Scalp-taking

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Abstract

At their arrival in North America, travelers from the Old Continent were exposed to a radically different civilization. Among the many practices that captured their imagination was scalp-taking. During a battle, the Native American warrior would often stop after having killed or subdued the enemy and cut-off his scalp. In this paper, we develop an economic theory of this gruesome practice. We argue that scalp-taking emerged as an institutional solution to the problem of monitoring warriors' behavior in the battlefield under conditions of high information costs.

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1 Introduction

Upon their arrival on the North American continent, European travelers and conquerors entered into contact with an entirely new civilization–really a wide array of civilizations. Estimates of the Native American population at the time of the first contact vary from a little more than one million to about sixty million (Driver 2011, 63), with the general consensus being between two and seven million (Thornton 2008, 25), divided into hundreds of tribes and villages. Language, customs, and political and military organization varied from region to region and from tribe to tribe. On the East Coast, the European travelers encountered the League of the Iroquois, the largest and more sophisticated political unit north of Mexico, governed by a council of chiefs from different tribes and representing different interest and professions (Driver 2011, 21, 302)[1]. On the West Coast, the modal form of social organization was much smaller and these people "lacked true political organization" until well into the 19th century (Driver 2011, 288; Kehoe 2014).

Among the indigenous custom that captured the interest of Europeans were cannibalism and trophy-taking. It was not uncommon for a successful war party to return to the village with prisoners which would then be tortured, killed, and finally "eaten in a cannibalistic feast" (Driver 2011, 324).[2] Human trophy taking was also extremely common (Chacon and Dye 2007). The most popular among these was the practice of scalp-taking. According to the most renowned student of the practice: "The Scalp was the characteristic trophy for the New World" (Friederici 1907, 181). Scalp-taking played a central role in the culture and social life of the group that practiced it. Warriors would risk their lives in order to severe the scalp from a dead or injured enemy. Scalps were publicly exhibited in the houses of warriors, sewn together and worn as hats and jackets, and prominently featured in victory parties after the battle.

[1] Other Native American people also organized into temporary or permanent federations, often for purposes of defense against aggressors (Eid 1985; Rice 2001; Bamforth 2018).

[2] While relatively widespread throughout the continent, the archeological evidence suggests that scalping was particularly common in the Southwest (Ross-Stallings 2007).

Scalp-taking has been the focus of much research in archeology (Neumann 1940; Miller 1994; Bueschgen and Chase 1996; Chacon and Dye 2007; Mensforth 2007; Ross-Stallings 2007) and social and cultural anthropology (Burton 1864; Friederici 1907; Grinnell 1910; Axtell and Sturtevant 1980; Smith 1995; Driver 2011), but has so far been ignored by economists. The purpose of this paper is to fill this gap. We provide an economic theory of scalp-taking: This practice, we argue, served as an institutional response to the collective action and principal-agent problems of organized violence. It did so by offering tribes a low-cost monitoring mechanism over the behavior of individual warriors during battle.

Our paper contributes to the literature on the economics of small-scale societies. In this, it takes the opposite view to the one that characterizes the perception of the European colonists following their first encounter with the indigenous peoples of North America. Rather than ascribing the institutions characteristic of these societies to moral decay and irrationality, it sees them, including the practice of scalp-taking, as the effective result of the interaction of rational individuals under the particular constraints imposed onto them by nature and technology.

Works in this literature apply the rational choice model to explain the institutions and customs of societies with limited specialization, little technological knowledge, and high information costs (V. Smith 1975; Posner 1980; Lueck 1994; Suarez 2018). Demsetz (1967) and Benson (1988) explore the nature and evolution of property rights in such societies. Notwithstanding the absence of a third-party enforcer, these men and women adopted a series of institutions for the delineation and enforcement of property rights. These institutions evolved and adapted efficiently in response to changing economic circumstances: New property rights are created an enforced as the exchange value of resources increases, as in the case of land ownership among the Indians of the Labrador Peninsula after the rise of the transatlantic fur trade (Demsetz 1967). Suchman (1989) provides an economic theory of witchcraft in small-scale societies as an informal institution for the protection of intellectual property rights. Similarly, Leeson (2014) uses the

rational choice model to explain the prevalence of human sacrifice in pre-modern India. This practice served as an institution for the reduction of intertribal conflict. Through human sacrifice, which comports the destruction of economic resources, a tribe can decrease another's expected benefits from waging war thus effectively decreasing the likelihood of violent conflict. More recently, Nunn and Sanchez de la Sierra (2017) study the effect of superstitious beliefs on the supply of effort in conflict situations in the Democratic Republic of Congo.

We also contribute to the social scientific literature on intergroup conflict (Hirshleifer 1994; Reyna 1994; Garfinkel and Skaperdas 2007; Leeson 2009). Our argument is closely related to the economic analysis of the institutions for the organization of violence on the battlefield. Brennan and Tullock (1982) first posited that the incentives of individual soldiers and those of their generals are not necessarily aligned. Armies suffer from principal-agent and prisoners' dilemma problems. Frey and Buhofer (1988) examine the effect of alternative property rights structures over prisoners and other spoils of war on armies' performance. Allen (1998, 2002) studies the institutional arrangements adopted by the British empire to align the incentives of the parties involved in military operations on land and sea. Leeson (2007; 2014) explores the constitutional rules regulating compensation in "pirating expeditions".

