them. In order to support the hypothesis presented in the article, I would like to see some additional information. For example, where were the deviant burials located? What was their relation to the other, normative, interments? Or, finally, were there any attempts made to verify the origin of the individuals buried in unusual contexts? I believe the answers to these questions would allow confirmation or falsification of the presented hypothesis. The localization of the nonnormative

graves and origin of the individuals buried within them have been proved to be very informative (Gardeła and Kajkowski 2013; Gregoricka et al. 2014).

Reply

We are very grateful for the thoughtful comments provided by the commentators. They provide several additional points for us to address as well as a sense of appreciation for our application of costly signaling theory (CST) to mortuary (or, more appropriately, nonmortuary) deposits. The primary intent of this article was to consider an alternative theoretical approach to atypical human burials from archaeological contexts (using the case study from the Sonoran Desert) and examine its links to similarly underrepresented social motivations—specifically, revenge—for violence in small-scale societies. The preceding comments tend to focus on the presentation and interpretation of the source material (the archaeological sample and its context) or our application of CST. Therefore, instead of addressing concerns expressed by each individual, we will respond to themes that we identify appearing across the comments.

Several commentators took issue with how we defined the atypical burials in the Early Agricultural period (EAP) sample from the Sonoran Desert, particularly in the context of such marked variability in the expression of mortuary behaviors during this time period. We certainly did not wish to downplay the remarkable variety inherent in mortuary deposits dating to this time and area, but we also felt that there was insufficient room in this article to dedicate the in-depth description and analysis necessary to examine the expanse of performance residues. In fact, this theme is being dealt with in the appropriate detail in a separate work (Watson, forthcoming). It is important to further acknowledge that we are intentionally describing and accepting a broad definition of what constitutes normative mortuary practices during the EAP. This is borne partly out of a continuity of similar mortuary diversity among subsequent archaeological traditions in the region; notably the Hohokam, among whom inhumation and cremation burials were practiced with fluctuating frequency over the course of 1,500 years (Rice 2016). A great deal of attention has been paid to what social phenomena contributed to Hohokam mortuary variability, much of which was recently summarized by Rice (2016). The fundamental differences between cremation and inhumation as mortuary practices deserve (and have received) special attention, but we view its appearance during the EAP as part of the larger continuum of mortuary behaviors in the region (Watson and Cerezo-Román 2010) and, again, did not feel that this was the appropriate venue to delve into that issue.

It may better serve our argument to simply dichotomize what we consider representative of normative mortuary practices simply as "funerary" deposits versus "nonfunerary" deposits, as suggested by Aspöck. The wide variety of body treatment and feature construction does haze the lines of defining what we might consider as normative. The thread that these burials have in common, from cremations to multiple inhumations, is that they appear to represent the intentional deposit of human remains resulting from performance related to mortuary or funeral rituals. In contrast, those that we define as atypical burials demonstrate distinctive features indicative of haphazard placement, possibly violence, and some degree of desecration of the individual in the process of interment. Applying this binary approach, we are differentiating the pluralistic nuances of ritual funerary deposits from those that we are trying to highlight as bioculturally contingent responses to violent interactions and socialization for violence.

In a similar vein, several commentators lament the lack of contextual information about the atypical burials that we focus on in the analysis, specifically, their relationship within EAP sites and to typical burials. This was indeed an inadvertent omission, but it is also a somewhat complicated matter given the nature of the archaeological record of this period. EAP burials (including those we define as atypical) were placed in a combination of intentionally excavated (primary) funerary pits, reused storage and cooking pits (extramural pits and pits within residential structures), and on house floors, and were dispersed within sites (Watson 2010). The consistent reuse of existing (nonfunerary) pits gives the impression of opportunistic placement within sites, but clusters of small numbers of burials consisting of 3–10 individuals have been identified at several locations (Carpenter et al. 2015; Huckell 1995; Mabry 2008). These burial clusters may represent the earliest manifestations of formal cemeteries in the region. All of the atypical burials were encountered within defined site boundaries but outside of these clusters.

An additional confounding factor in establishing relationships between burials is that the most intensively occupied EAP sites spread for several kilometers along the fertile river valleys of the Sonoran Desert. This appears to be an extreme site size for the incipient farming villages of the EAP, but "village drift" (as defined by Darling, Ravesloot, and Waters [2004] among historic Akimel villages) offers a possible explanation for how sites may shift locations gradually by kilometers over a period of years (Darling, Ravesloot, and Waters 2004:282). Evidence for continuous occupation, major flood events that resulted in village and field overprinting, population growth, and a dispersed settlement structure similar to that observed among historic Piman *rancherías* would suggest that significant investment in floodplain settlements could result in sites with an expansive archaeological footprint. The limited number of burials recovered from most EAP sites, their wide dispersion within sites, and the evidence for village drift make placing the atypical burials in meaningful contextual relationships difficult. We can minimally identify that these eight individuals were apparently interred within village boundaries, a pattern that could have been facilitated during bouts of

conflict whereby invaders were killed and disposed of or invaders killed and disposed of the villages' inhabitants.

