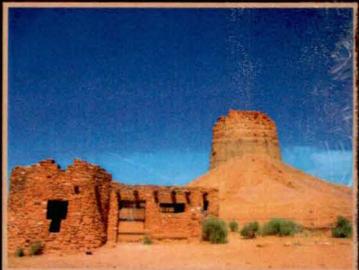


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Furthering Perspectives

Anthropological Views of the World



Anthropology Graduate
Student Society
2011—2012 Volume 5

*Furthering Perspectives:
Anthropological Views of the World*
Volume 5: 2011-2012

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' Note:

After taking a year hiatus in the production of *Furthering Perspectives*, the Anthropology Graduate Student Society (AGSS) is delighted to present the fifth volume of this fully student ran publication. The material covers a wide array of topics from the lives of football players to the morphological evidence in understanding human evolution, reflecting the breadth of knowledge available through the field of Anthropology. AGSS thanks the many people who made this journal possible. First, thank you to all the students who facilitated the production of this journal, from fundraising to serving on the journal committee, your hard work allowed this publication to materialize. Just as last year's journal saw continued collaboration between graduate and undergraduate students, this year's teamwork was no exception. We thank all students who submitted papers to the journal, and we hope you have benefited from the review process and become more confident in your research and writing.

We would like to express our sincere appreciation to the members of the editorial board, whose time and insights raised the caliber of the papers in this journal. Thank you to: Dr. Rebecca Forgash, Dr. Barbara Hawthorne, Dr. Suzanne Kent, Dr. Craig Lee, Ms. Kimberly Nichols, Dr. Julie Reyes, Dr. Jack Schultz, Dr. Richard Stoffle, Dr. Teresa Tellecha-Sanchez, and Dr. Peter VanArsdale.

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Finally, we thank you for purchasing a copy of this journal. With your support, we come closer to a sixth volume of *Furthering Perspectives*, continuing what we hope will be a long series of publications.

The AGSS Journal Committee welcomes and encourages feedback from those who come across this journal. Please feel free to contact us.

Editors-in-Chief
anthrograd.group@gmail.com

I. Biological Anthropology

The Neandertal Extinction: A climate affair or those pesky moderns?

Tyler Beeton

Abstract- *The present review provides a test of two competing models regarding the cause of the Neandertal extinction event in Europe during the Late Pleistocene. One model asserts that modern humans essentially outcompeted Neandertals leading to their eventual extinction, while others consider climatic instability the culprit. These competing models are tested using fine-scaled climatic data of the Weichselian Glaciation coupled with a biogeographical theoretical framework. While the archaeological and biogeographical evidence for competitive exclusion is lacking, results indicate that fluctuating climatic events greatly suppressed population viability of hominin and mammalian groups alike. This suggests that climatic variability is the most parsimonious explanation for the disappearance of the Neandertals.*

Introduction

Anatomically Modern Humans (AMH) emerged on the African landscape 160 thousand years ago (White et al. 2003) and following a series of dispersal events, spread throughout Eurasia where they undoubtedly coexisted with Neandertals (vanAndel & Davies 2004). The initial timing and distribution of modern humans outside of Africa is relatively well understood (Forster 2004; Lahr and Foley 2004). However, the distribution of modern humans and the degree to which they interacted with Neandertals during the

late Pleistocene in Europe is unresolved (vanAndel & Davies 2004; Finlayson 2005).

While no consensus exists regarding the duration of contemporaneity among the two hominin groups, most scholars agree that Neandertals, the children of Europe, disappeared from the archaeological record during marine oxygen isotope stage 3 (OIS 3; 59-27 kya; Table 1) leaving modern humans as the sole surviving hominin lineage (vanAndel & Davies 2004; Gamble et al. 2004; but see Balter 2011). This has spurred an enormous debate in the Paleoanthropology community. Finlayson and colleagues (e.g. Finlayson & Carrion 2007) purport that the Neandertal extinction was the result of climatically-driven ecological changes, while d'Errico and colleagues (e.g. Banks et al. 2008) argue that modern humans effectively drove Neandertals to extinction by way of competitive exclusion. Incidentally, in some circles, modern humans are thought to be responsible for both the megafaunal extinction at the end of the Pleistocene (Martin 1967) and the Neandertal extinction prior to the onset of the Last Glacial Maximum.