Our paper takes a similar approach by focusing on the institutional arrangements of organized conflict among Native Americans. More specifically, we focus on the popular practice of the taking of the scalp of the defeated enemy–during or soon after the end of a battle–as it developed in the North American continent before the arrival of the Europeans. We argue that this practice served a crucial role in solving the principal-agent problem that characterizes organized combat at under low levels of technological knowledge and high information costs. The historical, ethnographic, and archeological evidence strongly corroborates this interpretation. As we discuss in the body of the paper, standard historical and anthropological studies of this institution as it was practiced before European colonization have been silent

about the possible function, while emphasizing cultural and spiritual factors instead.[3] This is not the case with respect to the practice as it evolved after the creation of European colonies in the continent, as this was adopted and encouraged by the colonial governments with the explicit intent of encouraging the killing of European and Native enemies (Friederici 1907, 73-87)[4].

Our approach illuminates several important features of the practice of scalp-taking. For example, it explains why the scalp, and not some other body-part became the most widespread object of trophy-taking among Native American societies. It also provides insights into why the practice was more prevalent among some Native American peoples and not so prevalent or entirely absent among others. Finally, it accounts for a variety of other cultural features of these societies that were connected to this institution, including the 'scalp-dance', mating-market practices, and the customary hair-style of Native American warriors.

2 The Indian way of war

2.1 Native American warfare

Lack of technological knowledge and political sophistication notwithstanding, North American natives were brave and skilled warriors: "Few indigenous peoples in the world at the same level of culture have fought so valiantly against European intruders as the Indians east of the Rocky Mountains in the United States" (Driver 2011, 309). Violence was a ubiquitous fact of life in the North American continent before

[3] It is not the purpose of this paper to diminish these alternative explanations. Indeed, we believe that our own hypothesis provides a possible answer to the question of why scalping, and not some other practice, achieved such a central cultural and spiritual position in many Native societies.

[4] There seems to be one exception to this general trend. Clark (1884: 325-6) writes that "[t]he custom of taking scalps grew out of and became necessary because of false claims made to the honor of killing their enemies. It is simply a proof of the killing; evidence beyond cavil or doubt and no superstition exists that by scalping or other mutilation the progress of the spirit towards the happiness of life after death is thereby interfered with." These claims contradict the treatments by all other scholars of this practice. Tellingly, none of this treatments ever refer to Clark's discussion of the practice. We thank one anonymous referee for pointing us to Clark's work.

the arrival of the Europeans. Intergroup warfare became endemic among the peoples of the Plains, the Pueblos, and in the East between the 10th and 14th century. The archeological evidence suggests that during this period, tribes from these regions begun building defensive fortifications (Emerson 2007; Dye and King 2007; Milner 2007).[5]

Smith (1951) identifies the three most common types of conflict: The game of war, the mourning war, and the war party. Games of war were most common among the Plains Indians and can barely be characterized as violent conflict. They consisted of two clans or tribes facing each other in a sporting competition in order to solve inter-group disputes. Mourning wars were motivated by the goal of avenging the death of a family member (Smith 1951). They were usually undertaken by, and often only involved, members of a specific family or clan rather than the whole tribe.[6]

The type of conflict more relevant to our discussion is the war party, the more sophisticated form of Native American warfare, which included larger armies often accompanied by smaller bands of guerrilla fighters (Eid 1985). The peoples of the West Coast, from Alaska to California and the Southwest rarely experienced large-scale warfare before the arrival of the Europeans (Driver 2011, 310-312) while it was much more common among the tribes of the Plains, the Prairie, and the East Coast (Driver 2011, 320).

In some Native societies, any tribesman in good standing who had previously proven his worth in battle could organize a war party, usually after having been "inspired by a revelation in dream or vision,"[7] although only successful leaders could gather sufficient following (M. W. Smith 1951, 355). In other tribes, the war party was more formally organized, and "[military] leaders were chosen according to merit

[5] Scholars of Native American history and warfare attribute this increase in violence to "the appearance of sedentary lifestyles, resource scarcity, higher population densities, shifts in climatic regimes, and the introduction of chiefly sociopolitical forms that encouraged prestige war" (Emerson 2007, 143). See also Haas (1999, 19).
[6] Reyna (1994) develops a "mode of domination" model of intergroup conflict. According to this model, different types of domination-based relationships between groups will lead to alternative forms of organized violence.
[7] Robert Lowie, cited in Van de Logt (2008, 93).

based on courage and experience instead of privilege or purchase" (Starkey 2002, 18). A "war chief" was entrusted with planning the expedition and lead the party in battle (Driver 2011, 299). In both cases, participation seems to have been mostly voluntary (Holm 2004, 164). In the pre-Columbian period, the size of war parties was relatively small, varying from just four or five warriors to a few dozens (Driver 2011, 309, 320).

The purpose of war parties was the appropriation of resources from nearby villages and tribes: "[War parties] on the most part served an economic function. Goods were taken from traditional enemies, carried back to the home community, and distributed among tribal members and relatives" (Holm 2004, 156).[8] The war party would collect livestock, weapons, utensils, and other valuables (such as jewelry, furs, and so forth), as well as seize prisoners. Young children and women were particularly valuable, and, if they survived the attack, were taken to the war party's village and "adopted" by local families (Hodge 1912, 914-915; Driver 2011).

The surprise attack was the preferred fighting method in Native American warfare (M. W. Smith 1951, 356). Their methods have been compared to modern guerrilla warfare (Starkey 2002, 27): "Indian leaders taught their men to move in scattered order and take advantage of the ground, to surround the enemy or to avoid being surrounded" (Starkey 2002, 18). The "war chief" had little to no control over the behavior of his men, who were free to operate independently (Reyna 1994, 41), although sometimes small teams of friends would fight side by side (Hodge 1912, 915). The emphasis was the individual soldier's ability to take advantage of the natural environment to surprise the enemy and defeat him in hand to hand

[8] Rice (2001, 294) writes that "in at least of the raids family groups [from Apache and Yavapai tribes of Arizona] attempted to steal food and other resources from agricultural fields." Many scholars of Native American warfare have also pointed to the importance of cultural and ritual elements as motivating factors behind intergroup warfare. See, for example, Reyna (1994), Dye (2016) and Bamforth (2018). However, according to Rice (2001, 301) "[t]he practical and ideological reasons for going to war frequently coincided."

combat.[9] Pitched battles were relatively uncommon and took place only after the surprise attack had failed and two war parties met each other on a plain (M. W. Smith 1951, 356).