Specific concerns were voiced by Lambert and Więckowski about the distribution of violence and the potential origin of the individuals deposited as atypical burials. Skeletal observations of violent trauma, both antemortem and perimortem, must be tempered by the realization that these individuals represent only a portion of those who may have suffered or died from such violence. Many others, including those whom we classify as atypical burials, are just as likely to have suffered from injuries inflicted in soft tissue (healed or fatal) that did not impact bone. Although not presented in the article, there were relatively even numbers of individuals of both sexes in the sample that exhibit generalized trauma (10 males vs. 12 females) as well as violent trauma (16 males vs. 12 females). Lambert's observations are correct that only males appear to have experienced trauma from projectiles (embedded points), but other evidence of violence such as healed cranial blunt-force trauma (specifically, depressed cranial fractures) were also equally common among females in the EAP sample. Therefore, the possibility for nonlethal conflict resolution as an explanatory framework—although not impossible—is less likely given its ubiquity across both sexes. It should be pointed out, however, that the type of nonlethal conflict resolution described by Chagnon (1996) and argued for the Santa Barbara Channel area of California by Lambert (1997) is exactly the type of costly male ritual that socializes violence and which Sosis, Kress, and Boster (2007) argue to be common among communities that engage in warfare.

The likelihood that the atypical burials discussed here represent the disposal of outsiders is certainly a possibility, but there is no direct evidence (nor have any direct studies to investigate the possibility been conducted) that these individuals were any different culturally or biologically from the EAP communities in which they were interred. But if we give sufficient weight to Byrd's (2014) supposition that EAP males were more phenotypically variable than females, then the concept of who is an outsider becomes a malleable and contextually contingent perception among communities that are undergoing significant changes in social systems to deal with transitions in subsistence technology, economy, and population growth.

The final—and, perhaps, most relevant—concern expressed by several commentators we read as a basic question and, possibly, the crux of our argument: What is being signaled with the acts leading to these atypical burials? We argue that the act of killing and the continued violence extended to the corpse in interment (during the perimortem period) serve as an honest signal of fitness contextualized within a broader societal socialization for violence in which warfare is common. The possibility of reprisal makes the act potentially costly to the perpetrator. Potential benefits, however, could include prestige, wealth, greater access to resources and mates and, therefore, offspring and an increased Darwinian fitness. It further signals the individuals' commitment to defense of the community or execu-

tion of their interests. It is also important to stress that the signal does not need to be observed by the opposing group in order for the perpetrator to experience benefits. In fact, it is more important that members of the perpetrators' own social group observe honesty in the signal—bragging about something that no one sees constitutes a "big fish" story in most societies.

Commentators also focus on the limited number of atypical burials spread across a millennial timescale to question the validity of our hypothesis. And Gordón, specifically, cites the need to demonstrate local consistency and persistence over time as defined by Odling-Smee, Laland, and Feldman (2003) to identify evolutionarily mediated behaviors. We agree that it is a perceivable stretch to argue for a pattern across large expanses of space and time, but we also argue that it is a relatively small mortuary sample we are observing across these same dimensions. If we accept that the sample is even partly representative of broader trends during the EAP—and we have no reason to believe otherwise—then if it is amplified across the space and timescales considered, we would likely observe many more atypical burials (local consistency). This pattern has the very real potential to be tested as work continues on both well-known and newly discovered EAP sites. Our understanding of incipient village life in the Sonoran Desert has been completely transformed over the past few decades, largely as a result of contract archaeology (projects facilitated by legislative mandates), and we continue to look forward to new discoveries and refining our view of this dynamic period.

As for the persistence of perimortem signaling over time, we argue that atypical burials are present over much of the duration of the EAP—a period encompassing nearly 2,000 years. Again, with a larger sample, we anticipate that we could observe more cases over the EAP. But there are also reasonable explanations why the behavior may not have persisted into subsequent archaeological traditions. There is plenty of evidence to suggest that the EAP represents a protracted period of social and technological transformation stemming from the introduction of cultigens into the region—specifically, maize. A few of these include the independent development of irrigation technology, ceramic technology, and cremation mortuary rituals; the transition to the bow and arrow; and the emergence of segmented settlement structure and mechanisms for social integration. As with all traits (or behaviors) in evolutionary contexts, changes in environmental circumstances can shift a former selective advantage to become neutral or disadvantageous. This could have certainly been the case at the close of the EAP, as both the social and natural environment underwent significant perturbations. The end of the EAP is largely characterized by the development of formal pottery traditions and settlement reorganization (Wallace 2007) that formed the basis for Hohokam adaptations in southern Arizona and Trincheras adaptations in northern Sonora. Although some form of violence or warfare most certainly persisted throughout the prehispanic cultural sequence in the region, it is plausible that new social structures moved away from socialization for violence and

the kind of costly signaling that contributed to perimortem signaling.

—James T. Watson and Danielle O. Phelps

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