# Universal and variable leadership dimensions across human societies

Zachary H. Garfield[a,b,*], Kristen L. Syme[b], Edward H. Hagen[b]

[a] *Institute for Advanced Study in Toulouse, Université Toulouse 1 Capitole, 1, espanade de l'Université, 31080 Toulouse Cedex 06, France*
[b] *Washington State University, Department of Anthropology, College Hall 150, PO Box 644910, Pullman, WA 99164-4910, United States of America*

## ARTICLE INFO

## ABSTRACT

Many researchers have turned to evolutionary theory to better understand diversity in leadership. Evolutionary theories of leadership, in turn, draw on ethnographic cases of societies thought to more closely resemble the smaller-scale, face-to-face communities in which humans evolved. Currently, though, there is limited systematic data on the nature of leadership in such societies.

We coded 109 dimensions of leadership, including costs and benefits relevant to evolutionary models, in 1212 ethnographic texts from 59 mostly nonindustrial populations in Human Relations Area Files (HRAF). We discovered evidence for both cultural universals in leadership, as well as important variation by continental region, subsistence strategy, group context, and leader sex. Candidate universals included that leaders were intelligent and knowledgeable, resolved conflicts, and received material and social benefits. Evidence for other leader dimensions varied by group context (e.g., there was more evidence that leaders of kin groups were older and tended to provide counsel and direction), subsistence (e.g., hunter-gatherers tended to lack leaders with coercive authority), and sex (e.g., female leaders tended to be associated with family contexts). There was generally more evidence of benefits than costs for both leaders and followers, with material, social, and mating benefits being particularly important for leaders, and material and other benefits important for followers.

Shamans emerged as an important category of leaders who did not clearly conform to influential models that emphasize two leader strategies: using knowledge and expertise to provide benefits to followers vs. using physical formidability to impose costs. Instead, shamans and other leaders with supernatural abilities used their knowledge to both provide benefits and impose costs on others. We therefore propose a modified scheme in which leaders deploy their cognitive, social, material, and somatic capital to provide benefits and/or impose costs on others.

## 1. Introduction

Anthropologists and sociologists realized early on that leadership and followership were critical to understanding human psychology, social organization, and culture (e.g., Firth, 1927; Morgan, 1877; Mumford, 1906; Myres, 1917). Leaders are documented among every ethnographically observed society (Brown, 1991; Lewis, 1974), and in diverse contexts, such as kin groups (Dussart, 2000), ritual (Singh, 2017), economic groups (Macfarlan, Remiker, & Quinlan, 2012), conflicts between groups (Glowacki, Wilson, & Wrangham, 2017), and nonindustrial political groups (Cohen & Middleton, 1967). For review, see Garfield, von Rueden, and Hagen (2019).

Despite decades of scholarship on leadership, to our knowledge there is no systematic investigation of leader functions and qualities, and the costs and benefits of leadership and followership, across a representative sample of nonindustrial societies. Moreover, outside of anthropology, most scholarship on leadership is based on data from Western or Westernized, postindustrial societies (von Rueden & Van Vugt, 2015).

There is now a broad consensus on the importance of data from the full range of human cultural diversity. Since Henrich et al.'s (2010) seminal WEIRD people paper, many social scientists have sought data from "non-WEIRD" populations. Dichotomizing populations, their psychologies, or social dynamics as WEIRD or non-WEIRD, however, is a mistake.[1] As anthropology has conclusively demonstrated, there is enormous diversity across societies that does not remotely resemble a dichotomy. Conversely, anthropology has been criticized for essentializing diverse "Others" as part of its colonial history (Abu-Lughod, 2008; Said, 1979). In this regard, Abu-Lughod (2008) noted that the concept of culture operates much like its predecessor – race.

---

* Corresponding author at: Institute for Advanced Study in Toulouse, Université Toulouse 1 Capitole, 1, espanade de l'Université, 31080 Toulouse Cedex 06, France.
*E-mail address:* zachary.garfield@iast.fr (Z.H. Garfield).
[1] A Google Scholar search for "non-WEIRD" produced over 1000 results.

There is potentially more diversity within "non-WEIRD" populations than WEIRD ones, and there is also substantial overlap of the behaviors all people (Brown, 1991). Henrich et al. (2010) in their critique of the over-reliance on WEIRD samples emphasized a holistic approach to cultural diversity within and across "telescoping" levels of societies. Comparative research must assess cultural variation without assuming that all members within a population are essentially similar, and without putting undue emphasis on either the between-population differences or similarities.

Evolutionary scholars typically define leaders as individuals who maintain disproportionate influence over group decision-making (von Rueden & Van Vugt, 2015), whatever the group may be. One outstanding question is the degree to which theoretically important dimensions of leadership vary between cultures and across social contexts. Leadership studies have focused on community and political leaders, often overlooking leadership across contexts and levels of social organization, such as among kin and informal social groups. A second outstanding question is what benefits *and* costs leaders and followers incur. While the benefits leaders accrue have received substantial attention – fitness benefits in particular – the costs of leadership and followership have been relatively under-investigated (but see Cheng, 2019; Glowacki & von Rueden, 2015; Price & Van Vugt, 2014; von Rueden, Gurven, Kaplan, & Stieglitz, 2014).

### 1.1. The functions of leadership across cultures and contexts

Roscoe (2009) proposed leadership in small-scale societies is structured by the joint demands of within-group conflict resolution and cooperation, and signaling coalitional strength to rival groups. Among many small-scale societies, which generally lack institutionalized political structures, community leadership is typically informal and emerges in response to group demands (Boehm, 1993; Kantner, 2010; Lewis, 1974; von Rueden & Van Vugt, 2015). Theoretical literature suggests these demands most commonly arise in the contexts of collective actions, resolving conflicts between families, and punishing norm violations (e.g., Gavrilets, Auerbach, & Van Vugt, 2016; Glowacki & von Rueden, 2015; Henrich, Chudek, & Boyd, 2015; Hooper, Kaplan, & Boone, 2010; von Rueden, Gavrilets, & Glowacki, 2015). Leaders also play important roles in ritual and religious contexts (Singh, 2017; Winkelman, 2020), facilitating marriages (Walker, Flinn, Ellsworth, & Hill, 2011), and organizing feasts (Wiessner & Schiefenhövel, 1996). Leadership in between-group conflict and cooperation is also common across nonindustrial societies, including hunter-gatherers (Apicella, Marlowe, Fowler, & Christakis, 2012; Glowacki et al., 2017; Hames, 2019; Richerson et al., 2016).

Stronger authority of community leaders, leadership beyond the community, and institutionalized managerial roles are associated with sedentarization, defensible resources, and social stratification (Ames, 1985; Johnson, 1982; Johnson & Earle, 1987; Kaplan, Hooper, & Gurven, 2009). Among horticulturalists and agriculturalists, managerial leadership can promote more efficient use of shared resources such as water reserves and cooperative labor (e.g., von Rueden et al., 2014). Pastoralists and coastal populations often face similar pressures concerning grazing lands and fishing access (e.g., Stevens, 1990; Widmer, 1988). Defensibility of resources creates increased opportunities for resource management and is often associated with increased territoriality and inter-group conflicts (Glowacki et al., 2017). Community leaders among populations more reliant on domesticated plant foods, livestock, and specific territories are often required to manage military operations (Lopez, 2017).

### 1.2. The qualities of leaders across cultures and contexts

Intelligent and knowledgeable individuals (e.g., Antonakis et al., 2017; Antonakis, Simonton, & Wai, 2019; Judge, Colbert, & Ilies, 2004; Neel, 1980), elders, and respected individuals tend to have greater influence over community decisions across cultures, including among egalitarian hunter-gatherers, stratified chiefdoms, and nation-state organizations (Bass & Stogdill, 1990; Garfield, von Rueden, & Hagen, 2019; Silverman & Maxwell, 1978; Tooby, Cosmides, & Price, 2006). Leaders also tend to have large social networks (von Rueden, 2014; von Rueden et al., 2014; Walker et al., 2012), and embody the qualities most respected by the group (Collier & Rosaldo, 1981; Henrich & Gil-White, 2001; Low, 1992a; Roscoe, Chacon, Hayward, & Chacon, 2019; Van Vugt, 2006). Leaders across multiple contexts tend to be taller and more physically formidable, which might facilitate resolving inter- and intra-group conflicts (Lukaszewski, Simmons, Anderson, & Roney, 2016; von Rueden et al., 2014). Charisma and oratory skills are common properties of leaders when they must rely on persuasion to influence community members (Grabo & Van Vugt, 2016).

Leadership and status are similar but not identical. Leaders have disproportionate influence, whereas status is often conceptualized as a relative indicator of the social value of the individual by the group and of their relative access to contested resources (e.g., Blader & Chen, 2014; von Rueden, 2014). Although leaders are generally expected to be high status (e.g., Buss et al., 2020; Cheng, 2019; Van Vugt & von Rueden, 2020; von Rueden & Van Vugt, 2015), the causal relationship between the two is likely to be context-specific and driven by underlying correlates (e.g., Blader & Chen, 2014; Cheng, 2019; von Rueden, 2014).

Substantial evidence suggests a near universal male-bias in community leadership (Low, 1992b; Sanday, 1981; Whyte, 1978), as well as across diverse nonhuman social species (Smith et al., 2020; Tiger & Fowler, 1978). Sex, however, is confounded with factors such as social network size, economic specialization, and education, that are also associated with leadership. After controlling for these factors, some studies have found that sex is not a strong predictor of community leadership (Garfield & Hagen, 2020; von Rueden, Alami, Kaplan, & Gurven, 2018; Yanca & Low, 2004).

In the context of institutionalized social stratification, such as among chiefdoms, community leadership is often highly influenced by heredity and class structures (Earle, 1997; Redmond, 1998; Stanish, 2004). Managerial elites maintain influence over community decisions and are endowed with privileged social status (Stanish, 2010). Within state-level societies, including nonindustrial kingdoms, leadership positions are proscribed and institutionalized. Ruling classes, parties, or political bodies monopolize political influence and maintain control through a variety of mechanisms including military force, ideologies, and control of information (Bodley, 2011).

### 1.3. The benefits and costs of leadership across cultures and contexts

Evolutionary models generally assume that, on average, the fitness benefits of leadership outweigh the fitness costs. The costs, however, have received less attention. Fulfilling group responsibilities and mediating conflicts can be physically and socially costly, and some decisions will upset some followers (Wiessner, 2010). In the absence of institutionalized authority, all group members are equipped to challenge leaders directly or indirectly using a variety of leveling mechanisms including physical aggression, gossip, and ridicule (Boehm, 2008; Hess & Hagen, 2017). Physically formidable individuals with strong social networks are better equipped to manage these costs than others (Glowacki & von Rueden, 2015).

Leadership positions are also commonly associated with numerous social, material, and reproductive benefits (Cheng, Tracy, & Anderson, 2014; Grammer, 1996; von Rueden, 2014; von Rueden, Gurven, & Kaplan, 2008). Leaders and high-status individuals are more likely to be the recipients of social support and material benefits in times of need (Gurven, Allen-Arave, Hill, & Hurtado, 2000; Sugiyama, 2004; von Rueden, 2014). Many leadership positions in industrialized societies are associated with increased financial compensation (Tsui, Enderle, & Jiang, 2017). High social status, wealth, intelligence, and leadership

status are also generally viewed as sexually attractive, particularly to women (Buss, 2006; Stanik & Ellsworth, 2010). Most measures of reproductive success are positively associated with male social status, independent of subsistence type or status measure (von Rueden & Jaeggi, 2016).

Although, empirically, leadership is *associated* with benefits, evolutionary models require that leaders cause or generate benefits. Potential mechanisms include that leaders (1) facilitate collective actions that yield net benefits to themselves or close kin; (2) claim a fee or greater share of returns for their services; (3) receive reciprocal exchange in other currencies; or (4) gain other social or reproductive benefits by signaling their high qualities (von Rueden & Van Vugt, 2015). Leaders can also promote policies that either align with their individual interests or that are not especially costly for themselves, their kin, or their social partners (Garfield, Hubbard, & Hagen, 2019; Hagen & Garfield, 2019; Kantner, 2010).

## 2. Study aims

We seek to provide a systematic and near comprehensive view of the qualities and functions of leaders, and the costs and benefits of leadership and followership, from a representative sample of nonindustrial populations. We then explore how these dimensions of leadership vary within populations across social contexts and across populations with different subsistence strategies, as well as by leader sex and continental region. We aim to identify *features* of the qualities and functions of leaders (e.g., do particular qualities or functions tend to covary or cluster together?). Such features might lend support to existing theories; for instance they might correspond to qualities associated with "prestige" or "dominance" (Henrich & Gil-White, 2001) or functions associated with conflict or cooperation (Gavrilets, 2015; Glowacki et al., 2017; Hooper et al., 2010). Finally, we hope to synthesize empirically-derived features of leadership with evolutionary theories of social organization to propose essential elements of leadership.

Our approach was exploratory. Whereas previously we used the ethnographic record to conduct *a priori* tests of leadership theories (Garfield, Hubbard, & Hagen, 2019), here we aim to let the ethnographic record of leadership "speak for itself."

## 3. Methods

### 3.1. Ethnographic sample and coding

We use the database of 1212 ethnographic paragraphs (termed text records) on leadership, described in Garfield, Hubbard, & Hagen (2019) (https://doi.org/10.5281/zenodo.2541999), to code entirely new variables on the functions and qualities of leaders and the costs and benefits of leadership and followership. The text records were extracted from the 60-culture Probability Sample Files (PSF) of the electronic Human Relations Area Files (eHRAF) (Naroll, 1967). The PSF, which comprises over 212K pages of digitized text, aims to mitigate Galton's problem of cultural non-independence by randomly sampling one culture with high quality ethnographic coverage from each of 60 regions.

The function and quality variables were not operationalized *a priori*. Instead, we used an iterative process whereby ZG and KS made multiple passes through the database, identifying leader functions and qualities (see Table S1). In contrast, operationalizations of the costs and benefits of leadership were developed *a priori* based on theoretical literature (Garfield, von Rueden, & Hagen, 2019) (see Table S2). ZG and KS then coded all text records for the presence (1) or absence (0) of evidence for each variable, which we henceforth refer to as leadership dimensions. Some of the costs and benefits (e.g., mating) were similar to leader qualities (e.g., polygyny). The distinction is that costs and benefits were transactional whereas qualities were descriptive (e.g., leaders obtain wives vs. have wives). ZG then created a measure of group context (see Table 1). ZG and KS coded all text records for group context. Finally,

the sex of each leader was coded as male, female, both, or unknown.

ZG and KS discussed every instance of disagreement between their respective coding on all leadership dimensions and group context variables to produce a consensus database. See the *Coding example* section of the supplementary information (SI). Finally, each culture was coded for continental region, total pages of ethnography for that culture in the eHRAF, and subsistence strategy.

### 3.2. Data analysis

Our data comprised one row for each text record. For all 109 leadership dimensions, each row was coded as 1 if there was evidence in the text record for that dimension, and 0 otherwise. Because absence of evidence is not evidence of absence, our data only inform the extent to which there is evidence for the operationalized leadership dimensions.

Our first goal was to assess if discovery of evidence for each leadership dimension was biased by publication date, total pages of ethnography for a culture, and sex of the ethnographer(s). Our second goal was to assess the proportion of text records and cultures that provided evidence for each coded dimensions. We computed the proportion of text records supporting each dimension, and their 95% confidence intervals (CIs), using intercept-only logistic mixed effects models with random intercepts for document authors nested within cultures, using the lme4 package (Bates, Mächler, Bolker, & Walker, 2015). We then computed the proportion of cultures with at least one text record with evidence for each dimension, with 95% CIs computed using a cluster bootstrap.

Our third goal was to assess variation in each leadership dimension by four theoretically important factors for which we had data for all rows: group context, subsistence strategy, continental region, and leader sex. We again fit logistic mixed effects models using the lme4 package, with each leadership dimension as an outcome, all four factors as predictors, and author nested within culture as random intercepts. To investigate which words were associated with particular leadership dimensions, or which dimensions predicted evidence for other dimensions, we used elasticnet regression from the glmnet package (Friedman, Hastie, & Tibshirani, 2010). Elasticnet models are penalized regression models that are useful when the number of predictors is large relative to the number of observations. We used the "lasso" penalty ($\alpha = 1$), which will often set many coefficients to 0, thereby selecting the most important predictors.