2.2 The taking of scalps

The Native American warrior collected a variety of "war honors" or "trophies," most of which consisted of body parts belonging to a fallen enemy. "Heads, scalps, eyes, ears, teeth, cheekbones, mandibles arms, hands, fingers, legs, feet, and sometimes genitalia" and even "the entire skins of dead enemies" are examples of such "honors" (Chacon and Dye 2014, 6-7; Van de Logt 2008, 72). Often, war trophies were used for religious rites, such as sacrifice to deceased family members and the spirits of the heavens. Bones were also used for the production of utensils, fingers and teeth were worn as jewelry or used to decorate one's *tipi* or house (Mensforth 2007, 224).

Native Americans are far from the only people in human history to indulge in such practices. In the Old Testament, Saul, the first King of Israel, instructs David to go to war against the Philistine and bring back one-hundred of their foreskins as a bride price for Saul's daughter, Michal (Sam. 18, 25-27). The scalp was the preferred human trophy in the North American continent. In his *Historiae*, Herodotus describes scalp-taking as it was practiced by the Scythian members of the Persian army during the Greco-Persian wars of the fifth century BC:

> [The Scythian warrior] takes off the skin of the head by cutting it round about the ears and then taking hold of the scalp and shaking it off; afterward he scrapes off the flesh with the rib of an ox, and works the skin about with his hands; and when he has thus kneaded it, he keeps it as a napkin to wipe the hands upon, and hangs it from the bridle of the horse on

[9] The preferred weapon varied from tribe to tribe, with bow and arrow, clubs, and knives made of stone, reef, and wood being the most popular (Hodge 1912, 927; Driver 2011). Bows and arrows were a relatively ineffective weapon in intra-Native warfare as warriors had eventually developed the skill of dodging bows (Starkey 1999, 244)

> which he himself rides, and takes pride in it; for the man who has the greatest number of skins to wipe the hands upon is judged to be the bravest. (Herodotus IV, 64)

Evidence of scalp-taking has been found for ancient China (Xingcan 2001), South America (Friederici 1907), Central Europe, and Scandinavian countries as late as the sixth century AD (Chacon and Dye 2014), although in none of these regions did the practice place such a central role as among some North American Natives.

The first archeological evidence of this practice in the North American continent goes back to the late Archaic Period in the Mississippi valley, which coincides with the period of the first sedentarization and subsequent increase in population of the indigenous peoples of the American East (Mensforth 2007, 226-228). Before the arrival of the Europeans, scalp-taking was not uniformly widespread across the different peoples and tribes of the North American continent. Ironically, this iconic symbol of the American West was there relatively uncommon compared to the East and the Plains. The practice was also unknown to the Aztec empire (Friederici 1907, 29-33). The ethnographic and archeological evidence suggest that scalp-taking was much more common amongst the Indians of the Plains, such as the Lakota, Pawnee, Sioux, Comanche, and Cheyenne peoples, and those living east of the Mississippi River, such as the Algonquin, Cherokee, and the tribes that would later form the Creek federation (Friederici 1907; Neumann 1940; Mensforth 2007; Van de Logt 2008).

European travelers first encountered scalp-taking during their expeditions in the region north of Florida in the sixteenth century. It's in these years that the first written accounts of the practice also appeared (Axtell and Sturtevant 1980). After having subdued the enemy in combat, the Native American warrior would immediately perform a round incision around the enemy's hair.

> The skin is next loosened with the knife point if there be time to spare and much scalp is to be taken. The operator then sits on the ground, places his feet by way of leverage against

> the subject's shoulders, and holding the scalp-lock with both hands he applies a strain which soon brings off the spoils, with a sound which, I am told, is not unlike "flop." (Burton 1864, 51)

A skillful warrior could complete this operation in matters of one or two minutes (Friederici 1907, 140-141). The cut of the enemy's scalp was made with a dedicated weapon: The scalp-knife. Scalp-knives were made out of wood, stone, and reed, and were "sharper than any steel blade."[10] Most of the time, the removal of the scalp took place *perimortem,* that is, immediately after the enemy had been killed because, if conscious, the process would be "exceedingly painful" and the victim to wriggle "like a scotched snake" (Burton 1864, 51).

The size of the scalp varied from tribe to tribe. The only requirement was that it contained the enemy's scalplock, the characteristic hair braid of the warriors in the East and the Prairies (Friederici 1907, 140-141). After the battle, the warrior carefully treated the scalp according to the method dictated by the customs of his tribe. Van de Logt describes the treatment of scalps in Pawnee society:

> First, the scalper scraped off the blood and fat tissue. Then he made little holes at the edges of the scalp. Then he took a willow twig and bent it around the scalp and tied it through the little holes around the edge of the scalp, thereby stretching the scalp on the ring. Next, the scalp was tied to a willow stick four or five feet long. Using red paint, he colored the flesh part of the scalp. The sacred red color signified that the scalp had now been consecrated. (Van de Logt 2008, 73)

Across all scalp-taking Native American peoples, scalps were cleaned, dried, and smoked to make them durable. Sometimes, a scalp would be painted and decorated with feathers and shells and would then be

[10] Jacques le Moyne de Morgues, as quoted by Axtell and Sturtevant (1980, 458).