The purpose of the present review is to evaluate published research on this issue and current perspectives concerning the degree to which climate change in Pleistocene Europe affected hominin distribution and population viability. Using finely resolved analyses of climate change during the Weichselian Glaciation coupled with a biogeographical theoretical framework, the dynamic nature of climate change during glacial oscillations and its effect on biota is examined. The competing models (climate vs. AMH competitive exclusion) are tested to determine whether changes in hominin distribution and population structure in response to climate change can solely explain the extinction of the Neandertals and provide a basis for understanding later Pleistocene human evolution.

The working hypotheses derived from this line of inquiry are described here as a null and three competing hypotheses. The null hypothesis states that neither climate, nor competitive exclusion directly led to the extinction of Neandertals. If overturned, then three competing models can be tested: 1) climate fluctuation during the Weichselian Glaciation led to the Neandertal extinction, 2) AMH successfully outcompeted Neandertals for resources eventually leading to the extinction of the Neandertals, or 3) the coupled action of both climate instability during OIS 3 and competition with AMH led to the extinction of Neandertals. I will commence with a brief review of climate change in Europe during the Weichselian Glaciation. Next, I will provide a theoretical outline of biogeography and its implications during climate change. Lastly, this paper will address the debate in light of the evidence set forth to better understand the role of climate change in the extinction of the Neandertals.

Glacial environments during the Weichselian-Wurm Glaciation

SPECMAP	Climate Phase	Age (ka bp)
OIS 5a	Early Glacial Warm Ph.	>74
OIS 4	Transitional Phase	74-66
OIS 4	First Glacial Maximum	66-59
OIS 3	Stable Warm Phase	59-44
OIS 3	Transitional Phase	44-37
OIS 3	Early Cold Phase	37-27
OIS 2	Last Glacial Maximum	27-16

Table 1: Second order climate phases of the Weichselian Glaciation between OIS 5a and OIS 1 based on GISP2 (Van Andel et al. 2004).

The Pleistocene (2.5 ma – 12ka) witnessed a general cooling period and the Ice Age associated with this time-frame disturbed biota and altered the landscape on a global

scale (Cox & Moore 1993; vanAndel & Davies 2004). Specifically, the Weichselian-Wurm Glaciation event persisted from OIS-5 (74 ka) to the end of the Last Glacial Maximum (LGM; 27-16ka) and has had the most lasting effect on current distributions of species. Its impact on diversity and speciation in Europe and North America has been a main focus for climate change research (vanAndel 2004: 10). As such, paleoclimate reconstructions of this temporal period are much more finely resolved than others. Coincidentally, this time-slice in the Quaternary climate happens to co-occur with a major event in human evolutionary history; the Neandertal extinction (vanAndel et al. 2004: 49). Therefore, a brief overview of the Weichselian-Wurm Glaciation is pertinent to understanding the effects of glacial oscillations on population structure and diversity among mammalian and hominin groups alike.

VanAndel and Davies (2004) have compiled robust climatic models of the most recent glacial cycles. These models, coupled with Greenland Ice-Core data (GRIP; GISP2) and substantial palynological records across Europe (eg. Italy, Iberia, France, North, Central and Southern Europe), provide precise, nearly annual-scale climate resolution encompassing the Last Glaciation (vanAndel 2004: 13).

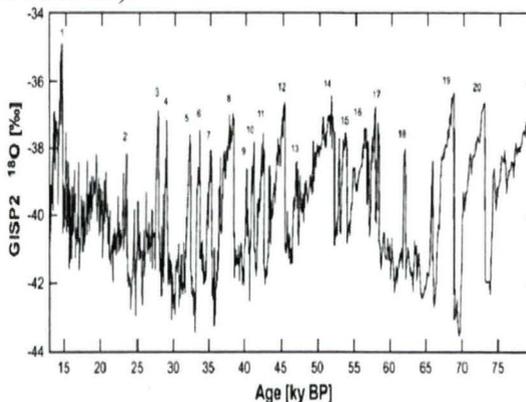


Figure 1: Stage 3 Climate with high frequency D/O climate oscillations (vanAndel & Davies 2004).