Our fourth goal was to explore lower dimensional representations of these data that might reveal informative "features." These included hierarchical cluster analysis, logistic PCA, and minimal spanning trees and k-nearest neighbors (mst-kNN). See the SI for additional details. Our fifth goal was to assess variation in our lower-dimensional features by group context, subsistence strategy, continental region, and leader sex, using logistic mixed effects models fit with the lme4 package. Our sixth goal was to evaluate the features in light of evolutionary theories of leadership. Guided by empirically derived features, we aimed to construct "elements" of leadership that corresponded to elements of influential theories, examining intersections of these elements across all text records.

The analyses computing levels of evidence for each dimension used the entire set of text records. Analyses investigating lower dimensional representations used a smaller set that omitted rows with no evidence for any dimension (i.e., all zeros), and dimensions with very little evidence (almost all zeros).

Throughout, we compare regression models of the same outcome variable using the Akaike information criterion (AIC). $AIC = 2k - 2ln(\widehat{L})$, where $k$ is the number of model parameters and $\widehat{L}$ is the maximum likelihood. AIC increases as model complexity increases, and decreases with improved fit. Hence, a model with a lower AIC value is considered to be superior.

All analyses were conducted with R version 3.6.1 (2019-07-05).

**Table 1**
Operationalization of the group context variable.

| Group context | Description |
| --- | --- |
| Residential subgroup | Informal groups of co-residents, social groups, age-based groups, or performance groups |
| Kin group | Groups based on kin relationships, such as lineages, phratries, and clans |
| Economic group | Subsistence groups, market groups, and other groups with primarily economic goals |
| Military group | All groups related to inter-group conflict |
| Religious group | Groups formed for spiritual or supernatural purpose |
| Political group (community) | Political groups at the level of the community, i.e., political leaders, such as village headmen, can potentially interact directly with most community members |
| Political group (supracommunity) | Political groups that encompass multiple residential communities, such as complex chiefdoms, regional political leaders, and kings or state-level leaders |
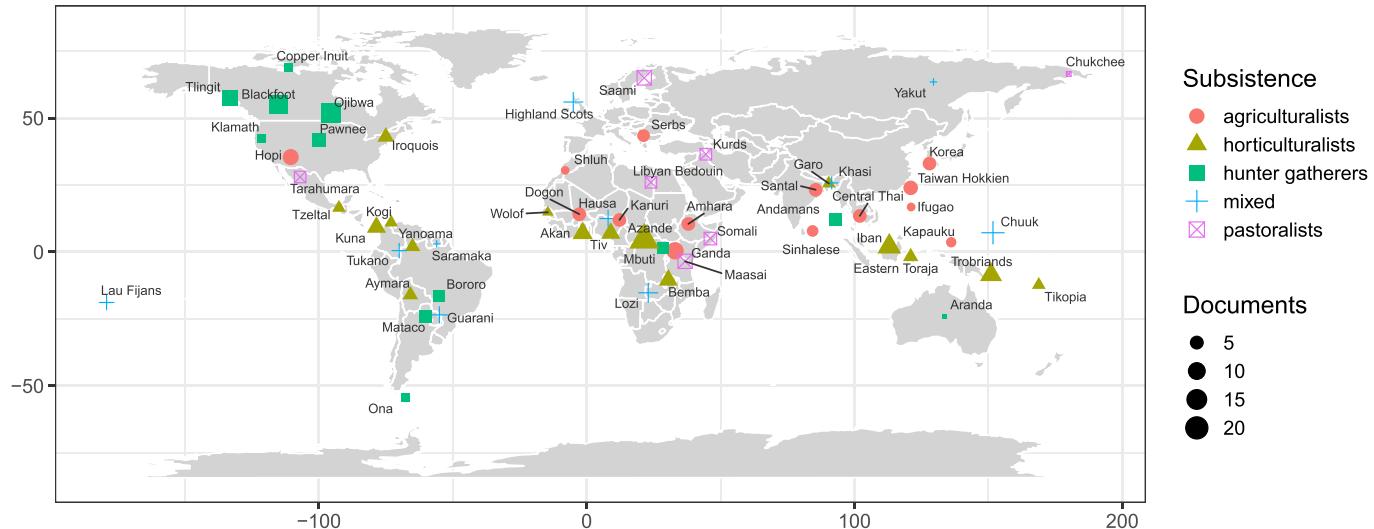


**Fig. 1.** The geographical distributions of cultures in this analysis. Symbol shapes indicate subsistence strategy and symbol size indicates the number of documents available for that culture. Axes are degrees latitude and longitude.

## 4. Results

The geographic distribution of the culture sample is displayed in Fig. 1 (see also Fig. S1). The database comprised 1212 text records from 321 documents describing 59 cultures.

Subsistence strategy, group context, and continental region were confounded. Hunter-gatherer text records often referred to residential and kin leadership, but rarely to supracommunity leadership; agriculturalist text records rarely referred to residential leadership but often referred to supracommunity leadership. Community-level political groups were frequent across all subsistence types. African text records were predominantly from horticulturalists whereas North American text records were predominantly from hunter-gatherers. See Figures 2 and S1, and Table S3.

The majority of text records discussed male leadership (88.1%) and very few discussed female leadership (2.5%), with the remaining records not sex-specific (Table S3). There were female leaders in almost all contexts, however, except military and religious. Female leaders did tend to lead within kin and residential subgroups, though: 26.7% of female leaders led at the residential subgroup level, compared to 6.65% of male leaders. The majority of text records which exclusively described female leaders were from horticulturalists (63.3%) (Table S4).

We investigated if there were biases in the discovery of evidence for any of our 109 leadership dimensions by document publication date, female gender of any author or co-author, or total pages of ethnography from each culture. We found minimal evidence of bias, and therefore do not control for bias variables in subsequent analyses. For details, see the *Bias* section of the SI.

### 4.1. Evidence for leader functions and qualities

For all 109 coded dimensions (Tables S1 and S2), we computed the proportion of text records (95% CI) that provided support and computed the proportion of cultures with at least one text record providing support for that dimension (see Methods section). See Fig. 3 and Table S9.

The most common leader functions, documented in over 70% of cultures, were resolving conflicts, providing social functions, organizing cooperation, and providing counsel or direction to followers. In about half of cultures sampled here leaders punished group members and managed economic systems. Controlling group movement and immigration were notably rare functions.

The most common leader qualities were having high social status (over 90% of cultures), being experienced or accomplished, and being knowledgeable or intelligent (approximately 80% of cultures). Notably rare qualities included physical formidability, having many social contacts, and being feared (approximately 35% of cultures) and charisma and fairness (approximately 20% of cultures).

The random intercepts indicated that support for many variables did vary modestly by author and culture. Most of the standard deviations of the random author and culture intercepts for each model were between 0 and 1, on the scale of the linear predictor (Figures S13 and S14). In a few cases, one or the other was exactly 0, which can occur in models like ours that have many random effect levels (e.g., 312 authors) and a relatively small data set (Bates et al., 2015).

### 4.2. Benefits and costs of leadership and followership

Evidence for leader and follower costs and benefits were estimated
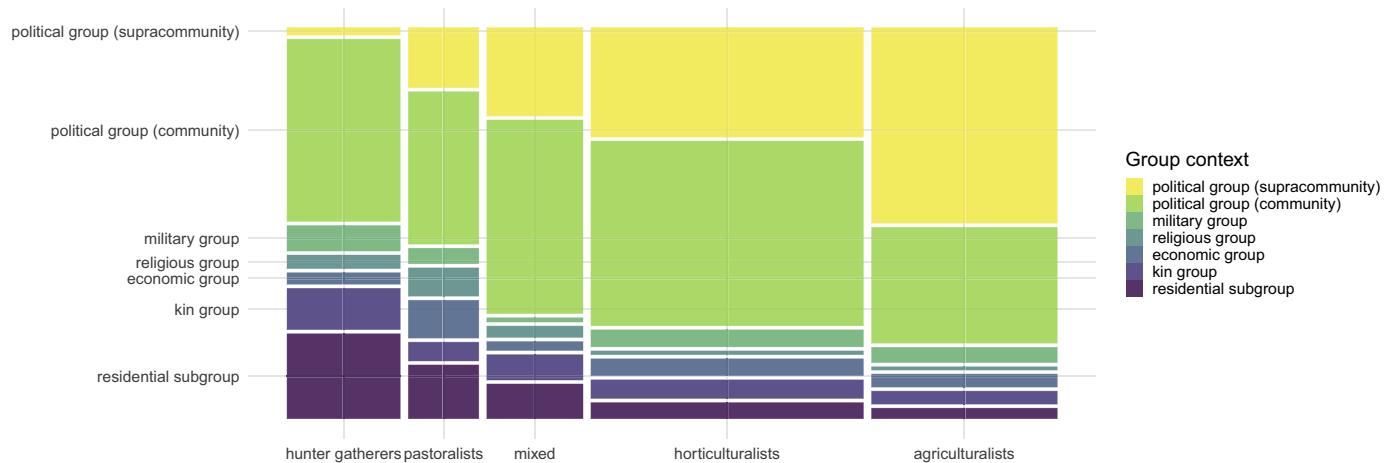
**Fig. 2.** The distribution of text records by subsistence and group context. Areas of the bars are proportional to the number of text records in that category.

similarly to the leader qualities and functions described above. Common leader benefits included greater access to material resources and increased social status (documented in 69.5% and 66.1% of cultures, respectively). Evidence for mating benefits and social services benefits was also relatively common. In general, the costs tracked the benefits. Leaders were often described as losing their high social status and greater access to resources (documented in 45.8% and 39% of cultures, respectively). See Fig. 4.

Followers on the other hand most commonly benefited from leadership systems by receiving material resources (documented in 47.5% of cultures) but otherwise by receiving social services (documented in 35.6% of cultures). Evidence of mating and fitness benefits was relatively rare for followers. Followers were most frequently described as incurring costs in the form of material resources lost and in providing social services (documented in 37.3% and 25.4% of cultures, respectively). See Fig. 4.

Leadership and followership can evolve when their benefits exceed their costs. Our data did not allow us to compare benefits and costs. Instead, we compared levels of evidence for benefits vs. costs for each leader and follower benefit/cost dimension. Specifically, we fit a mixed effects logistic regression model of evidence (0/1) as a function of the leader dimension (e.g., *Mating*, *Food*), a binary term indicating if the evidence was for a benefit or cost, and their interaction, with random intercepts for author nested within culture. We fit separate models for leaders and followers. These two models allowed us to estimate the relative evidence for, e.g., leader mating benefits vs. leader mating costs, and follower mating benefits vs. follower mating costs, etc. For leaders, the odds ratio that a text record would provide evidence for a benefit vs. a cost (averaging across all benefit/cost dimensions), was $OR = 3.2$, and for followers, was $OR = 1.8$. Hence for both leaders and followers, there was more evidence of benefits than costs.

Within benefit/cost dimensions, there was relatively more evidence for mating and territory benefits than costs for both leaders and followers, and equal levels of evidence for protection from harm vs. risk of harm. For leaders compared to followers, there were noticeably higher odds ratios for mating, inclusive fitness, material resources, and social services. See Fig. 5.

### 4.3. Universality in leadership dimensions

We investigated four possibles sources of variation in evidence for our 109 leadership dimensions: group context, subsistence strategy, continental region, and leader sex. Specifically, we fit separate multiple logistic mixed effects regression models of each leadership dimension as a function of these four factors, with random intercepts for author nested within culture. We then compared the AIC value of each model

to a model with only the fixed and random intercepts. Models whose AIC values were at least two less than the intercept-only models were deemed to outperform the intercept-only model (Burnham & Anderson, 2002).

We first examined the leadership dimensions with the most evidence, i.e., the 15 for which evidence was found in at least 60% of cultures. Of these, 9 dimensions did not meaningfully vary by continental region, subsistence strategy, group context, or leader sex, and are therefore candidates for universal human leadership dimensions. See Table 2.

### 4.4. Variation by group context, subsistence strategy, continental region, and leader sex

We then examined the 20 (out of 109 total) leadership dimensions that exhibited important variation by one or more of our four factors, i.e., whose AIC values indicated improved fits over intercept-only models (Tables S5 and S6). To determine which factor contributed to improved fit, we dropped each factor in turn and computed the change in AIC. For most of these 20 varying leadership dimensions, one factor had a noticeably bigger effect on fit than the others. Variation in group context, in particular, was associated with variation in almost half of the dimensions (Fig. 6).

For each of our four factors, we then investigated which levels of the factor were associated with higher or lower levels of evidence for the leadership dimension. For instance, there were three dimensions in which subsistence strategy played an important role: *No coercive authority*, *Provide subsistence*, and *Distribute resources* (see Fig. 6). Hunter-gatherers had particularly high levels of evidence for *No coercive authority*, relative to other subsistence strategies (and averaging over levels of the other three factors), and pastoralists had relatively low evidence for *Distribute resources* (see Fig. S10). For group context, region, and leader sex see Figures S9, S11, and S12.

### 4.5. When do leaders have high status?

*High status* was the most frequently identified leader quality (32.3% of text records and 91.5% of cultures provided evidence of high status leaders). To explore factors that distinguished these records from those with no evidence for high status, we first created a document-term matrix (DTM) of all "informative" words in our corpus of texts and the frequency with which they occurred in each text record (see SI for details). We then fit an elasticnet logistic regression model (with the lasso penalty, $\alpha = 1$) of *High status* (0/1) as a function of the frequencies of all 9656 words. Words that were strong positive predictors epitomized the semantic content of the text records which provided evidence
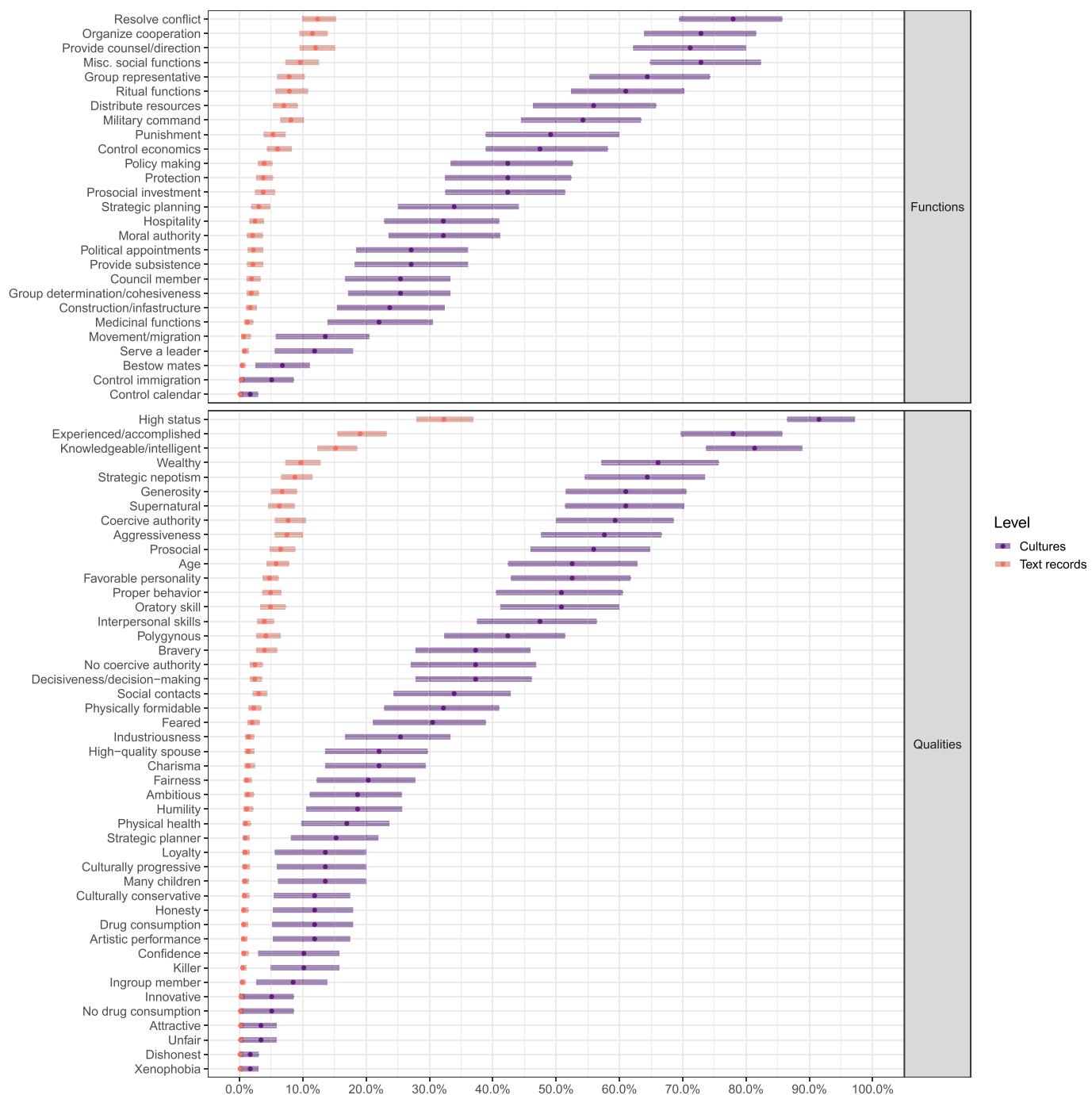
**Fig. 3.** Evidence for each coded dimension of leader functions (top) and qualities (bottom). Red (lower values): percent of text records with evidence of support (95% CI computed with intercept-only binomial mixed effects models with random intercept for author nested within culture). Purple (higher values): percent of cultures with evidence of support (95% CI computed with a cluster bootstrap).

of high status leaders. These included *respect, prestige, status, reputation, honor* and *rank*, which were the strongest predictive terms. Notable weak-predictor terms included, *influence, authority, headman,* and *chief,* and *economic* was a negative predictor. See Fig. 7A.