worn by the warrior. Other times they were burnt as a sacrifice to the guardian spirits of the tribe or given to mourning families to be used to quite literally dry their tears (Friederici 1907; Van de Logt 2008). Ethnographers and scholars of Native American customs have provided a variety of explanations for the phenomenon of scalp-taking. The first anthropologist to attempt a scientific analysis of the practice, Friederici writes of the "manifold … causes that could lead a warrior to go on a scalp hunt":

> Psychological hunger for fame and honor, lust for revenge and ambition, restoring a reputation as a warrior that was perhaps shaken; vanity, vainglory, and the greed for profit were the main motivating forces for such undertakings. Political reasons could be quite often the cause: scalps were exhibited as the visual indication of power and designed to attract allies. In addition, a belief in mystical powers that were associated with the scalp appeared, and at the same time a warrior wanted to put himself in the possession of scalps for all kinds of religious ideas, which made its presence necessary in many ceremonial activities, like incantations and burials." (Friederici 1907, 138-139)

2.3 Existing theories of scalp-taking

Most theories of scalp-taking do not go much further than Friederici's and fall within one of two categories: Economic and cultural. According to economic explanations, the individual warrior' motivation to scalp was associated with the expectation of deriving material benefits from it, for example, in the form of "social power": "[C]ommon men could climb the social ladder by distinguishing themselves on the field of battle […]. A man who had led successful war parties, expeditions among the people, and who had sacrificed scalps to the sacred powers, could be asked to join the council of chiefs that governed village affairs" (Van de Logt 2008, 88).[11]

[11] See also Mensforth (2007, 224).

Friederici (1907, 35) also formulated the materialist hypothesis that sees the taking of scalps as emerging out of the previously popular practice of head-hunting. After the battle, warriors would remove the heads of the defeated enemies and take them back to the village. When the carrying of whole heads proved particularly inconvenient for those war parties fighting far away from their village, these substituted them for scalps instead. An alternative, cultural, hypothesis, known as the animal hunting model, argues that "[m]any warfare-related behaviors practiced by foragers are derived directly and logically from hunting behavior itself" (Mensforth 2007, 223). According to this interpretation, most Native American people did not distinguish as strongly between the animal world and human beings belonging to other tribes. According to this theory, then, a warrior taking the scalp of a dead enemy and a hunter severing the fur from a dead animal are one and the same (Starkey 1999).[12]

Another cultural interpretation argues that the true nature of scalp-taking was fundamentally spiritual. Native Americans believed that the scalplock contained in the scalp represented a warrior's soul's connection with the spirits of the heavens. Taking an enemy's scalp, gave access to one's soul, his mental and physical faculties (Bandelier, 1890: 153). The removal of the scalp also comported the spiritual mutilation of the enemy. Some tribes believed the soul of a warrior to be extinguished as a consequence of having been scalped and therefore prevented it from reaching the heavens (Mensforth 2007, 223) while others believed that the scalper controlled the soul of the scalped, which he could torture or keep as slave in the afterlife (Van de Logt 2008, 76). Finally, scalps would sometimes be offered in sacrifice to spirits and ancestors. For example, among the Pawnees, the sacrifice of an enemy's scalp served to revitalize the tribe and to affirm the relationship between the Pawnees and the sacred powers of the universe.

We offer an alternative interpretation of scalp-taking among some Native American tribes. Our interpretation is rooted in the economic approach to human behavior and tries to explain the practice as

[12] The 'head-hunting' an '

resulting from the purposeful behavior of individuals under externally given constraints. We do not suggest previous explanations be entirely discarded in favor of ours. Indeed, economists have long recognized the fundamental function of cultural beliefs and customs for the governance structure of premodern societies.[13] Rather, we provide the microfoundations for an understanding of the role that cultural and economic elements played in the emergence and persistence of this apparently irrational practice.

Admittedly the empirical testing of the suggested interpretation is intrinsically tricky. First, because the North American people of the time did not leave written records, we have no access to indigenous descriptions of the scalp-taking in the pre-Columbian period. Second, the practice rapidly evolved in the years following the arrival of the Europeans. Thus, most modern accounts of this practice refer to a radically different phenomenon than the one we attempt to explain. Finally, the archeological evidence must also be carefully treated and interpreted. Scalp-taking needs not leave any sign on the victim's skull, while other practices (such as therapeutic and surgical intervention on a head wound) could leave signs indistinguishable from those due to scalping (Mensforth 2007).

For the reasons above, we must be cautious in claiming correctness for our theory with a high degree of certainty. The nature of the evidence is such that any experimental or quasi-experimental methods to adjudicate among alternative explanations is beyond our reach. Nevertheless, the available ethnographic evidence is broadly consistent with, and corroborates, the monitoring interpretation of the practice of scalping in some Native American tribes.

[13] For a discussion of the function of superstitious beliefs, see, among others, Posner and Rasmussen (1999), Greif (1994), Leeson (2012, 2013), Leeson and Suarez (2015) and Nunn and Sanchez de la Sierra (2017).

3 A model of human trophies

Brennan and Tullock (1982) were the first economists to characterize the organization of violence as a collective-action problem (Olson 1965). The basic intuition is that violent gangs, revolutionary mobs, and professional armies face the same kind of obstacles as the organization of production in teams (Alchian and Demsetz 1972). Throughout history, human groups have adopted a wide variety of ingenuous institutional solutions to these obstacles, such as the war spoils system, military commissions, and even the physical disposition of the army in the battlefield (Brennan and Tullock 1982; Allen 1998). Modern technology vastly reduces the cost of monitoring the behavior of individual soldiers and in combination with the appropriate compensation mechanism can bridge the gap between individual and collective incentives.

Small-scale societies cannot rely on such tools for the solution of the incentive alignment problems of organized violence. Consider the conflict between two groups competing over the control of some resource. Both are characterized by the typical features of small-scale societies, such as high information costs, little technological knowledge, and a low degree of specialization (usually, gender-based) (Posner 1980). Assume that each tribe has solved the problem of motivating its members to go to battle in the first place, say, through a system of negative incentives. Once in the battlefield, each warrior knows that he would be better off if his group was to emerge victorious from the battle. At the same time, his incentive is to minimize the expected losses from fighting, such as injuries and possibly death. He could, for example, hide behind a tree or a rock, until the battle has ended, free-riding on his fellow tribesmen's effort. Clearly, if everyone were to behave this way, the likelihood of success for his group will be very low.

Every member would be better off if they could devise an enforceable contract to align the incentives of individual warriors with those of the tribe. Such a contract would have to solve both a free-rider problem and a principal-agent problem. Consider the following alternatives available to the group:

A) input-based compensation; B) war spoil system; C) output-based compensation. When there are costs associated with the enforcement of these schemes, none of them would foster individual warriors to supply the unconstrained socially-optimal level of effort. Each of them will be associated with a net value function of the form

$$(1)\ V = g(E) - \Gamma(E) - m - d - cE$$

Equation (1) represents the total value *V* associated by the members of society to the prize they expect to obtain from the group's involvement in armed conflict.[14] Where *g(E)* represents the group's contest success function, $\Gamma(E)$ the disutility of effort, and $E = \Sigma e_i$ the sum of warriors' individual effort. *m* and *d* are the costs associated with the monitoring of warriors' behavior and of dividing up the spoils of war respectively.[15] Finally, *c* is the per-unit cost of producing a human trophy, where the production function of the latter is assumed to be linear in effort to simplify the discussion. The groups will strive to maximize the value of *V* as a function of effort, monitoring costs, division costs, and the costs of producing the trophy. Thus, they would select the institutional solution that solves this value maximization problem.

Under an input-based compensation contract, *d* and *c* are both zero. The individual warrior is paid based on the amount of input (in this case, effort) he supplies. The very logic of this scheme is that it does not require a division of the prize among the warriors, nor does it require the latter to produce a signal of their effort. It does, however, require some monitoring. Without monitoring, if participation itself allows one to receive compensation, very little effort will be supplied. This task could be entrusted to the whole tribe, to a commander, or to the warriors themselves. The first option is generally an implausible solution,

[14] In this, we follow the modeling strategy employed in Lueck (1994) and Allen and Lueck (2004). The underlying assumption is that wealth-maximizing agents will end up adopting the (informal, in this particular case) contractual solution that yields the highest net value to the participants to the interaction, net of the transaction costs, which we define (following Barzel (1994: 395), as "'the costs of capturing and protecting property rights").

[15] Our argument is independent of whether the monitoring is performed by one individual (a chief), by a subset of the group (a council of elders), or by the group as a whole. All that matters is that the agent(s) in charge of the dispensation of the reward has the ability to observe (directly or indirectly) the performance of the warrior.

especially if the fighting takes place away from the village itself. The relative benefit of the latter two options will depend on such factors as battling style and the size of the army. Larger armies will tend to employ a specialized subset of individuals (the officers), as the cost of mutual monitoring by the warriors themselves increases with the size of the army. The spoil system has an advantage over the wage-rate contract in that it requires no monitoring. Warriors self-monitor because they get to keep the items they acquire during and after the battle, thus capturing directly the benefits of their behavior. In other words, it constitutes a transfer of residual rights over the outcome of the battle to the warriors. This is a relatively cheap method of providing incentives in a world in which most resources are in the private domain and the warrior's ownership over the spoils is easily enforced. Finally, in the performance-based or output-based compensation case, the warriors' reward is a function of the output they produce. A car salesman's compensation is tied to the number of cars sold as well as the prices she is able to get from buyers; a factory worker might be paid a fixed amount per widget produced, and so forth. In the case of war, the measurement of a warrior's performance is trickier. For example, a warrior might be asked to report the number of enemies killed. But this would open the door to overreporting and shirking. Alternatively, the warriors could be asked to produce an easily identifiable proof of effort, such as a human trophy and tie this to their compensation. Because costly to produce, only those who actually supply effort in the battle are going to receive a reward.

The comparative statics for this model are straightforward. The input-based contract becomes less likely in equilibrium as the costs of monitoring warriors (either by a commander or by the fighting men themselves) increases. Pre-Colombian warfare is characterized by the lack of central coordination and of a command hierarchy (Turney-High 1991, 26) and relies on ambushes and surprise attacks, not the organized marching of well-ordered armies. The lack of internal specialization was probably due to both the size and the nature of these armies. Small war parties do not have the luxury of scarifying the fighting

skills of a man to such a task. Such a figure would also be an easy target. Under these circumstances, requiring soldiers to pay close attention to the behavior of others on the battlefield can be quite costly, as even the smallest distraction during hand-to-hand combat can be fatal. The spoil system is a superior alternative whenever the costs of dividing up and enforcing individual ownership over the prize are relatively low. For such items as weapons, jewelry, and slaves, for example, this cost will be relatively low. But when the prize of the battle consists of a common pool resource or some other asset from which members of the tribe cannot be excluded, *d* can become prohibitive. One solution would be to simply allow equal access to the asset to all warriors. Unfortunately for the tribe, this would produce the same result of discouraging individuals from supplying much effort. An alternative would be to require that warriors produce some output other than the outcome of the battle, although one that is highly correlated with it. A human trophy can serve this purpose. As long as the combined cost of producing and establishing the authenticity of the trophy is relatively low, this strategy can serve as a complement and, in some cases, even a substitute to other compensation schemes.