To determine which leader quality and function dimensions were associated with evidence for high status leaders, we fit an elasticnet logistic model of *High status* as a function of all quality and function dimensions, (with the lasso penalty, $\alpha = 1$). The non-zero coefficients indicated that *Punishment*, the only identified function, was a negative predictor, whereas *Wealthy, Strategic nepotism, Age, Experienced/accomplished*, and several other qualities, were positive predictors. See Fig. 7B.

*High status* meaningfully differed by levels of group context, subsistence strategy, continental region, and leader sex, with the most important factors being region followed by group context (see Fig. 6). Examining the estimated marginal means, South America and East Eurasia had relatively high levels of evidence compared to Africa and North America, and kin and religious groups had relatively high levels of evidence compared to political groups. Nevertheless, the differences were quite modest. See Fig. S11.

### 4.6. When do leaders have coercive authority?

*Coercive authority* was documented in 59% of cultures. Unlike other
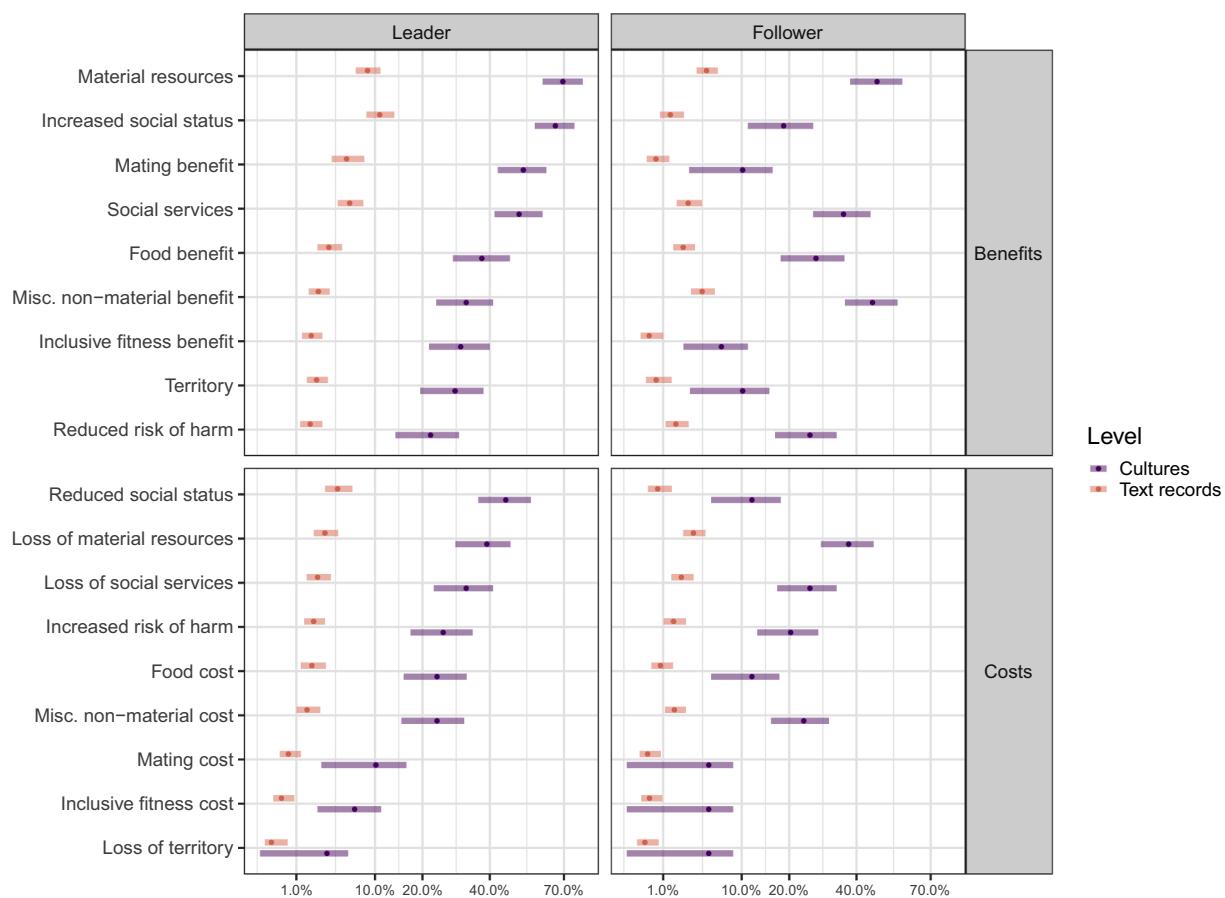
**Fig. 4.** Support for each coded dimension for the costs and benefits of leadership and followership. Red (lower values): percent of text records with evidence of support (95% CI computed with intercept-only binomial mixed effects models with random intercept for author nested within culture). Purple (higher values): percent of cultures with evidence of support (95% CI computed with a cluster bootstrap). X-axis on the square root scale.

more frequent leader qualities, which were generally positive or pro-social traits, *Coercive authority* was the most frequent negative or dominance-style quality. Additionally, it was one of the few dimensions with a complementary dimension, *No coercive authority*, which was documented in 37% of cultures (Fig. 3). *No coercive authority* demonstrated variability by subsistence strategy, with hunter-gatherers providing relatively higher levels of evidence. See Fig. S10.

We therefore chose to perform additional exploratory analyses with

*Coercive authority* and *No coercive authority* as the outcomes in logistic elasticnet regression models similarly as described above for *High status* (see Fig. 8).

Words that were strong predictors of leaders with coercive authority included, unsurprisingly, *power* and *authority*, as well as *territory*, *chief*, and *control*; the word *leadership* was the only strong negative predictor. Words that predicted no coercive authority tended to be those that indicated either hunter-gatherers, such as *band* and *Mbuti* (Congo Basin
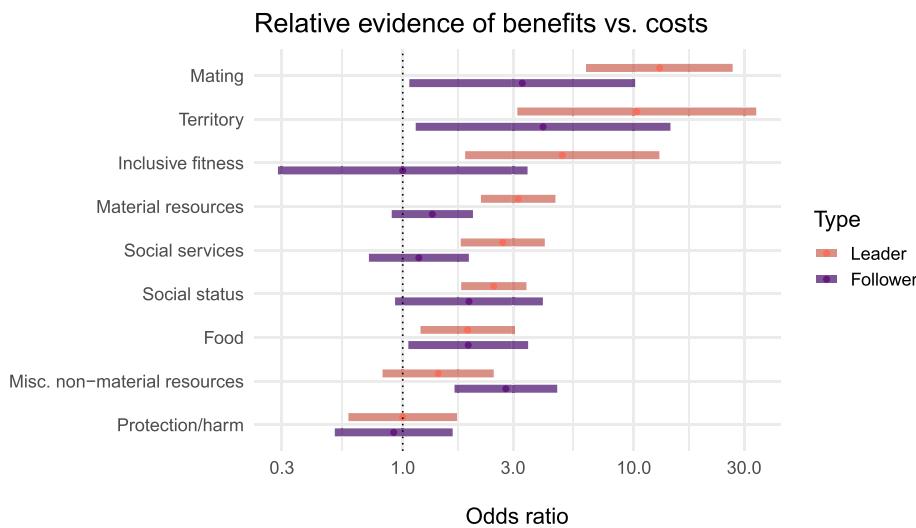


**Fig. 5.** Odds ratios of finding evidence of a benefit vs. a cost in a text record for leaders and followers, by each dimension of benefits and costs. Odds ratios estimated using a mixed effects logistic regression model of evidence (0/1) as a function of each dimension (e.g., Mating, Food), a term indicating if the evidence was for a benefit or cost, and their interaction, with random intercepts for author nested within culture. Separate models were fit for leaders and followers. X-axis is on a log scale.

**Table 2**

Candidate universal leadership dimensions. These dimensions were common in the ethnographic record (appearing in at least 60% of cultures) and did not appear to meaningfully vary by continental region, subsistence strategy, group context, or leader sex.

| Variable | Type | Percent of cultures |
|---|---|---|
| Knowledgeable/intelligent | Qualities | 81.4 |
| Resolve conflict | Functions | 78.0 |
| Misc. social functions | Functions | 72.9 |
| Material resources | Leader Benefits | 69.5 |
| Increased social status | Leader Benefits | 66.1 |
| Wealthy | Qualities | 66.1 |
| Group representative | Functions | 64.4 |
| Strategic nepotism | Qualities | 64.4 |
| Generosity | Qualities | 61.0 |

foragers), or kinship and residential-level contexts, such as *lineage, house, clan,* and *village*. See Figures 8A,C.

Using all other quality and function dimensions as predictors identified *Punishment* as the strongest predictor of evidence for *Coercive authority*. *No coercive authority* was most strongly predicted by *Humility*. See Figures 8B,D.

*4.7. Dimension reduction*

Our qualities and functions data comprised sparse 1212 × 46 and 1212 × 27 matrices of binary data, respectively. Most data reduction methods did not find strong or stable evidence of structure in the data. We therefore explored reduced matrices that removed uninformative rows with no evidence for any dimension, and dimensions with only a few rows with evidence. Stable clusters emerged with 796 × 42 and 633 × 27 matrices for qualities and functions, respectively.

Here we report the cluster analysis of dimensions that used the correlation distance metric $(1 - cor)$, and the Ward agglomeration algorithm (for results from other methods, see the SI). Fig. 9A displays a dendrogram from the cluster analysis of the 46 leader quality dimensions and Fig. 9B a dendrogram from the cluster analysis of the 27 leader function dimensions. Each cluster analysis includes two estimates of significance for how strongly each cluster within the dendrogram is supported by the data. We rely on the AU (Approximately Unbiased) $p$ values, which are computed by multiscale bootstrap resampling and represented as percentages (e.g., clusters with AU values > 95 are strongly supported, and the top-level clusters are automatically highlighted by rectangles).

The leader quality cluster analysis (Fig. 9A) identified two top-level clusters, one that comprised mostly dimensions related to prosocial

qualities and one that comprised other individual-level qualities which were not necessarily prosocial. Within the latter top-level cluster we identified two interpretable and strongly supported subclusters: *Social, reproductive, and material success* and *Competencies*. Within the first top-level cluster, we also identified two subclusters, one of which contained measures related to group-level pressures (*Cultural conformity*) and one which contained the prosocial traits (*Prosocial competencies*); these subclusters were moderately supported.

The leader functions cluster analysis (Fig. 9B) also identified two top-level clusters; the larger of which we identified as a management cluster and the smaller of which we identified as a *Prosociality* cluster. Within the management cluster, we identified two moderately supported subclusters: *Strategize* and *Organize*.

We identify these seven named subclusters as "features" of leadership dimensions in the ethnographic record. In naming these features, we gave extra weight to dimensions that were strongly supported empirically (Fig. 3), therefore not all dimensions within these clusters were clearly related to the themes of each feature. These features correspond fairly well to major elements of evolutionary theories of leadership, with the possible exception of *Competencies*, a single feature that included at least two important theoretical elements: dominance and prestige. Because features were aggregated dimensions, they are more common at both the text record and culture level (see Fig. 10).

There were modest or no correlation between features (see Fig. S22). We fit separate logistic mixed effects models of each of the 7 features as a function of group context, subsistence strategy, continental region, and leader sex, reported in the SI.

*4.8. Shaman leaders and competencies*

The *Competencies* feature combined dimensions of prestige-style leadership, such as knowledge and experience, with dimensions of dominance-style leadership, such as aggressiveness and feared. It also included supernatural qualities. The MST-kNN analysis similarly clustered leaders with ritual and medicinal functions, which rely on special knowledge, with those who had supernatural, feared or killer qualities (see Fig. S21).

Shamans and leaders with supernatural qualities were surprisingly common. Of our 1212 text records, 33 used the word "shaman", 77 provided evidence for supernatural qualities, and 95 provided evidence for one or both (7.84% of all text records). We term the latter variable *Shamanism*. We fit a logistic elasticnet model of *Shamanism* as a function of all leadership dimensions (minus *Supernatural*). This model revealed that shaman leaders combined dimensions of dominant leaders (*Feared*) with dimensions of prestigious leaders (*Medical functions*, a form of knowledge or expertise, and *Experienced/accomplished*). See Fig. 11.
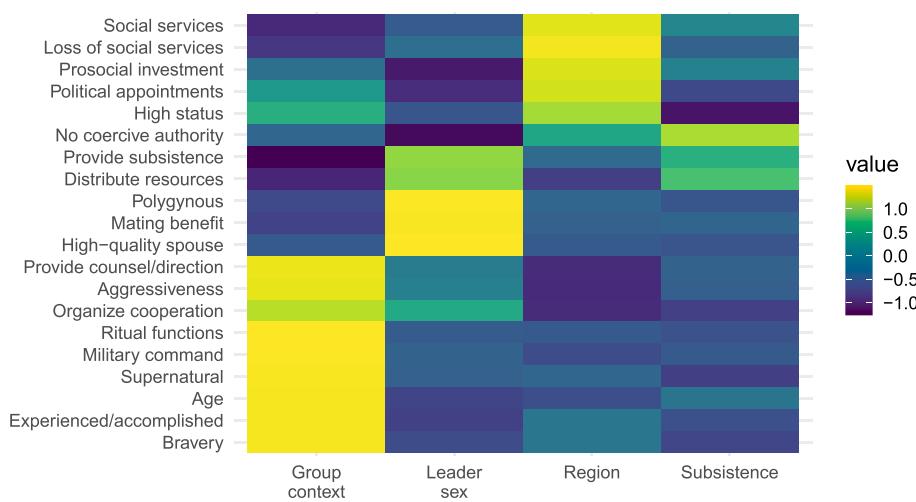


**Fig. 6.** Leadership dimensions that, according to a decrease in AIC relative to intercept-only models, varied by group context, subsistence strategy, continental region, and/or leader sex. Colors represent the relative change in AIC value after dropping that factor from a multiple logistic mixed effects regression model. Yellow: dropping factor substantially increased AIC relative to other factors. Black: dropping factor did not substantially increase AIC relative to other factors. For display purposes, delta AIC values were standardized by rows, and therefore can only be compared within rows.