4 Explaining scalp-taking

4.1 Historical evidence

The monitoring theory of scalp-taking produces several testable implications and can, therefore, be used to make sense of some interesting properties of this practice. First among these is the puzzling fact, from a rational choice perspective, that the taking of scalps is a directly unproductive behavior. Warriors would only remove an enemy's scalp after this had been killed or otherwise subdued (Miller 1994, 212). It's direct marginal effect on the outcome of the battle is therefore insignificant if not negative as the taking of scalps is potentially dangerous (and, therefore, costly) to the individual warriors who, in performing this action, expose themselves to the enemy. The monitoring theory purports that the function scalp-taking was to foster the supply of effort on the battlefield. If this interpretation is correct, the following must also

be true. First, the production of scalps must be correlated with a warrior's level of effort supplied. Second, a warrior's compensation must have been tied to the performance in battle as proxied by the taking of scalps. Third, scalps must have been hard to counterfeit. Finally, Native American tribes must not have had any obvious lower cost alternative available to them.

While arguably imperfect, the number of scalps collected in battle is strongly correlated with one's effort. Warriors could not collect scalps while hiding behind a bush, a tree, or a rock at the edge of the battlefield. They must face the enemy, fight him, and hopefully kill or subdue him, and only then, pull out their scalp-knives and sever the top of the enemy's scalp. Hence, it was unlikely, although not impossible, for someone to obtain the scalp from someone else's victim, mostly because warriors had incentives to enforce their claims over the scalps of their victims. But this will not prevent coward from taking an unearned scalp, for example, when a fellow tribesman dies after having killed an enemy in battle. The former might be tempted to hide in hope of such an occasion and then jump in and to collect the enemy's scalp and receive the promised remuneration. Given that Native American warfare was generally characterized by a low number of casualties, this seems a poor strategy. Furthermore, even in this scenario, the lure of the scalp still worked its magic by forcing the coward to enter the battlefield thus getting exposed to potential attacks. If attacked, it is in the best interest of the coward to fight back, which necessarily increases the warrior's level of effort.

The Native American tribes that employed this practice recognized the correlation between it and one's contribution on the battlefield. They explicitly identified individual ability and success in battle with the number of scalps collected during the conflict (Maschner and Reedy-Maschner 2007, 33) and tied compensation to this measure. The taking of scalps was "an important element in male status advancement" (Axtell and Sturtevant 1980, 461). In the words of a scholar of Native American culture, compensation followed a simple principle: "[t]he more scalps the more honour. The young man who

cannot boast of a single murder, or show the coveted trophy, is held in such scant esteem as the English gentleman who contents himself with being passing rich on £100 a year" (Burton 1864, 51). Great warriors, measured in terms of scalps taken, were entrusted with political power and social status (Snow 2007, 150). They were called to mediate and decide of disputes between litigants (Driver 2011, 322) and, within some tribes, successful scalp-takers would be selected for the highest ranks:

> [C]ommon men could climb the social ladder by distinguishing themselves on the field of battle, both in defense of their people and in expeditions in search of horses or scalps. A man who had led successful war parties, expeditions among the people, and who had sacrificed scalps to the sacred powers, could be asked to join the council of chiefs that governed village affairs" (Van de Logt 2008, 88)[16]

Scalp-takers were also given preferential access in the mating market. Much like in other societies, success on the battlefield was seen as "visible proof of manly strength" (Friederici 1907, 153). For example, amongst the Native Americans of the East, Plains, and Prairies "[n]o young men ever thought of getting married or of being accepted as an adult until he had slain an enemy and brought back a scalp to prove it" (Driver 2011, 320). Among the Pawnees, scalps were interpreted as a signal of physical and moral strength as well as fertility. This signal was so strong that, according to one story, the father of a young Pawnee girl, named Yellow-Corn, offered the following response to a young Pawnee man who had asked for his daughter's hand: "You have not walked over this earth to the enemy's camp, you have no scalps over your tipi [...]. My son, you can not have Yellow-Corn, for you have made no sacrifice to the heavens; the heavens have not received your smoke" (quoted in Van de Logt 2008, 89).

[16] See also Driver (2011, 299): "All young men went to war to obtain scalps and other war honors which were necessary before they could be accepted as full citizens in the society. Only after success in war was a man likely to be selected for membership on the council and from there to civil chieftainship." According to Arikara customs, "the man who takes the most scalps and captures the most enemies shall become a chief" (Van de Logt 2008, 88).

A proxy that is easy to counterfeit is unlikely to serve its purpose for any significant amount of time. This was the advantage scalps had an over a wide array of alternative human trophies popular among Native Americans. Human teeth, fingers, and other hand bones seem to have been particularly widespread but never reached the cultural and social relevance scalps did (Owsley et al. 2007; Friederici 1907). Unlike the scalp, these are all easy to counterfeit. It's hard, and therefore quite costly, to establish whether a tooth or a finger belongs to a fellow tribesman or an enemy. The origins of a scalp were more easily identified. This was due to the fact that, according to Native American customs, to be valid a scalp would have to contain the victim's scalplock (Friderici 1907, 141). Warriors made and decorate their hair before every battle according to the customs of their tribe. Each tribe had a peculiar and easy-to-identify hairstyle. Indeed "[m]any tribes owed their names solely to their headdress" (Friederici 1907, 165-166). For example, Pawnee warriors used to shave their heads around a scalplock shaped in the fashion of a horn, or "pawnee" (Van de Logt 2008, 83).

This practice made it quite easy for the tribe to establish the origins of a scalp. At the same time, this could have resulted in tribes attempting to make strategic use of this custom. Warriors could shave their heads or attempt to replicate the hairstyle of a hostile tribe so as to make their own scalps "void" and discourage the enemy. As some warriors might have soon realized, this was not a winning strategy. First, given that warriors tended to fight naked and covered in oil (Friederici 1907), a scalplock dressed in a tribe's specific style was the only way to distinguish one's friends from one's foes on the battlefield. Without it, the likelihood of one becoming the victim of friendly fire increases exponentially. Adopting the enemy's tribe hairstyle would have had its downsides as well. Not only would the warriors be hard to distinguish from the enemy, but there might be the temptation to go attack one's fellow tribesman's scalp.

Unlike teeth and fingers, scalps could not be multiplied at will (Burton 1968, 51). One could not simply cut two scalps out of one, because either one or neither of them would end up containing a full

scalplock. On the other hand, the number of teeth per person varies much more radically than that of scalplocks. Alternatives such as bones or pieces of skin from other areas of the enemy's body face similar problems. Given the level of Native American technology, and the fact that they did not possess metallic blades, the removal of a bone from a dead or unconscious enemy would have been so demanding and time-consuming to make its production contrary to the interest of the individual warrior even the proxy-based compensation scheme. Both alternatives are also much more easily counterfeited.[17]

If the taking of scalps served the function we suggest, we should be able to rule out the possibility of lower-cost solutions available to the groups that employed it. Here, the lack of evidence makes it hard to establish whether this was true or not. For example, it is unclear whether warriors took the scalps during the battle or after it. In the former case, the correlation between scalps taken and contribution to the war effort would have been high and uncontroversial, but the individual cost to the warrior of producing the scalp would have been quite high. Even a highly skilled fighter would take at least one minute to complete the task (Friederici 1907, 141). In the case in which scalps were taken at the conclusion of the battle, this could result in conflicting claims over the scalps of dead enemies. This conflict could only be resolved if warriors could observe each other's performance, at least to some extent. But if this is true, it is unclear why the taking of scalps would be needed at all. The free rider problem would be solved by the mutual monitoring of the warriors while the principal-agent problem could be overcome by having them simply report on each other's performance.

The evidence we do have about the warring style of those tribes that did perform scalping offers some insight into these issues. According to a sixteenth-century European traveler in the American east, intertribal warfare was characterized "by sudden surprising of one another, most commonly about the dawning of the day or [by] moonlight, or else by ambushes, or some subtle devices" (quoted in Heath

[17] For example, the cost of establishing whether a bone belonged to a human being or to some other species is relatively hard without access to modern technology.

1999, 113) and the war parties avoided pitched battles on open fields (Heath 1999, 113-4). Under these circumstances, mutual monitoring by itself would not do it. At the same time, because of their very nature, battles were a quick affair. A war party would usually retreat as soon as one of them had been killed (Holm 2004, 158). Hence, there was little room for confusion and conflicting claims over the remains of the victim, since the warrior responsible for the killing had a strong incentive to prevent others from claiming the scalp.

The taking of the scalp also allowed the tribe to easily observe whether the warriors had been victorious or not. Absent this practice, warriors could claim to have performed heroic acts and, therefore, deserving of compensation. Bringing a scalp home meant that not only they did, in fact, fight enemy warriors, but that they had also defeated them. Once back, a number of customs made sure that the acts of the war party be made public knowledge. The single most important of these customs was the scalp-dance, "one of the greater events in the lives of these primitive peoples" (Friederici 1907, 149). Scalp-dances had two main parts. During the first part, the women of the village performed dances and chants for the returning warriors (Axtell and Sturtevant, 1980, 459). During the second part, the warriors themselves would reenact their deeds in battle and display the scalps in front of the rest of the tribe (Friederici 1907, 150) and then hang these on a "scalp-pole" for everyone to see (Bandelier 1890, 242). The scalp-dance also allowed for a warrior to challenge another's recollection of the battle. The penalty for one who was found guilty of false appropriation of another's scalp was death (Hodge 1912, 301). Among some tribes, scalps were also worn by the warrior the way of contemporary war medals (Friederici 1907, 137, 147-148). Finally, warriors would often tattoo on themselves their military achievements and the number of scalps taken throughout the years (Driver 2011, 324).

One last piece of evidence comes from the prevalence of the practice across the North American continent before the arrival of the European. Two sources, ethnographic and archeological, are available.

Unfortunately, as the data in table 1 shows, the two are not always in agreement. The ethnographic evidence is from Driver (2011). In this review of the ethnographic literature, the author divides the North American continent into twelve major cultural areas. He finds evidence of the practice in five of them: East, Northeast Mexico, Northwest, Plains, and Prairies. In the Northwest, the ethnographic evidence suggests that only one group, the Tlingit people, practiced it. The archeological evidence is from a meta-study by Ross-Stallings (2007). The author identifies 35 sites containing 568 cases of scalping. These are distributed across five cultural areas: East, Plains, Prairies, and Southwest. About eighty percent of all the archeological cases in this study belong to the same site in Crow Creek, South Dakota. No other site contains upward of fifteen individual cases. Treating it as an outlier, we still have 131 cases. The study finds no cases of scalping in Northeast Mexico and the Northwest.

Region	Frequency of warfare	Scalping	Archeological sites	Cases
Arctic	Low	No	0	0
Baja California	Low	No	0	0
California	Medium	No	0	0
East	High	Yes	14	50
Great Basin	Low	No	0	0
Northeast Mexico	Low	Yes	0	0
Northwest	Medium	Yes*	0	0
Plains	High	Yes	15	472**
Plateau	Medium	No	0	0
Prairies	High	Yes	4	18
Southwest	Medium	No	12	28
Sub-Arctic	Medium	No	0	0

Table 1: Prevalence of scalping by cultural areas

Sources: Frequency of warfare and scalping (Driver 2011). Archeological sites and cases (Ross-Stallings 2007). *Only among the Tlingit people (Driver 2011). **This includes one site containing 437 individual cases of victims of scalping.