Predictors of High status
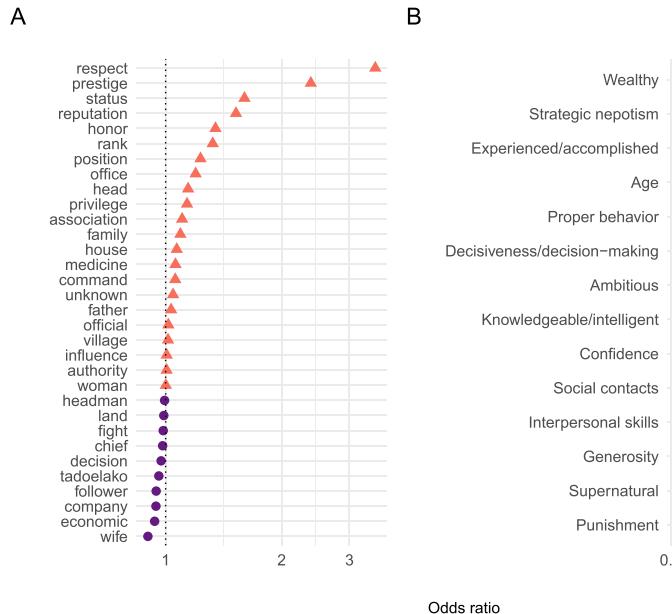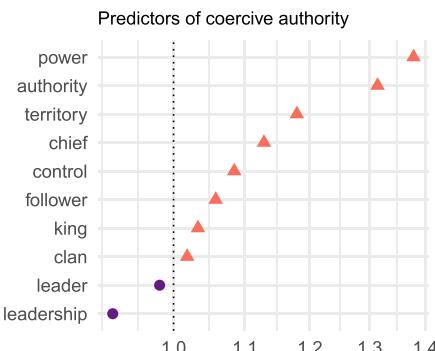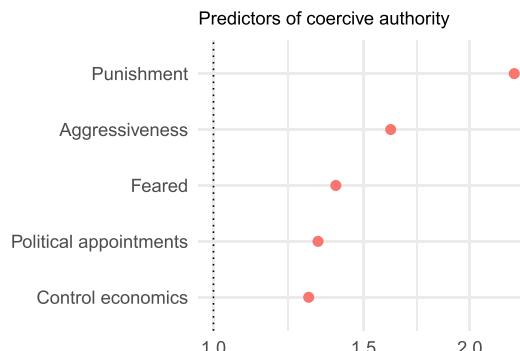


**Fig. 7.** Coefficients of logistic elasticnet regression models of evidence for High Status. A: Coefficients indicate the words whose frequencies in each text record best predicted evidence for High status in each text record. B: Non-zero coefficients of all quality and function dimensions that best predicted evidence for High status. Both models used the lasso penalty ($\alpha$ = 1), with $\lambda_{1SE}$ chosen by cross-validation (1 SE from $\lambda_{min}$). Red values are positive predictors; purple values are negative predictors. Predictors with coefficients = 0 not displayed. X-axes are odds ratios on a log 10 scale.
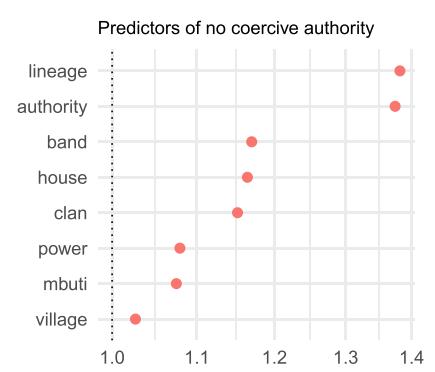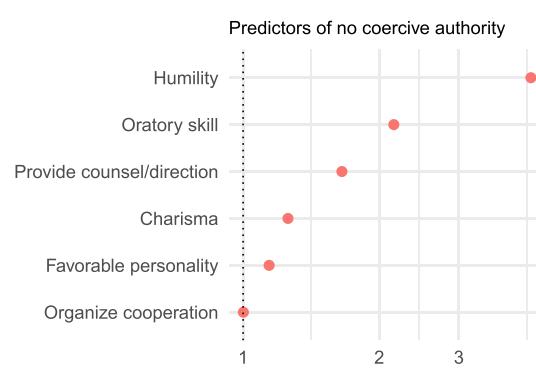


**Fig. 8.** Coefficients of logistic elasticnet regression models of evidence for Coercive authority and No coercive authority. A, C: Coefficients indicate the words whose frequencies in each text record best predicted evidence for Coercive authority and No coercive authority, respectively, in each text record. B, D: Non-zero coefficients of all quality and function dimensions that best predicted evidence for Coercive authority and No coercive authority, respectively. All models used the lasso penalty ($\alpha$ = 1) and chosen $\lambda$1SE by cross-validation (1 SE from $\lambda_{min}$).

There were no text records that described shamans or leaders with supernatural qualities who were exclusively female. However, there were 3 text records describing such leaders of both sexes. There was also more evidence of shamans and leaders with supernatural qualities in the Americas compared to other regions. See Fig. S8.

*4.9. Cognitive, social, and somatic capital*

Motivated by our feature analysis, and the apparent importance of shaman leaders, we tentatively advance a scheme, similar to von Rueden (2014) (and inspired by Kaplan, Lancaster, & Robson, 2003;
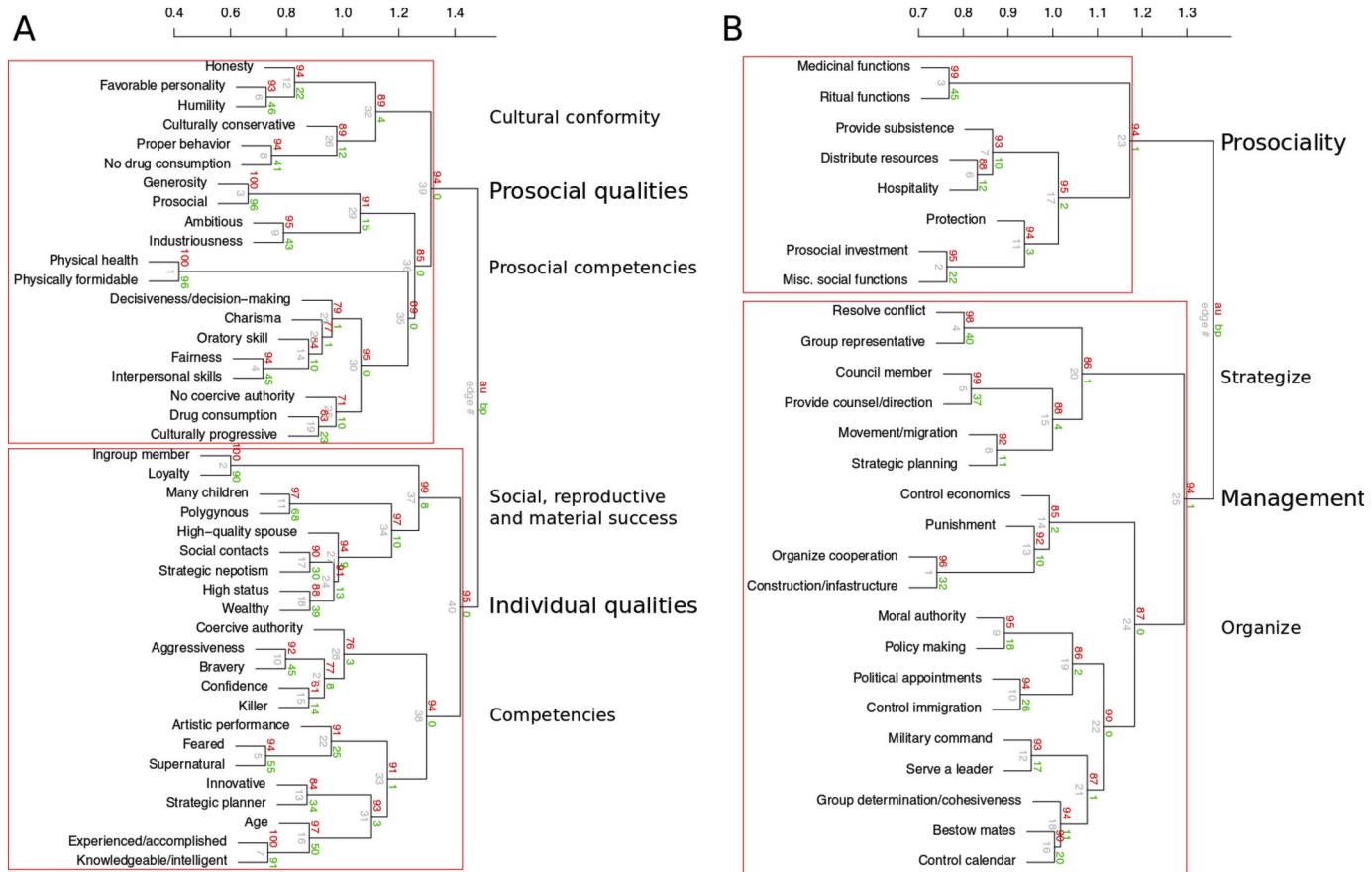
**Fig. 9.** Cluster analysis of (A) leader quality dimensions and (B) leader function dimensions. Distances were 1 − cor. Ward agglomeration method. AU p-values (red) computed with 10,000 bootstrap samples using the pvclust package (Suzuki & Shimodaira, 2015).

Kaplan et al., 2009; Borgerhoff Mulder et al., 2009), whereby leaders possess some combination of cognitive, social, material, and somatic capital that they deploy to provide benefits and impose costs (for further justification, see the Discussion). Hence, we should be able to find examples of leaders with various combinations of these six elements.

To test this idea, we operationalized the six elements using the leadership qualities cluster analysis (Fig. 9A) as guidance (for variable operationalizations, see Table S7). About half of the text records (58%) had evidence for one or more of the six elements, in heterogeneous combinations. See Fig. 12. In particular, not all leaders have evidence for high *Social capital*, leaders with *Cognitive capital* provide benefits *and* impose costs, and *Somatic capital* is rarely mentioned, but when it is, it is associated with providing benefits as well as imposing costs. Shamans

are associated with evidence for *Cognitive capital* and imposing costs.

## 5. Discussion

This exploratory study systematically evaluated ethnographic evidence for 109 leadership dimensions from a diverse sample of 59 largely nonindustrial cultures. Results revealed universal dimensions of leadership as well as important variation by group context, subsistence type, continental region, and leader sex.

### 5.1. Universal dimensions of leadership

We found strong evidence that several leadership dimensions were
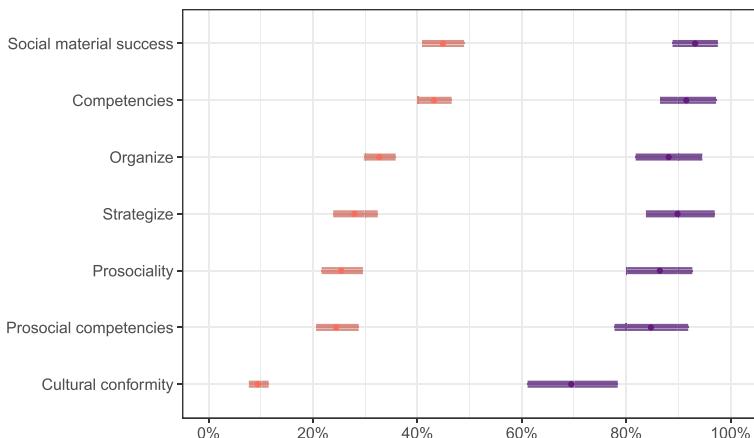


**Fig. 10.** Support of each feature variable at the levels of text records and cultures. Feature support at the text record was defined as the adjusted proportion of text records with evidence for at least one underlying dimension in the feature. Feature support at the culture level was defined as the proportion of cultures with evidence for the feature in at least text record in the culture.

Predictors of Shamanism
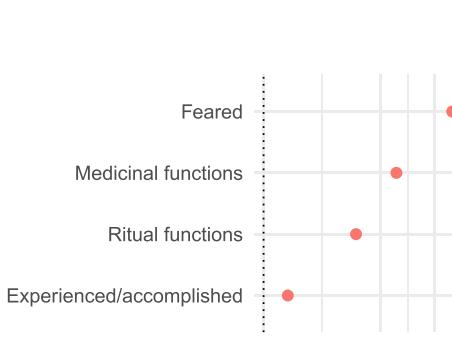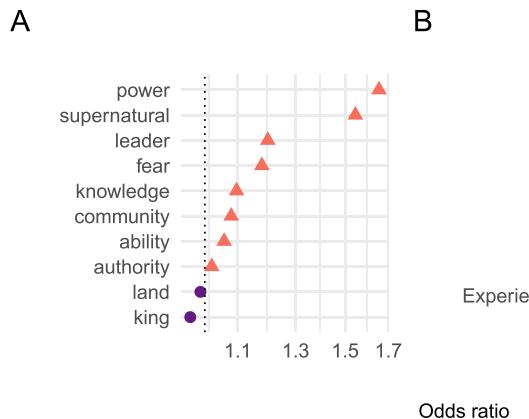


Fig. 11. Coefficients of logistic elasticnet regression models of evidence for Shamanism. A: Coefficients indicate the words whose frequencies in each text record best predicted evidence for Shamanism in each text record. B: Non-zero coefficients of all quality and function dimensions that best predicted evidence for Shamanism. Both models used the lasso penalty ($\alpha = 1$) and chose λ1SE by cross-validation (1 SE from λ$_{min}$). Red values are positive predictors; purple values are negative predictors. Predictors with *coefficents* = 1 not displayed. X-axes are odds ratios on a log 10 scale.

universal across cultures and across contexts within cultures. Leaders are seen as high status, knowledgeable or intelligent, and experienced or accomplished in about 80% or more of cultures, and function to resolve conflicts, organize cooperation, and provide counsel or direction in over 70% of cultures (Fig. 3). Leaders benefited materially, reproductively, or socially in 50% or more of cultures (Fig. 4).

Some common leadership dimensions were also relatively invariant across group context, subsistence strategy, continental region, and leader sex. These dimensions included the qualities, knowledgeable/intelligent, wealthy, strategically nepotistic, and generous; and functions, resolving conflicts and representing the group. These dimensions are therefore candidates for universal dimensions of human leadership. By "universal" we do not mean all leaders have all these traits. Instead, we mean there is evidence for these traits across a solid majority of cultures that do not vary much by key measures of population or group variation (i.e., the four factors) (Table 2 and Fig. 3).

The leadership features we derived by clustering leadership dimensions were represented across most cultures. Leaders performed three broad functions: providing prosocial services, strategizing, and organizing collective actions. Regarding characteristic traits, leaders possessed some combination of individual competencies, many of which are prosocial, conformed to cultural norms, and received various benefits (Fig. 10).

These potentially universal dimensions of leadership correspond to several evolutionary theories that have drawn on select ethnographic cases (Garfield, von Rueden, & Hagen, 2019). They partially correspond to the prestige model (Henrich et al., 2015; Henrich & Gil-White, 2001), which emphasizes knowledge, skill and generosity, but they do not include a key feature of that model: emulation of prestigious leaders. We labeled one of our leader quality features "cultural conformity", however, in which leaders are culturally conservative and exemplify desirable traits such as honesty, humility, and "proper behavior" (Fig. 9). This feature corresponds in part to leaders who serve as models for followers (see also Garfield & Hagen, 2020).

The universal dimensions also partially correspond to the service-for-prestige model (Price & Van Vugt, 2014, 2015) in which leaders receive special status in exchange for providing services, but that model does not emphasize the concrete material benefits seen here. The absence of *High status* and *Aggressiveness* on this list of universals corresponds to the reverse dominance hierarchy model (Boehm, 1993), which emphasizes knowledge, conflict resolution, generosity, and status leveling mechanisms among largely egalitarian societies.

Our candidate universal dimensions appear in the computational services model (Hagen & Garfield, 2019), in which knowledgeable and intelligent individuals provide computational (cognitive) services (e.g., conflict resolution, strategizing) to group members in exchange for a variety of fitness benefits (see also Garfield, Hubbard, & Hagen, 2019).

This model emphasizes mating benefits, however, which appear in 52.5% of cultures, below our arbitrary 60% threshold for "universality" (Fig. 4). But there was evidence for the *Social, reproductive, and material success* feature, which included polygynous leaders, having a high-quality spouse, and having many children, in more cultures (93.2%) than other features (Fig. 10). Interestingly, the computational services model highlights women's family leadership role, and there was proportionally more evidence for the *Social, reproductive, and material success* feature among females leaders than male leaders (Fig. S24), with the caveat that there were few text records on female leaders in our sample.

Pawnee chiefs illustrate leadership involving several of the universal dimensions, including intelligence, conflict resolution, and generosity (Murie & Parks, 1989):

> …a chief was a regulator, not an absolute ruler or tyrant. Although chiefs had considerable authority, their decisions were generally based on a consensus of opinion rather than arbitrary whim. The chief, like his celestial forebear, was supposed to be a guardian of the people, always mindful of their wishes and needs. And even though the office was hereditary in certain families, the man chosen to fill it had to demonstrate humility, generosity, and sagacity, because a jealous or aggressive temperament was considered unbefitting a chief.

Evidence of coercive authority is common in the ethnographic record of leadership and does not vary by any of our four factors, yet did not quite make the 60% cutoff for our candidate universals. This dimension features in several evolutionary models of leadership involving dominance hierarchies (Barkow, 1989; Cheng, 2019; Henrich & Gil-White, 2001; Tiger & Fox, 1971; Van Vugt & Smith, 2019) and the role of punishment in promoting cooperation (e.g., Marlowe et al., 2008; Boyd & Richerson, 1992; J. Henrich, Ensminger, et al., 2010; Henrich et al., 2006). Indeed, we found that coercive authority among leaders was associated with enforcing punishment, aggressiveness, being feared, and also with controlling economics, which evokes "resource holding power," a concept from the behavioral ecology of dominance hierarchies (Fig. 8). The authority of Trobriand chiefs is illustrative (Pospisil, 1993, pp. 64–65):

> Power implies not only the possibility of rewarding, but also the means of punishing. This in the Trobriands is as a rule done indirectly, by means of sorcery. The chief has the best sorcerers of the district always at his beck and call….If anyone offends him, or trespasses upon his authority, the chief summons the sorcerer, and orders that the culprit shall die by black magic….As the natives are very deeply and genuinely afraid of sorcery, the feeling of being hunted, of imagining themselves doomed, is in itself enough to doom them in reality. Only in extreme cases, does a chief inflict

direct punishment on a culprit.

## 5.2. Variable dimensions of leadership

There was substantial cross-cultural variation in evidence for most leadership dimensions: 83 of 109 leadership dimensions had evidence in less than 50% cultures (Figures 3 and 4). There was *systematic* variation in 20 leadership dimensions by group context, subsistence strategy, continental region, and/or leader sex, factors for which we had complete data for all text records.

These four factors were confounded. Evidence for leadership in residential subgroups and kin groups was relatively more common in hunter-gatherer and pastoralist societies, populations more likely to experience high residential mobility (Kelly, 2013; Rigby, 1985; Wild et al., 2019). Evidence for supracommunity political leadership was more common in horticultural and agricultural societies, which tend to rely heavily on cultivated land and maintain fixed, defensible territories (Figures 2 and S4). These patterns support perspectives suggesting restricted residential mobility and subsistence intensification are associated with increasing complexity of sociopolitical organization (Johnson & Earle, 1987; Powers & Lehmann, 2014; Steward, 1938). Perhaps as political structures become more institutionalized and economic systems transcend the household, leadership within households and residential groups diminishes.

The clearest pattern to emerge from analyses of systematic variation is that, not too surprisingly, many leadership dimensions are context-specific: aggressiveness and bravery were associated with military leadership, supernatural qualities and ritual functions were associated with religious leadership, organizing cooperation and being experience or accomplished were associated with economic-group leadership, and providing counsel and older age were associated with kin-group leadership (Fig. S9). (Six leadership dimensions varied by continental region; Fig. S11. We do not have clear theoretical interpretations of this variation, so we treat region simply as a control variable.) These results underscore recent trends in evolutionary approaches to leadership that emphasize the context-dependency of leader emergence and evolutionary selection pressures (Hagen & Garfield, 2019; Smith et al., 2016; Smith & Van Vugt, 2020).

Four leadership dimensions varied by subsistence strategy. There was more evidence that hunter-gatherer leaders lacked coercive authority compared to others, supporting much theory and ethnography discussing egalitarianism and the resistance of hierarchy among hunter-gatherers (e.g., Boehm, 1999, 2008; Woodburn, 1982). Reliance on a mobile and stochastic resource base is suggested to promote social norms of sharing (Cashdan, 1980; Peterson, 1993) and shape resource transfers and partner preferences (c.f., D. Smith et al., 2018; K.M. Smith, Larroucau, Mabulla, & Apicella, 2018). There was more evidence that both hunter-gatherer and pastoralist leaders generated food surpluses, but less evidence that pastoralist leaders distributed food and other resources. Thus, systematic ethnographic evidence supports the important role of provisioning resources by influential males among foragers (Alger, Hooper, Cox, Stieglitz, & Kaplan, 2020; Gurven, 2005; Gurven et al., 2009; Wood, 2006). However, there was more evidence that leaders in communities with mixed subsistence strategies distributed resources, lending support to males using economic productivity as an influence-seeking strategy (Hawkes & Bird, 2002; Hawkes, O'Connell, & Coxworth, 2010).

## 5.3. The rarity of some important leadership dimensions

Evidence for several theoretically important leadership dimensions was relatively rare in the ethnographic record. The nonhuman animal leadership literature, for example, commonly focuses on group movement (Couzin, Krause, Franks, & Levin, 2005), and "movement" was one of four leadership dimensions Smith et al. (2016) compared

between small-scale human societies and nonhuman animal societies, yet movement or migration was identified as a leader function in only 13.6% of cultures, of which the vast majority (71.4%) were hunter-gatherers.

Several theories of leadership also emphasize the moral authority of leaders (e.g., Bøggild & Petersen, 2016; Henrich et al., 2015; Henrich & Gil-White, 2001; Richerson & Henrich, 2009; Tietjen & Walker, 1985), yet evidence for leaders as sources of moral authority or "fair" was found in only a minority of cultures (32.2% and 20.3% of cultures, respectively). The dominance theory of leadership (e.g., Chapais, 2015; Cheng, Tracy, & Henrich, 2010; Henrich & Gil-White, 2001; Tiger & Fox, 1971) emphasizes leaders' ability to instill fear, but in only 30.5% of cultures was there evidence that leaders were feared. Finally, a large literature on leadership in industrialized societies highlights the physical attractiveness of leaders (e.g., Altemeyer & Jones, 1974; March & Weil, 2009; Sinclair, 1995), but evidence that leaders were attractive was found in only 3.4% of the nonindustrial cultures sampled here.

## 5.4. Benefits and costs of leadership and followership

Leadership often involves the provisioning of a public good at an individual cost, raising the question of how the individual benefits of leadership outweigh the costs. Followership, on the other hand, involves relinquishing individual decision-making to a leader who might or might not act in the follower's interest. The benefits of followership (and by extension, group living) must also outweigh the costs for leadership to evolve and be maintained (e.g., Bastardoz & Van Vugt, 2018; Garfield, von Rueden, & Hagen, 2019; Gavrilets & Fortunato, 2014; Hagen & Garfield, 2019; Hooper et al., 2010; Price & Van Vugt, 2014).

Leaders were widely reported to receive material benefits, social status, and mating benefits but loss of material resources and social status were also widely reported, suggesting leadership to be a high-risk, high-return strategy (Fig. 4). Nevertheless, for most dimensions of benefits and costs, there was more evidence of benefits than costs (Fig. 5), and the same was true averaging across all benefit/cost dimensions ($OR$ = 3.2). Additionally, several positive leader qualities indicating social, reproductive, and material success clustered together (bottom cluster Fig. 9A). These results are consistent with much theoretical literature that links leader benefits to their capacities to provide prosocial benefits (e.g., resolving conflicts, organizing collective actions, and generosity) and/or impose social costs (e.g., punishing and aggressiveness) (e.g., Bowles, Smith, & Mulder, 2010; Gavrilets & Fortunato, 2014; Glowacki & Wrangham, 2013; Hooper et al., 2010; Price & Van Vugt, 2014; Smith et al., 2016; von Rueden & Jaeggi, 2016).

Among the Trobriand horticulturalists in Papua New Guinea, Irwin (1983, p. 47) describes relationships between polygynous marriages, increased wealth, and widespread social contacts:

> Chiefs managed unusually large quantities of resources and it is agreed that the basis of such wealth was polygamy. Rank was quite directly expressed in the number of wives. The chief of Omarakana had 16 wives in Malinowski's time, while his predecessor Enamakala had 19….In traditional Trobriand society it seems that all leaders of village clusters of guyau status became polygamists. An emerging leader might also expect to be given wives by traditional allies outside the cluster while he might demand them from traditional rivals of subordinate subclans….

Followers similarly benefited from increased material and social resources, but also often lost these resources. Followers were not reported to receive mating benefits, relative to leaders or other benefit types.

For both leaders and followers, individuals stood to lose what they were able to gain (Fig. 4). Hauptman (1981, p. 183) describes Laura Cornelius Kellogg (also known as Minnie and Wynnogene, 1880-1947), a land-claims activist, writer, and perhaps the most famous Iroquois

female leader, whose life exemplified the risks to both leaders and followers:

> Despite her exceptional gifts – a brilliant mind, beauty, self confidence, unusual oratorical abilities, and her educational attainments – Kellogg is also the most controversial Iroquois leader of the twentieth century. It is clear from her many bizarre involvements that she misused her prodigious talents and/or was incapable of carrying out all the massive designs she had for her people's betterment. Although acknowledged today as a major force and brilliant person, she is accused by many Iroquois elders of swindling them out of hundreds of thousands of dollars in her abortive efforts to bring their land claims to fruition and of creating debilitating factionalism that impeded tribal development for decades. Unfortunately, because of her questionable ethics and her inability to carry out what she espoused, Kellogg is blamed today for all that went wrong in Iroquois history in the interwar period. Consequently, her life story had the feel of a Greek tragedy: she wanted to use her extraordinary abilities to help her people but ended up accused by them of being a common outlaw.

### 5.5. Female leadership and sex differences

Only 30 of the 1212 text records discussed female leaders exclusively, and another 11 explicitly discussed both female and male leaders. Leader sex was only associated with variation in seven of our 109 leadership dimensions (Fig. S12), and one feature variable (Fig. S24), indicating that most dimensions of leadership probably characterize leaders of both sexes.

When ethnographic texts described female leaders exclusively, they were relatively more likely to be described as married to a high-quality spouse in a polygynous marriage, and the recipients of various mating benefits (Fig. S12). Female leaders also had higher levels of evidence for the *Social, reproductive, and material success* feature (Fig. S24). Evidence for female leaders was also more likely to be found in kin and residential subgroups. This suite of characteristics supports discussions of high status first-wives who gain and maintain social influence across the lifespan by leveraging their extended kin and social networks (Brown & Kerns, 1985; Goodale, 1971; Yanca & Low, 2004). Garfield and Hagen (2020) similarly found evidence of positive assortative mating of high status leaders in a small-scale society with relative gender-egalitarianism. Our results are also consistent with theoretical arguments emphasizing women as leaders of families (e.g., Garfield, Hubbard, & Hagen, 2019; Hagen & Garfield, 2019).

### 5.6. Disentangling the relationship between leadership and high status

Although leadership and high social status often covary, leaders are not always high-status individuals, nor are high status individuals always leaders (see Cheng & Tracy, 2020; Garfield, von Rueden, & Hagen, 2019; Van Vugt & Smith, 2019; von Rueden, Redhead, O'Gorman, Kaplan, & Gurven, 2019). Because individuals maintain multiple social "statuses," social context is critical (see Wiessner, 2010). In many cultures, for example, communities form work-groups and appoint "chiefs-for-a-day" who manage the work but have little status or authority otherwise (e.g., Macfarlan et al., 2012). Garfield, Hubbard, & Hagen (2019) found that leader organization dimensions clustered separately from leader prestige dimensions, suggesting a distinction. Garfield and Hagen (2020) found that some leaders among recently settled hunter-gatherers had organizing responsibilities but unexceptional levels of respect. Some older individuals, on the other hand, were highly respected but had little influence or authority.

Our results (Figures 3 and 4) support the importance of high social status for leader emergence (Cheng & Tracy, 2020). Nevertheless, over two thirds of our text records on leadership did not mention status, and it was not one of our candidate universal leadership dimensions, with

more evidence for high status from South American cultures (Fig. S11).

The words and leadership dimensions predictive of high status leaders (Fig. 7) resemble "Big men" (Garfield, von Rueden, & Hagen, 2019): wealthy, accomplished, older men who are respected for their decision-making abilities, knowledge and intelligence, and who favor their kin. These associations implicate leadership in the evolution and emergence of inequality (c.f., Sanday, 1981; Borgerhoff Mulder et al., 2010; Bowles et al., 2010; Mattison, Smith, Shenk, & Cochrane, 2016; Price & Feinman, 2010; Shenk, Kaplan, & Hooper, 2016). Our results did not strongly implicate high status leaders with particular functions, with the exception that punishment was modestly negatively associated with evidence for high status. The word "economic" was a negative predictor of high status, hinting that organizational roles might not be high status.

Smith and Van Vugt (2020) speculate that, "leadership may…be more strongly correlated with high status in large, complex organizations, such as in corporations and governments (p. 2)." Evidence for high status leaders, however, did not substantially vary by group context, which included levels of social organization ranging from sub-residential to supracommunity (Fig. S7). This null result fails to support this hypothesis.

### 5.7. Beyond dual models of leadership

Our results support many aspects of influential evolutionary theories of leadership, but offer new directions for expansion and synthesis.

#### 5.7.1. Dominance and prestige

Leadership styles have long been described as based on either force and strength (i.e., dominance) or respect and expertise (i.e., prestige) (see Barkow et al., 1975; Bernstein, 1976; Kracke, 1978; Lewis, 1974; Mead, 1935; Sahlins, 1963; Tiger, 1970). Barkow (1980; 1975), synthesizing the ethological evidence of primate dominance hierarchies with ethnographic evidence, distinguished human prestige from dominance, suggesting the evolution of human prestige was linked to intra- and inter-sexual selection of culturally acquired competencies. Henrich and Gil-White (2001) introduced this important distinction to social science disciplines outside of anthropology, agreeing with Tiger (1970) and Barkow (1980; 1975) on a primate heritage of dominance, but offering an evolutionary account of prestige rooted in social rather than sexual selection for culturally acquired competencies. Henrich and Gil-White (2001) inspired much subsequent work across the behavioral sciences (e.g., Cheng, Tracy, Foulsham, Kingstone, & Henrich, 2013; Garfield, Hubbard, & Hagen, 2019; Halevy, Chou, Cohen, & Livingston, 2012; Maner, 2017; Suessenbach, Loughnan, Schönbrodt, & Moore, 2019; Van Vugt & Smith, 2019).

Our analyses supported the cross-cultural importance of leader aggression and coercion (dominance), as well as culturally acquired competencies (prestige). Our logistic PCA analysis of leader qualities, for instance, indicated that dominance qualities, such as coercive authority and aggressiveness loaded positively on PC1 and PC2, whereas prestige qualities, such as knowledge, experience, and high status loaded negatively on PC1 and PC2. See Fig. S19. But our analyses also indicated that some important modifications are required.

#### 5.7.2. Leader competencies, shamanism, and the use of knowledge to impose costs

The individual competencies cluster (Fig. 9A) comprises dimensions associated with dominance-based leadership, including coercive authority and aggressiveness, as well as qualities associated with prestige-based leadership, including knowledgeable/intelligent and experienced/accomplished. These dimensions are among the most strongly supported in the ethnographic record (Fig. 3).