The distribution of these cases is interestingly correlated with the frequency of warfare within a region. Excluding the Crow Creek outlier, seventy-eight percent of all archeological cases of scalping (103 out 131) belong to cultural areas characterized by high frequency of intertribal warfare. According to both types of evidence, scalping was absent in all regions characterized by low frequency and low levels of social complexity. In the Arctic region, Baja California, the Great Basin, and the Sub-Arctic, warfare was prevalently a matter of individual or clan-based revenge (Driver 2011, 311). With the exception of Northeast Mexico and the Southwest, scalp-taking was also rare in California, the Northwest, and the Plateau. While in general the people of these regions were characterized by "a more definite warlike behavior […] on the whole, these Indians were among the most mild-tempered and peace-loving on the entire North American continent" (Driver 2011, 317). Paradoxically, it is in these regions that we observe the only cases of hierarchically organized armies north of the Aztec Empire.

This pattern is consistent with the monitoring theory of scalping. On the one hand, personal or domestic vendettas, the most recurrent style of warfare in most of the regions lacking the practice, require less oversight than intertribal warfare and, therefore, are less likely to suffer from free rider and principal-agent problems. Similarly, well-ordered marching armies fighting pitched battles have less of a need for scalping, since they can rely on the officers for the monitoring of their fighting men.[18] On the other hand, in those cultural areas where scalping was practiced, war parties were smaller (between five and fifty men, on average), lacked central command, and "[placed a premium] on individual fighting with full use of the natural protection afforded by trees and rocks" (Driver 2011, 320). It is exactly under these circumstances that we should expect a scheme based on the production of some human trophy to emerge.

[18] After the increase in the prevalence of warfare in the Southeastern region and the development of the first chiefdoms between the 11th and 13th centuries, we observe the rise of larger, better-organized armies amongst these groups

4.2 Evolution

The evolution of scalp-taking in the North American continent after the arrival of the Europeans is itself somewhat indicative of the success of the practice in solving incentive-compatibility problems. Less than one-hundred years later, Carolina became the first colonial government to institute a scalp-bounty. Within a few decades, Carolina was followed by New Holland, Connecticut, South Carolina, Canada, and Louisiana (Friederici 1907, 73-87). Even Pennsylvanian, "[notwithstanding] the peace-loving principles of its founder, because on July 7, 1764, Governor Penn offered the following bounties: For each captive male Indian older than 10 years of age 150 dollars, For each scalp of a slain Indian 134 dollars, For each captive enemy squaw or boy under 10, 130 dollars, For each scalp of a slain squaw 50 dollars" (Friederici 1907, 77-8).

The practice became commonplace beyond those tribes and cultures that employed it in the pre-Colombian era. The European presence affected both the demand and supply sides of scalp-taking. On the one hand, the promise of monetary compensation for a French (English) scalp by an English (French) colonial governments provided new incentives for Native American warriors to get their hands on those gruesome items (Axtell and Sturtevant 1980). On the other, European supplied Native Americans with modern weaponry and other technology which vastly reduced the marginal cost of a scalp (Starkey 2002, 11). The original wooden or stone-made scalp-knife was substituted by iron-made blades more akin to a butcher knife (Friederici 1907, 71). Soon enough, white settlers started taking scalps as well (Friederici 1907, 88).

Testament to its effectiveness, scalp-bounties were employed by each side in every major North American conflict (French-Indian war, the war of Independence, and the Anglo-American) up until (and including) the Civil War. Throughout the nineteenth century, Native American scouts serving in the US Army were allowed to take scalps (Van de Logt 2008, 101).

The most recent evidence of the practice is from the turn of the twentieth century (Friederici 1907; Axtell and Sturtevant 1980; Van de Logt 2008).[19] By then, North American countries were politically stable and professional armies leading to the abandoning of scalp-bounties. Meanwhile, Native American society and politics had been radically transformed. At the arrival of the European travelers, the Native American population was scattered throughout the North American continent. Other than Mexico, the areas with the largest population density were the East and West Coasts, the Southeast, and Wisconsin (Driver 2011). Today's situation is almost entirely reversed. Except for the East Coast, the areas with the highest level of Native American population density are Midwest and Southwest (Norris et al. 2012). Native American tribes from the East have either been decimated or forced to move west and settle into "Indian Territory" and reservations (Van de Logt 2008, 102). This comported the end of the endemic intertribal conflict and the rise of the modern Native American "leagues" or "federations" that provide some form of overarching governance to their members. With these changes, the taking of scalps stopped playing its millenarian function and was finally abandoned.

5 Conclusion

In this paper, we offer a theory of scalp-taking. We argue that this practice served a fundamental social role: it generated incentives for warriors to supply effort on the battlefield under circumstances in which we should expect free riding and agency problems. We show that this monitoring theory of scalp-taking is broadly consistent with the data. It explains, for example, why scalps, and one of the myriad possible alternatives, emerged as the characteristic human trophy of the North American continent. It also explains why it was more popular among some Native American tribes than others. The reader should be cautious when evaluating the validity of our argument due to the impossibility to use the (limited in size and

[19] Legend has it that Native Americans fighting with the US army during World War II used to take the scalps of German soldiers (Van de Logt 2008).

reliability) evidence to design a quasi-experimental mechanism to evaluate our hypothesis *vis-à-vis* the potential alternatives. This is even more of a concern when evaluating a phenomenon, like conflict, that is influenced by a wide array of variables not usually considered in economics, such as culture, pride, honor, and ritual. However, we believe that economics is uniquely placed to identify the effect of materialist factors even in contexts where these may not place a very large role, including the case of scalp-taking.

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