Shamanism appears to be a distinct form of leadership that combines a strategy of inducing fear, similar to the dominance strategy, but

is based on knowledge and expertise, similar to the prestige strategy. The *Competencies* feature included supernatural and feared dimensions (Fig. 9). The MST-kNN analysis similarly clustered leaders with ritual and medicinal functions, which rely on special knowledge, with those who had supernatural, feared or killer qualities (Fig. S21). Our *Shamanism* variable (which was not one of our original leadership dimensions) was predicted by words that evoke both dominance and prestige, such as *supernatural, power, fear,* and *knowledge* (Fig. 11A), and by four other leadership dimensions that also overlap with the dominance and prestige constructs: *Feared, Medicinal functions, Ritual functions,* and *Experience/accomplished.*

Winkelman and White (1987) found that in societies sampled from the HRAF (*n* = 43) shamans provided decision-making services within judiciary, economic, military, or political domains in 44% or more of societies, and held charismatic leadership roles in 19% of societies. Winkelman (1992) emphasized the influential positions of leadership shamans attain through their charisma, social unification, healing abilities, and use of supernatural powers to cause harm. Artistic performance is also implicated in this style of leadership, and ceremonial, artistic performances by shamans are common displays which often incorporate superhuman abilities (Singh, 2017). Earlier we quoted Pospisil (1993) on Trobriand chiefs' use of sorcerers to punish. Here, Bishop (1974) describes Ojibwa shaman leaders:

> Leadership was vested in the heads of the co-residential groups who held their position through their hunting abilities and supernatural power as shamans. Shamans had the ability to foresee future events and the ability within certain limits to control them. These men were feared as well as respected and prior to 1900, most leaders were polygynists.

The potential evolutionary theoretical importance of shaman leaders (which in our data includes all leaders with supernatural qualities), highlights the importance of evidence on leadership from nonindustrial and non-Western populations. Shaman leaders, with their abilities to provide valuable benefits and impose severe costs, can play an outsized role in nonindustrial populations in numerous domains (Winkelman & White, 1987). The WEIRD notion of secular nationalism, which separates the religious and temporal spheres (Juergensmeyer, 1993), can perhaps blind scholars raised in this tradition from recognizing how weird this separation is.

### 5.7.3. Prosociality

The prosocial cluster (Fig. 9A), comprising prosocial competencies such as generosity and charisma, along with cultural conformity, generally corresponds to a charismatic style of leadership that has been identified in industrialized settings and widely discussed in sociology and evolutionary psychology (Den Hartog, House, Hanges, Ruiz-Quintanilla, & Dorfman, 1999; Grabo, Spisak, & Van Vugt, 2017; Grabo & Van Vugt, 2016; Howell & Shamir, 2005; Weber, 1978). The importance of leader prosociality also supports the Henrich et al. (2015) Big-man mechanism by which positive assortment of followers to prosocial leaders can facilitate the evolution of cooperative social norms and prestige-based leadership.

We also found leader functions often involve prosocial investments in group welfare (Fig. 9B). The prosociality feature of leader functions included distributing resources and providing protection, which are commonly highlighted in the anthropological leadership literature (Boehm, 1993, 1999; Johnson, 1982; Johnson & Earle, 1987; Sahlins, 1963; Service, 1975). In the absence of institutionalized leadership roles, leaders often maintain social influence via continued community investment and the demands of followers can shape leadership functions to meet local needs.

### 5.7.4. Leaders are managers

Our results (Fig. 9B) correspond very closely to what Van Vugt and Kurzban (2007) define as *strategic leadership*, where leaders increase the

pay-offs of another individual's behavior, thereby incentivizing followership, versus *coordinating leadership*, where individuals must effectively organize collective effort. There is also a history within managerial studies among industrial populations of contrasting *leaders* from *managers* (Zaleznik, 1977).

Leaders, possibly drawing on their special competencies, devise and implement strategic solutions to group problems including resolving conflicts and providing counsel (strongly supported functions), as commonly noted in the literature (Boehm, 1999; De Cremer & Van Vugt, 2002; Knauft et al., 1991; Wiessner, 1982, 2019). The *Organize* feature aligns with many evolutionary theories that emphasize the role of leaders in organizing collective actions (e.g., Glowacki et al., 2016; Hooper et al., 2010; Perret, Hart, & Powers, 2020; Pietraszewski, 2020; Van Vugt & Kurzban, 2007).

### 5.8. Leadership and cognitive, social, material, and somatic capital

In our view, the dominance-prestige and "dual-model" theories of leadership, while advancing the discipline, cannot easily account for shaman leaders nor "chiefs-for-a-day" (managers). Critically, these models have conflated the ability to provide "benefits" with knowledge and expertise, and the ability to impose "costs" with physical formidability. Van Vugt and Smith (2019), for instance, state that the source of deference for prestige-style leadership is "Information asymmetry", and for dominance-style, "Power asymmetry" (their Table 1). Instead, as shaman leaders demonstrate, knowledge and expertise can both provide benefits and impose costs, and the same goes for physical formidability. The use of knowledge to impose costs is widely recognized by many social scientists. The role of gossip and other forms of indirect aggression in social dominance, for instance, has been extensively investigated in industrial populations (e.g., Hawley, 1999; Hess & Hagen, 2006, 2017) and also among hunter-gatherers (Hess, Helfrecht, Hagen, Sell, & Hewlett, 2010).

Our revised model, inspired by von Rueden (2014) and others, proposes that leaders deploy cognitive, social, material, and somatic capital to provide benefits and impose costs on followers. If their abilities to do so are similar to other groups members, as in "chiefs-for-a-day", they acquire little status, but if their abilities are exceptional relative to others, they gain status via biological market mechanisms (Garfield, Hubbard, & Hagen, 2019; Hagen & Garfield, 2019; Hammerstein & Noë, 2016; Pietraszewski, 2020). There was strong evidence for cognitive and social capital, with cognitive capital associated with both providing benefits and imposing costs, particularly among shaman leaders (Fig. 12).

## 6. Limitations

Our results are conditional upon the content ethnographers chose to discuss, the way they discussed it, and the way we interpreted and coded their texts. There was a general male bias, which could reflect a male bias in community leadership or a more systemic bias of the ethnographic record (see Mukhopadhyay & Higgins, 1988; Rosaldo, Lamphere, & Bamberger, 1974). These data are also biased towards cultural models of leadership (rather than particular cases) and community leadership; descriptions of kin and residential group leadership were less frequent. The high proportion of text records discussing political leaders could be attributable to our broad search strategy or the content of the ethnographic record of "leadership." Our sample of cultures and text records by continental region and subsistence strategy is also unbalanced. We also detected bias in evidence by date of publication for nine of our 109 leader dimensions (see Fig. S6).

Another limitation lies in our ability to interpret the absence of evidence. The cross-culturally frequent measures discussed here are strongly represented in the ethnographic record and hence very likely to represent broad cross-cultural patterns. We cannot strongly conclude, however, that the relatively infrequent measures identified are
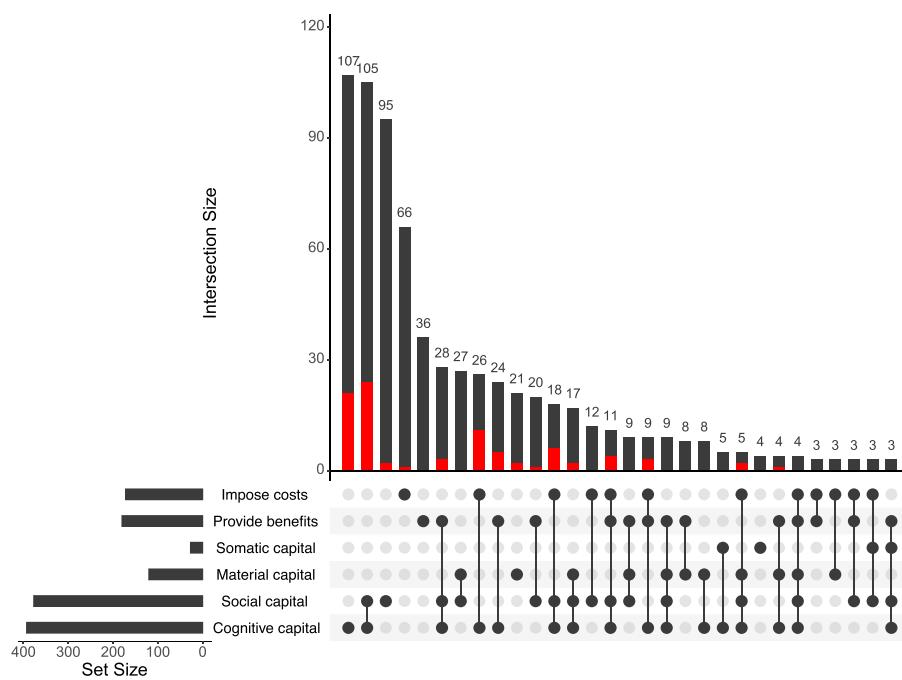
**Fig. 12.** The intersections of evidence for our six basic elements of leadership among all text records (an 'upset' plot) (Gehlenborg, 2019). Horizontal bars (left): The total number of text records in each element. Black dots: has evidence. Gray dots: does not have evidence. Vertical bars (top): The number of text records in that intersection (with lower limit set at 3). Red: The number of text records involving shamans or leaders with supernatural qualities.

truly infrequent dimensions of human behavior and culture, only that they are relatively less frequent in the ethnographic record.

This is an exploratory study. Our analyses were driven by data rather than by *a priori* hypotheses. This has the advantage that unexpected patterns can be discovered, such as the role of shaman leaders, but the disadvantage that some random variation can, and almost certainly will, be misinterpreted as meaningful patterns. In particular, our cluster analysis of leader qualities (Fig. 9A) was sensitive to the choice of different clustering algorithms and inclusion or exclusion of dimensions with little evidence.

## 7. Concluding remarks: Beyond the non-WEIRD

The WEIRD people problem in behavioral science cannot be remedied simply by a "non-WEIRD" solution. Our results, and much of anthropology, clearly demonstrate enormous diversity among populations that are now often categorized as "non-WEIRD", "traditional", or "small-scale." Anthropologists have often made the opposite mistake in essentializing diverse "others" and failing to recognize deep similarities among peoples of all cultures (Brown, 1991; Reyes-García, Zurro, Caro, & Madella, 2017; Said, 1979).

Our results support important, potentially universal dimensions of leadership, as well as systematic variation in other dimensions, especially by the specific context in which leadership occurs. We found leaders in the ethnographic record are widely portrayed as generally prosocial, equipped with special competencies such as knowledge and expertise, resolve conflicts and organize cooperation, and receive material, social, and reproductive benefits. Cross-cultural evidence also supports a dominance style of leadership involving coercive authority, punishment, aggression, and control of resources. These results generally provide broad cross-cultural support for several influential theories, such as the dominance-prestige model, the service-for-prestige model, the computational services model, and numerous collective action models (for review, see Garfield, Hubbard, & Hagen, 2019).

Shamans emerged as an important category of leaders that are rarely discussed in the evolutionary literature (but see Singh, 2017). Supernatural qualities were among the top ten leader qualities across cultures (Fig. 3). Shamans share qualities with prestige-style leaders, such as having specialized knowledge and abilities, yet appear, at least at times, to use their knowledge to instill fear, similar to dominance-

style leaders. We therefore suggest moving beyond dichotomous or "dual" models of leadership, which have tended to conflate knowledge and expertise with providing benefits. Instead, our data indicate that leaders deploy cognitive, social, material, and somatic capital to provide benefits and impose costs (Fig. 12). This view aligns with the theoretical framework developed by many scholars that emphasizes the importance of embodied capital (neural and somatic) and social and material capital in the evolution of human social organization (Bowles et al., 2010; Kaplan et al., 2009, Kaplan, Lancaster, & Robson, 2003; Kaplan, Mueller, Gangestad, & Lancaster, 2003; von Rueden, 2014).

Leaders across cultures rely on a range of individual competencies, including cognitive, supernatural, material, social, and physical endowments, to organize group members, implement strategic actions, provide prosocial services to the group, and impose costs, all while conforming to cultural norms. Currently, no single theoretical perspective has yet captured the ethnographic reality of human leadership.

## Acknowledgements

Data availability

The data associated with this research are available at https://doi.org/10.5281/zenodo.2541999.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.evolhumbehav.2020.07.012.

## References

Abu-Lughod, L. (2008). Writing against culture. *The cultural geography reader* (pp. 62–71). Routledge.

Alger, I., Hooper, P. L., Cox, D., Stieglitz, J., & Kaplan, H. S. (2020). Paternal provisioning results from ecological change. *Proceedings of the National Academy of Sciences.*. https://doi.org/10.1073/pnas.1917166117.

Altemeyer, R. A., & Jones, K. (1974). Sexual identity, physical attractiveness and seating position as determinants of influence in discussion groups. *Canadian Journal of Behavioural Science/Revue Canadienne Des Sciences Du Comportement, 6*(4), 357.

Ames, K. M. (1985). Hierarchies, Stress, and Logistical Strategies among Hunter–Gatherers in Northwestern North America. In T. D. Price, & J. A. Brown (Eds.). *Prehistoric Hunters-Gatherers* (pp. 155–180). . https://doi.org/10.1016/B978-0-12-564750-2.50011-1.

Antonakis, J., House, R. J., & Simonton, D. K. (2017). Can super smart leaders suffer from too much of a good thing? The curvilinear effect of intelligence on perceived leadership behavior. *Journal of Applied Psychology, 102*(7), 1003.

Antonakis, J., Simonton, D. K., & Wai, J. (2019). Intelligence and Leadership. In M. D. Mumford, & C. A. Higgs (Eds.). *Leader thinking skills* (pp. 14–45). New York: Routledge.

Apicella, C. L., Marlowe, F. W., Fowler, J. H., & Christakis, N. A. (2012). Social networks and cooperation in hunter-gatherers. *Nature, 481*(7382), 497–501. https://doi.org/10.1038/nature10736.

Barkow, J. H. (1980). Prestige and self-esteem: A biosocial interpretation. *Dominance Relations,* 319–332.

Barkow, J. H. (1989). *Darwin, sex, and status.* University of Toronto Press.

Barkow, J. H., Akiwowo, A. A., Barua, T. K., Chance, M. R., Chapple, E. D., Chattopadhyay, G. P., ... Isichei, P. A. C. (1975). Prestige and culture: A biosocial interpretation [and comments and replies]. *Current Anthropology,* 553–572.

Bass, B. M., & Stogdill, R. M. (1990). Handbook of leadership. *Theory, Research & Managerial Applications, 3*.

Bastardoz, N., & Van Vugt, M. (2018). The nature of followership: Evolutionary analysis and review. *The Leadership Quarterly.*. https://doi.org/10.1016/j.leaqua.2018.09.004.

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software, 67*(1), 1–48. https://doi.org/10.18637/jss.v067.i01.

Bernstein, I. S. (1976). Dominance, aggression and reproduction in primate societies. *Journal of Theoretical Biology, 60*(2), 459–472.

Bishop, C. A. (1974). *Northern Ojibwa and the fur trade: An historical and ecological study. xx,* 379. Retrieved from https://ehrafworldcultures.yale.edu/document?id=ng06-054.

Blader, S. L., & Chen, Y.-R. (2014). What's in a name? Status, power, and other forms of social hierarchy. *The psychology of social status* (pp. 71–95). Springer.

Bodley, J. H. (2011). *Cultural anthropology: Tribes, states, and the global system.* Rowman Altamira.

Boehm, C. (1993). Egalitarian behavior and reverse dominance hierarchy. *Current Anthropology, 34*(3), 227.

Boehm, C. (1999). *Hierarchy in the forest: The evolution of egalitarian behavior.* Cambridge, MA: Harvard University Press.

Boehm, C. (2008). Purposive social selection and the evolution of human altruism. *Cross-Cultural Research, 42*(4), 319.

Bøggild, T., & Petersen, M. B. (2016). The evolved functions of procedural fairness: An adaptation for politics. In T. K. Shackelford, & R. D. Hansen (Eds.). *The evolution of morality* (pp. 247–276). Springer.

Borgerhoff Mulder, M., Fazzio, I., Irons, W., McElreath, R. L., Bowles, S., Bell, A., ... Hazzah, L. (2010). Pastoralism and wealth inequality: Revisiting an old question. *Current Anthropology, 51*(1), 35–48.

Borgerhoff Mulder, M. B., Bowles, S., Hertz, T., Bell, A., Beise, J., Clark, G., ... Wiessner, P. (2009). Intergenerational Wealth Transmission and the Dynamics of Inequality in Small-Scale Societies. *Science, 326*(5953), 682–688. https://doi.org/10.1126/science.1178336.

Bowles, S., Smith, E. A., & Mulder, M. B. (2010). The emergence and persistence of inequality in premodern societies: Introduction to the special section. *Current Anthropology, 51*(1), 7–17. https://doi.org/10.1086/649206.

Boyd, R., & Richerson, P. J. (1992). Punishment allows the evolution of cooperation (or anything else) in sizable groups. *Ethology and Sociobiology, 13*(3), 171–195.

Brown, D. E. (1991). *Human universals.* New York: McGraw-Hill.

Brown, J. K., & Kerns, V. (1985). In her prime: A new view of middle-aged women. *South Hadley.* MA: Bergin: Garvey Publishers.

Burnham, K. P., & Anderson, D. R. (Eds.). (2002). *Model selection and multimodel inference: A practical information-theoretic approach*https://doi.org/10.1007/b97636.

Buss, D. M. (2006). Strategies of human mating. *Psychological Topics, 15,* 239–260.

Buss, D. M., Durkee, P. K., Shackelford, T. K., Bowdle, B. F., Schmitt, D. P., Brase, G. L., ... Trofimova, I. (2020). Human status criteria: Sex differences and similarities across 14 nations. *Journal of Personality and Social Psychology.* https://doi.org/10.1037/pspa0000206.

Cashdan, E. A. (1980). Egalitarianism among hunters and gatherers. *American Anthropologist, 82,* 116–120.

Chapais, B. (2015). Competence and the evolutionary origins of status and power in humans. *Hum Nature, 26*(2), 161–183. https://doi.org/10.1007/s12110-015-9227-6.

Cheng, J. T. (2019). Dominance, Prestige, and the Role of Leveling in Human Social Hierarchy and Equality. *Current Opinion in Psychology.*. https://doi.org/10.1016/j.copsyc.2019.10.004.

Cheng, J. T., & Tracy, J. L. (2020). Why Social Status Is Essential (But Sometimes Insufficient) for Leadership. *Trends in Cognitive Sciences, 24*(4), 261–263. https://doi.org/10.1016/j.tics.2019.12.008.

Cheng, J. T., Tracy, J. L., & Anderson, C. (2014). *The Psychology of Social Status.* Springer.

Cheng, J. T., Tracy, J. L., Foulsham, T., Kingstone, A., & Henrich, J. (2013). Two ways to the top: Evidence that dominance and prestige are distinct yet viable avenues to

social rank and influence. *J Pers Soc Psychol, 104*(1), 103–125. https://doi.org/10.1037/a0030398.

Cheng, J. T., Tracy, J. L., & Henrich, J. (2010). Pride, personality, and the evolutionary foundations of human social status. *Evolution and Human Behavior, 31*(5), 334–347. https://doi.org/10.1016/j.evolhumbehav.2010.02.004.

Cohen, R., & Middleton, J. (Eds.). (1967). *Comparative Political Systems: Studies in the Politics of Pre-Industrial Societies.* Garden City, NY: The Natural History Press.

Collier, J. F., & Rosaldo, M. Z. (1981). Politics and gender in simple societies. In S. B. Ortner, & H. Whitehead (Eds.). *Sexual Meanings* (pp. 275–329). Cambridge: Cambridge University Press.

Couzin, I. D., Krause, J., Franks, N. R., & Levin, S. A. (2005). Effective leadership and decision-making in animal groups on the move. *Nature, 433*(7025), 513–516. https://doi.org/10.1038/nature03236.

De Cremer, D., & Van Vugt, M. (2002). Intergroup and intragroup aspects of leadership in social dilemmas: A relational model of cooperation. *Journal of Experimental Social Psychology, 38,* 126–136.

Den Hartog, D. N., House, R. J., Hanges, P. J., Ruiz-Quintanilla, S. A., & Dorfman, P. W. (1999). Culture specific and cross-culturally generalizable implicit leadership theories: Are attributes of charismatic/transformational leadership universally endorsed? *The Leadership Quarterly, 10,* 219–256.

Dussart, F. (2000). *The politics of ritual in an Aboriginal settlement: Kinship, gender, and the currency of knowledge.* Smithsonian Books.

Earle, T. K. (1997). *How chiefs come to power: The political economy in prehistory.* Stanford University Press.

Firth, R. W. (1927). *Economic organisation of Polynesian societies: Wealth and work of the Maori.* PhD thesisThe London School of Economics; Political Science (LSE).

Friedman, J., Hastie, T., & Tibshirani, R. (2010). Regularization paths for generalized linear models via coordinate descent. *Journal of Statistical Software, 33*(1), 1.

Garfield, Z. H., & Hagen, E. H. (2020). Investigating evolutionary models of leadership among recently settled Ethiopian hunter-gatherers. *Special Issue on Evolution and Biology of Leadership, 31*(2), 101290. https://doi.org/10.1016/j.leaqua.2019.03.005.

Garfield, Z. H., Hubbard, R. H., & Hagen, E. H. (2019). Evolutionary models of leadership: Tests and synthesis. *Human Nature, 30*(1), 23–58. https://doi.org/10.1007/s12110-019-09338-4.

Garfield, Z. H., von Rueden, C. R., & Hagen, E. H. (2019). The evolutionary anthropology of political leadership. *The Leadership Quarterly, 30*(1), 59–80. https://doi.org/10.1016/j.leaqua.2018.09.001.

Gavrilets, S. (2015). Collective action problem in heterogeneous groups. *Phil. Trans. R. Soc. B, 370,* 20150016.

Gavrilets, S., Auerbach, J., & Van Vugt, M. (2016). Convergence to consensus in heterogeneous groups and the emergence of informal leadership. *Scientific Reports, 6,* 29704.

Gavrilets, S., & Fortunato, L. (2014). A solution to the collective action problem in between-group conflict with within-group inequality. *Nature Communications, 5.*

Gehlenborg, N. (2019). UpSetR: A more scalable alternative to Venn and Euler diagrams for visualizing intersecting sets. Retrieved from https://CRAN.R-project.org/package=UpSetR.

Glowacki, L., Isakov, A., Wrangham, R. W., McDermott, R., Fowler, J. H., & Christakis, N. A. (2016). Formation of raiding parties for intergroup violence is mediated by social network structure. *Proceedings of the National Academy of Sciences, 113*(43), 12114–12119.

Glowacki, L., & von Rueden, C. R. (2015). Leadership solves collective action problems in small-scale societies. *Philos Trans R Soc Lond B Biol Sci, 370*(1683), https://doi.org/10.1098/rstb.2015.0010.

Glowacki, L., Wilson, M. L., & Wrangham, R. W. (2017). The evolutionary anthropology of war. *Journal of Economic Behavior and Organization.*. https://doi.org/10.1016/j.jebo.2017.09.014.

Glowacki, L., & Wrangham, R. W. (2013). The role of rewards in motivating participation in simple warfare. *Hum Nat, 24*(4), 444–460. https://doi.org/10.1007/s12110-013-9178-8.

Goodale, J. C. (1971). *Tiwi wives: A study of the women of Melville Island.* North Australia: University of Washington Press Seattle.

Grabo, A., Spisak, B. R., & Van Vugt, M. (2017). Charisma as signal: An evolutionary perspective on charismatic leadership. *The Leadership Quarterly, 28*(4), 473–485. https://doi.org/10.1016/j.leaqua.2017.05.001.

Grabo, A., & Van Vugt, M. (2016). Charismatic leadership and the evolution of cooperation. *Evolution and Human Behavior, 37,* 399–406.

Grammer, K. (1996). Symptoms of power: The function and evolution of social status. *Food and the status quest: An interdisciplinary perspective* (pp. 68–85). Providence, RI: Berghahn Books.

Gurven, M. (2005). To give and to give not: The behavioral ecology of human food transfers. *Behavioral and Brain Sciences, 27,* 543–559.

Gurven, M., Allen-Arave, W., Hill, K., & Hurtado, M. (2000). "It's a wonderful life": Signaling generosity among the Ache of Paraguay. *Evolution and Human Behavior, 21*(4), 263–282.

Gurven, M., Hill, K., Hames, R., Kameda, T., McDermott, R., Lupo, K., ... (2009). Why do men hunt? A reevaluation of "man the hunter" and the sexual division of labor. *Current Anthropology, 50*(1), 51–74.

Hagen, E. H., & Garfield, Z. H. (2019). *Leadership and prestige, mothering, sexual selection, and encephalization: The computational services model.* Preprint, https://doi.org/10.31219/osf.io/9bcdk.

Halevy, N., Chou, E. Y., Cohen, T. R., & Livingston, R. W. (2012). Status conferral in intergroup social dilemmas: Behavioral antecedents and consequences of prestige and dominance. *Journal of Personality and Social Psychology, 102*(2), 351.

Hames, R. (2019). Pacifying Hunter-Gatherers. *Human Nature, 30*(2), 155–175. https://doi.org/10.1007/s12110-019-09340-w.

Hammerstein, P., & Noë, R. (2016). Biological trade and markets. *Phil. Trans. R. Soc. B, 371*, 20150101.

Hauptman, L. M. (1981). *Iroquois and the new deal. xviii,* 256. Retrieved from https://ehrafworldcultures.yale.edu/document?id=nm09-056.

Hawkes, K., & Bird, R. B. (2002). Showing off, handicap signaling, and the evolution of men's work. *Evolutionary Anthropology, 11*, 58–67.

Hawkes, K., O'Connell, J. F., & Coxworth, J. E. (2010). Family provisioning is not the only reason men hunt. *Current Anthropology, 51*, 259–264. https://doi.org/10.1086/651074.

Hawley, P. H. (1999). The ontogenesis of social dominance: A strategy-based evolutionary perspective. *Developmental Review, 19*(1), 97–132.

Henrich, J., Chudek, M., & Boyd, R. (2015). The Big Man Mechanism: How prestige fosters cooperation and creates prosocial leaders. *Phil. Trans. R. Soc. B, 370*(1683), 20150013.

Henrich, J., Ensminger, J., McElreath, R., Barr, A., Barrett, C., Bolyanatz, A., ... Ziker, J. (2010). Markets, religion, community size, and the evolution of fairness and punishment. *Science, 327*, 1480–1484. https://doi.org/10.1126/science.1182238.

Henrich, J., & Gil-White, F. J. (2001). The evolution of prestige: Freely conferred deference as a mechanism for enhancing the benefits of cultural transmission. *Evolution and Human Behavior, 22*(3), 165–196.

Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world? *Behavioral and Brain Sciences, 33*, 61–135. https://doi.org/10.1017/S0140525X0999152X.

Henrich, J., McElreath, R., Barr, A., Ensminger, J., Barrett, C., Bolyanatz, A., ... Ziker, J. (2006). Costly Punishment Across Human Societies. *Science, 312*(5781), 1767–1770. https://doi.org/10.1126/science.1127333.

Hess, N. H., & Hagen, E. H. (2006). Sex differences in indirect aggression: Psychological evidence from young adults. *Evolution and Human Behavior, 27*(3), 231–245.

Hess, N. H., & Hagen, E. H. (2017). Gossip, reputation, and friendship in within-group competition: An evolutionary perspective. *Handbook of Reputation and Gossip*. Oxford University Press.

Hess, N. H., Helfrecht, C., Hagen, E., Sell, A., & Hewlett, B. (2010). Interpersonal aggression among Aka hunter-gatherers of the Central African Republic. *Human Nature, 21*(3), 330–354. https://doi.org/10.1007/s12110-010-9094-0.

Hooper, P. L., Kaplan, H. S., & Boone, J. L. (2010). A theory of leadership in human cooperative groups. *Journal of Theoretical Biology, 265*(4), 633–646.

Howell, J. M., & Shamir, B. (2005). The role of followers in the charismatic leadership process: Relationships and their consequences. *Academy of Management Review, 30*(1), 96–112.

Irwin, G. J. (1983). *Chieftainship, kula and trade in Massim prehistory.* 29–72. Retrieved from https://ehrafworldcultures.yale.edu/document?id=ol06-037.

Johnson, A. W., & Earle, T. K. (1987). *The evolution of human societies: From foraging group to agrarian state.* Stanford Univ Pr.

Johnson, G. A. (1982). Organizational structure and scalar stress. *Theory and Explanation in Archaeology,* 389–421.

Judge, T. A., Colbert, A. E., & Ilies, R. (2004). Intelligence and leadership: A quantitative review and test of theoretical propositions. *J Appl Psychol, 89*(3), 542–552. https://doi.org/10.1037/0021-9010.89.3.542.

Juergensmeyer, M. (1993). *The new cold war? Religious nationalism confronts the secular state. vol. 5.* Univ of California Press.

Kantner, J. (2010). Identifying the pathways to permanent leadership. In K. J. Vaughn, J. W. Eerkens, & J. Kanter (Eds.). *The Evolution of Leadership: Transitions in Decision Making from Small-Scale to Middle-Range Societies* (pp. 249–281). Santa Fe: SAR.

Kaplan, H. S., Hooper, P. L., & Gurven, M. (2009). The evolutionary and ecological roots of human social organization. *Philosophical Transactions of the Royal Society B: Biological Sciences, 364*, 3289–3299.

Kaplan, H. S., Lancaster, J., & Robson, A. (2003). Embodied capital and the evolutionary economics of the human life span. *Population and Development Review, 29*, 152–182.

Kaplan, H. S., Mueller, T., Gangestad, S., & Lancaster, J. (2003). Neural capital and life span evolution among primates and humans. In C. Finch, J. Robine, & Y. Christen (Eds.). *Brain and longevity (pp. 69–97).* Springer.

Kelly, R. L. (2013). *The foraging spectrum: Diversity in hunter-gatherer lifeways* (2nd ed.). Smithsonian Inst Pr.

Knauft, B. M., Abler, T. S., Betzig, L., Boehm, C., Dentan, R. K., Kiefer, T. M., ... Rodseth, L. (1991). Violence and Sociality in Human Evolution [and Comments and Replies]. *Current Anthropology, 32*(4), 391–428. https://doi.org/10.1086/203975.

Kracke, W. H. (1978). *Force and persuasion. Leadership in an Amazonian society.* The University of Chicago Press.

Lewis, H. S. (1974). *Leaders and followers: Some anthropological perspectives.* Addison-Wesley.

Lopez, A. C. (2017). The Evolutionary Psychology of War: Offense and Defense in the Adapted Mind. *Evolutionary Psychology, 15*(4), https://doi.org/10.1177/1474704917742720 1474704917742720.

Low, B. S. (1992a). Men, women, resources, and politics in pre-industrial societies. In J. van der Dennen (Ed.). *The nature of the sexes: The sociobiology of sex differences and the battle of the sexes* (pp. 149–169). Groningen, Netherlands: Origin Press.

Low, B. S. (1992b). Sex, Coalitions, and Politics in Preindustrial Societies. *Politics and the Life Sciences, 11*, 63–80.

Lukaszewski, A. W., Simmons, Z. L., Anderson, C., & Roney, J. R. (2016). The role of physical formidability in human social status allocation. *J Pers Soc Psychol, 110*(3), 385–406. https://doi.org/10.1037/pspi0000042.

Macfarlan, S. J., Remiker, M., & Quinlan, R. (2012). Competitive altruism explains labor exchange variation in a Dominican community. *Current Anthropology, 53*, 118–124.

Maner, J. K. (2017). Dominance and Prestige: A Tale of Two Hierarchies. *Current Directions in Psychological Science, 26*(6), 526–531. https://doi.org/10.1177/0963721417714323.

March, J. G., & Weil, T. (2009). *On leadership.* John Wiley & Sons.

Marlowe, F. W., Berbesque, J. C., Barr, A., Barrett, C., Bolyanatz, A., Cardenas, J. C., ... Tracer, D. (2008). More "altruistic" punishment in larger societies. *Proceedings of the Royal Society B: Biological Sciences, 275*(1634), 587–592. https://doi.org/10.1098/rspb.2007.1517.

Mattison, S. M., Smith, E. A., Shenk, M. K., & Cochrane, E. E. (2016). The evolution of inequality. *Evolutionary Anthropology: Issues, News, and Reviews, 25*, 184–199.

Mead, M. (1935). *Sex and temperament.* Kegan Paul: Routledge.

Morgan, L. H. (1877). *Ancient society; or, researches in the lines of human progress from savagery, through barbarism to civilization.* H. Holt.

Mukhopadhyay, C. C., & Higgins, P. J. (1988). Anthropological studies of women's status revisited: 1977-1987. *Annu Rev Anthropol, 17*, 461–495. https://doi.org/10.1146/annurev.an.17.100188.002333.

Mumford, E. (1906). The Origins of Leadership. *American Journal of Sociology, 12*(2), 216–240. Retrieved from https://www.jstor.org/stable/2762385.

Murie, J. R., & Parks, D. R. (1989). *Ceremonies of the pawnee. xiv,* 497. Retrieved from https://ehrafworldcultures.yale.edu/document?id=nq18-015.

Myres, J. L. (1917). *The Influence of Anthropology on the course of Political Science. Vol. 4.* University of California Press.

Naroll, R. (1967). The proposed HRAF probability sample. *Cross-Cultural Research, 2*(2), 70–80.

Neel, J. V. (1980). On being headman. *Perspectives in Biology and Medicine, 23*(277–94).

Perret, C., Hart, E., & Powers, S. T. (2020). From disorganized equality to efficient hierarchy: How group size drives the evolution of hierarchy in human societies. *Proceedings of the Royal Society B: Biological Sciences, 287*(1928), 20200693. https://doi.org/10.1098/rspb.2020.0693.

Peterson, N. (1993). Demand sharing: Reciprocity and the pressure for generosity among foragers. *American Anthropologist, 95*(4), 860–874.

Pietraszewski, D. (2020). The evolution of leadership: Leadership and followership as a solution to the problem of creating and executing successful coordination and co-operation enterprises. *Special Issue on Evolution and Biology of Leadership, 31*(2), 101299. https://doi.org/10.1016/j.leaqua.2019.05.006.

Pospisil, L. J. (1993). I am very sorry I cannot kill you any more': War and peace among the kapauku. *Studying war : Anthropological perspectives: . Vol. 2. War and Society* (pp. 113–126). . Retrieved from https://ehrafworldcultures.yale.edu/document?id=oj29-007.

Powers, S. T., & Lehmann, L. (2014). An evolutionary model explaining the Neolithic transition from egalitarianism to leadership and despotism. *Proceedings of the Royal Society of London B: Biological Sciences,* 281. https://doi.org/10.1098/rspb.2014.1349.

Price, M. E., & Van Vugt, M. (2014). The evolution of leader-follower reciprocity: The theory of service-for-prestige. *Frontiers in Human Neuroscience, 8*(363), 1–17. https://doi.org/10.3389/fnhum.2014.00363.

Price, M. E., & Van Vugt, M. (2015). The Service-for-Prestige Theory of Leader-Follower Relations: A Review of the Evolutionary Psychology and Anthropology Literatures. In R. D. Arvey, & S. M. Colarelli (Eds.). *Biological Foundations of Organizational Behavior* (pp. 397–477). Chicago: The University of Chicago Press.

Price, T. D., & Feinman, G. M. (2010). Social Inequality and the Evolution of Human Social Organization. In G. M. Feinman, T. D. Price, T. D. Price, & G. M. Feinman (Eds.). *Pathways to Power* (pp. 1–14). . Retrieved from http://link.springer.com/10.1007/978-1-4419-6300-0_1.

Redmond, E. M. (1998). Introduction: The dynamics of chieftaincy and the development of chiefdoms. In E. M. Redmond (Ed.). *Chiefdoms and Chieftaincy in the Americas, University Press of Florida, Gainesville* (pp. 1–17). Gainesville: University Press of Florida.

Reyes-García, V., Zurro, D., Caro, J., & Madella, M. (2017). Small-scale societies and environmental transformations: Coevolutionary dynamics. *Ecology and Society, 22*(1), https://doi.org/10.5751/ES-09066-220115.

Richerson, P., Baldini, R., Bell, A. V., Demps, K., Frost, K., Hillis, V., ... Newson, L. (2016). Cultural group selection plays an essential role in explaining human cooperation: A sketch of the evidence. *Behavioral and Brain Sciences, 39*.

Richerson, P., & Henrich, J. (2009). *Tribal social instincts and the cultural evolution of institutions to solve collective action problems.*

Rigby, P. (1985). *Persistent pastoralists.*

Rosaldo, M. Z., Lamphere, L., & Bamberger, J. (1974). *Woman, culture, and society. Vol. 133.* Stanford University Press.

Roscoe, P. (2009). Social Signaling and the Organization of Small-Scale Society: The Case of Contact-Era New Guinea. *Journal of Archaeological Method and Theory, 16*(2), 69–116.

Roscoe, P., Chacon, R. J., Hayward, D., & Chacon, Y. (2019). Social Signaling and the Warrior-Big-Man among the Western Dani. *Human Nature.*. https://doi.org/10.1007/s12110-019-09345-5.

von Rueden, C. R. (2014). The roots and fruits of social status in small-scale human societies. In J. T. Cheng, J. L. Tracy, & C. Anderson (Eds.). *The psychology of social status* (pp. 179–200). Springer.

von Rueden, C. R., Alami, S., Kaplan, H. S., & Gurven, M. (2018). Sex differences in political leadership in an egalitarian society. *Evolution and Human Behavior.*. https://doi.org/10.1016/j.evolhumbehav.2018.03.005.

von Rueden, C. R., Gavrilets, S., & Glowacki, L. (2015). Solving the puzzle of collective action through inter-individual differences. *Philos Trans R Soc Lond B Biol Sci, 370*(1683), https://doi.org/10.1098/rstb.2015.0002.

von Rueden, C. R., Gurven, M., & Kaplan, H. S. (2008). The multiple dimensions of male social status in an Amazonian society. *Evolution and Human Behavior, 29*(6), 402–415. https://doi.org/10.1016/j.evolhumbehav.2008.05.001.

von Rueden, C. R., Gurven, M., Kaplan, H. S., & Stieglitz, J. (2014). Leadership in an Egalitarian Society. *Hum Nat.*. https://doi.org/10.1007/s12110-014-9213-4.

von Rueden, C. R., & Jaeggi, A. V. (2016). Mens status and reproductive success in 33 nonindustrial societies: Effects of subsistence, marriage system, and reproductive strategy. *Proceedings of the National Academy of Sciences, 201606800*.

von Rueden, C. R., Redhead, D., O'Gorman, R., Kaplan, H. S., & Gurven, M. (2019). The dynamics of men's cooperation and social status in a small-scale society. *Proceedings of the Royal Society B: Biological Sciences, 286*(1908), 20191367. https://doi.org/10.1098/rspb.2019.1367.

von Rueden, C. R., & Van Vugt, M. (2015). Leadership in small-scale societies: Some implications for theory, research, and practice. *The Leadership Quarterly, 26*, 978–990. https://doi.org/10.1016/j.leaqua.2015.10.004.

Sahlins, M. D. (1963). Poor man, rich man, big-man, chief: Political types in Melanesia and Polynesia. *Comparative Studies in Society and History, 5*(03), 285–303.

Said, E. W. (1979). *Orientalism.* Vintage.

Sanday, P. R. (1981). *Female power and male dominance: On the origins of sexual inequality.* Cambridge Univ Pr.

Service, E. R (1975). *Origins of the state and civilization: The process of cultural evolution.* Norton & Comp.

Shenk, M. K., Kaplan, H. S., & Hooper, P. L. (2016). Status competition, inequality, and fertility: Implications for the demographic transition. *Philosophical Transactions of the Royal Society B: Biological Sciences, 371*(1692), https://doi.org/10.1098/rstb.2015.0150.

Silverman, P., & Maxwell, R. J. (1978). How Do I Respect Thee? Let Me Count The Ways: Deference Towards Elderly Men and Women. *Cross-Cultural Research, 13*, 91–108. https://doi.org/10.1177/106939717801300201.

Sinclair, A. (1995). Sexuality in leadership. *International Review of Women and Leadership, 1*(2), 25–38.

Singh, M. (2017). The cultural evolution of shamanism. *The Behavioral and Brain Sciences, 2017*, 1–83.

Smith, D., Dyble, M., Major, K., Page, A. E., Chaudhary, N., Salali, G. D., ... Mace, R. (2018). A Friend in need is a friend indeed: Need-based sharing, rather than cooperative assortment, predicts experimental resource transfers among Agta hunter-gatherers. *Evolution and Human Behavior.*. https://doi.org/10.1016/j.evolhumbehav.2018.08.004.

Smith, J. E., Gavrilets, S., Mulder, M. B., Hooper, P. L., Mouden, C. E., Nettle, D., ... Smith, E. A. (2016). Leadership in mammalian societies: Emergence, distribution, power, and payoff. *Trends Ecol Evol, 31*(1), 54–66. https://doi.org/10.1016/j.tree.2015.09.013.

Smith, J. E., Ortiz, C. A., Buhbe, M. T., & Van Vugt, M. (2020). Obstacles and opportunities for female leadership in mammalian societies: A comparative perspective. *Special Issue on Evolution and Biology of Leadership, 31*(2), 101267. https://doi.org/10.1016/j.leaqua.2018.09.005.

Smith, J. E., & Van Vugt, M. (2020). Leadership and Status in Mammalian Societies: Context Matters. *Trends in Cognitive Sciences, 24*(4), 263–264. https://doi.org/10.1016/j.tics.2020.01.003.

Smith, K. M., Larroucau, T., Mabulla, I. A., & Apicella, C. L. (2018). Hunter-Gatherers Maintain Assortativity in Cooperation despite High Levels of Residential Change and Mixing. *Current Biology, 0*(0), https://doi.org/10.1016/j.cub.2018.07.064.

Stanik, C. E., & Ellsworth, P. C. (2010). Who Cares About Marrying a Rich Man? Intelligence and Variation in Women's Mate Preferences. *Human Nature, 21*, 203–217. https://doi.org/10.1007/s12110-010-9089-x.

Stanish, C. (2004). The evolution of chiefdoms: An economic anthropological model. In G. M. Feinman (Ed.). *Archaeological perspectives on political economies* (pp. 7–24). Salt Lake City: University of Utah Press.

Stanish, C. (2010). The evolution of managerial elites in intermediate societies. *The Evolution of Leadership: Transitions in Decision Making from Small-Scale to Middle-Range Societies* (pp. 97–119). Santa Fe: SAR.

Stevens, S. F. (1990). *Sherpa Settlement And Subsistence: Cultural Ecology And History In Highland Nepal.* Ann Arbor, Mich.: University Microfilms International.

Steward, J. H. (1938). *Basin-plateau aboriginal sociopolitical groups. Vol. 120.* US Government Printing Office.

Suessenbach, F., Loughnan, S., Schönbrodt, F. D., & Moore, A. B. (2019). The Dominance, Prestige, and Leadership Account of Social Power Motives. *European Journal of Personality, 33*(1), 7–33. https://doi.org/10.1002/per.2184.

Sugiyama, L. S. (2004). Illness, injury, and disability among Shiwiar forager-horti-culturalists: Implications of health-risk buffering for the evolution of human life history. *American Journal of Physical Anthropology: The Official Publication of the American Association of Physical Anthropologists, 123*(4), 371–389.

Suzuki, R., & Shimodaira, H. (2015). Pvclust: Hierarchical clustering with p-values via multiscale bootstrap resampling. Retrieved from https://CRAN.R-project.org/package=pvclust.

Tietjen, A. M., & Walker, L. J. (1985). Moral reasoning and leadership among men in a Papua New Guinea society. *Developmental Psychology, 21*, 982.

Tiger, L. (1970). Dominance in human societies. *Annual Review of Ecology and Systematics, 1*(1), 287–306.

Tiger, L., & Fowler, H. T. (1978). *Female hierarchies.* Chicago, Ill.: Beresford Book Service.

Tiger, L., & Fox, R. (1971). *The imperial animal.* Holt, Rinehart: Winston.

Tooby, J., Cosmides, L., & Price, M. E. (2006). Cognitive adaptations for n-person exchange: The evolutionary roots of organizational behavior. *Managerial and Decision Economics, 27*, 103–129. https://doi.org/10.1002/mde.1287.

Tsui, A. S., Enderle, G., & Jiang, K. (2017). Income Inequality in the United States: Reflections on the Role of Corporations. *Academy of Management Review, 43*(1), 156–168. https://doi.org/10.5465/amr.2016.0527.

Van Vugt, M. (2006). Evolutionary origins of leadership and followership. *Pers Soc Psychol Rev, 10*(4), 354–371. https://doi.org/10.1207/s15327957pspr1004_5.

Van Vugt, M., & Kurzban, R. (2007). Cognitive and Social Adaptations for Leadership and Followership. *Evolution and the Social Mind: Evolutionary Psychology and Social Cognition, 9*, 229.

Van Vugt, M., & Smith, J. E. (2019). A Dual Model of Leadership and Hierarchy: Evolutionary Synthesis. *Trends in Cognitive Sciences, 23*(11), 952–967. https://doi.org/10.1016/j.tics.2019.09.004.

Van Vugt, M., & von Rueden, C. R. (2020). From genes to minds to cultures: Evolutionary approaches to leadership. *Special Issue on Evolution and Biology of Leadership, 31*(2), 101404. https://doi.org/10.1016/j.leaqua.2020.101404.

Walker, R. S., Beckerman, S., Flinn, M. V., Gurven, M., von Rueden, C. R., Kramer, K. L., ... Hagen, E. H. (2012). Living with kin in lowland horticultural societies. *Current Anthropology, 54*, 96–103.

Walker, R. S., Flinn, M. V., Ellsworth, R., & Hill, R. (2011). Evolutionary history of hunter-gatherer marriage practices. *PLOS ONE, 6*(4).

Weber, M. (1978). The distribution of power within the political community: Class, status, party. *Economy and Society, 2*, 926–940.

Whyte, M. K. (1978). *The status of women in preindustrial societies.* Princeton University Press.

Widmer, R. J. (1988). *The evolution of the Calusa: A nonagricultural chiefdom on the southwest Florida coast.* Tuscaloosa: University of Alabama Press.

Wiessner, P. (1982). Risk, reciprocity, and social influence on !Kung San economics. *Kung San Economics. See Ref, 58*, 61–84.

Wiessner, P. (2010). The power of one? Big men revisited. In K. J. Vaughn, J. W. Eerkens, & J. Kanter (Eds.). *The evolution of leadership: Transitions in decision-making from small-scale to middle-range societies* (pp. 195–222). Santa Fe: SAR.

Wiessner, P. (2019). Collective Action for War and for Peace: A Case Study among the Enga of Papua New Guinea. *Current Anthropology, 60*(2), 224–244. https://doi.org/10.1086/702414.

Wiessner, P. W., & Schiefenhövel, W. (Eds.). (1996). *Food and the status quest: An inter-disciplinary perspective.* Providence: Berghahn Books.

Wild, H., Glowacki, L., Maples, S., Mejía-Guevara, I., Krystosik, A., Bonds, M. H., ... Barry, M. (2019). Making pastoralists count: geospatial methods for the health surveillance of nomadic populations. *bioRxiv, 572685*. https://doi.org/10.1101/572685.

Winkelman, M. (1992). *Shamans, priests, and witches: A cross-cultural study of magico-re-ligious practitioners.* Arizona State University.

Winkelman, M. J. (2020). A cross-cultural study of the elementary forms of religious life: Shamanistic healers, priests, and witches. *Religion, Brain & Behavior, 0*(0), 1–19. https://doi.org/10.1080/2153599X.2020.1770845.

Winkelman, M. J., & White, D. (1987). *A cross-cultural study of magico-religious practi-tioners and trance states: Database (HRAF Research Series in Quantita- tive Cross-Cultural Data III).* Retrieved from https://doi.org/10.13140/RG.2.1.4381.2720.

Wood, B. M. (2006). Prestige or provisioning? A test of foraging goals among the Hadza. *Current Anthropology, 47*.

Woodburn, J. (1982). Egalitarian societies. *Man, 17*(3), 431–451.

Yanca, C., & Low, B. S. (2004). Female allies and female power A cross-cultural analysis. *Evolution and Human Behavior, 25*, 9–23.

Zaleznik, A. (1977). Managers and leaders: Are they different. *Harvard Business Review, 55*(3), 67–78.