In accordance with previous research by Stephen Porter (1989), vanAndel (2004: 9) determined that the Weichselian-Wurm climate consisted of incredibly abrupt changes, inconsistent with the conventional view (Martinson et al. 1987) of long, cold glaciations interrupted by short, warmer interglacials (Fig. 1). These third order climatic events, called Dansgaard/Oeschger (D/O) oscillations, occurred between the glacial maxima and created unstable conditions throughout Europe (vanAndel 2004: 10; Figure 1).

Heinrich events have also been the focus of recent climate research. Heinrich events are caused by the surge of icebergs into the North Atlantic that lead to a disturbance in the thermohaline circulation. It is understood that the events occurred in similar fashion as D/O events (vanAndel 2004), while Carto et al. (2009) attribute oscillating Heinrich events to the initial dispersal of hominins outside of Africa.

The penultimate Eemian interglacial (OIS-5e) ended at 115 ka as indicated by a slow cooling effect. Although the sea levels dropped significantly, there is no evidence of the expansion of the Fennoscandian ice sheet until OIS 4 (vanAndel 2004; Table 1). The climate during OIS 3 was punctuated by a series of Heinrich events and D/O oscillations intermixed with several interstadials including the Henelgo, Moershoofd and Denekamp (vanAndel 2004). At this time the European landscape was subject to abrupt, large-scale shifts in vegetation patterns, characterized by a series of temperate expansion during interstadials and severe contraction in response to glacial expanse (2004). Although milder in severity when compared to the Last Glacial Maximum, the dynamic nature of OIS 3 created a constant state of instability. The Last Glacial Maximum (LGM; OIS 2) exhibited the lowest temperatures of the Weichselian Glaciation (2004: 12). Although the cold phase began around 35kya, climate patterns had very little effect on areas

south of the Balkans until the full extent of the LGM (vanAndel 2004).

Biogeography

Biogeography is the study of terrestrial and marine organisms in a spatial and temporal context (Simpson 1953; Cox & Moore 1993). It is concerned with explaining patterns of distribution now, and how those distributions have been affected by past events. As a result, two complementary but distinct factions of the discipline have emerged; ecological biogeography, which is primarily concerned with the past 200 years up to the present and historical biogeography, or paleobiogeography, which is interested in understanding the mechanisms responsible for divergence, speciation and extinction events over the course of the Earth's history. Biogeography is deeply rooted in evolutionary theory thus in order to understand hominin distribution during the Upper Pleistocene, it is critical to describe the major tenants of a biogeographical theoretical framework.

The principles of biogeography have been used by Charles Darwin, Alfred Russell Wallace, and other evolutionary scientist interested in understanding the recursive interaction of organisms and their environment. However, the discipline did not come to fruition until the 1960's when MacArthur and Wilson published their seminal work on "Island Biogeography" (1967). MacArthur and Wilson posited that the number of species in space depended on area, topography, habitat diversity, accessibility, source richness, and an equilibrium between colonization and extinction (1967).

The vast biodiversity evident on this planet is manageable from a global perspective because of species' propensity for particular niches and habitats. The pattern and process of species distribution is dependent upon the biotic and abiotic factors that define an ecological niche and allow

the population to persist in a specific habitat (Hutchinson 1957). The niche of a species relates to the adaptive suite of a particular organism to extract resources from its surrounding habitat. Gradients form an integrated system of factors that must overlap in a niche space to sufficiently limit the distribution of a species and define its range (Cox & Moore 1993; Guissan & Zimmerman 2000). Although many ranges overlap, no two ranges are identical owing in part to resource, direct and indirect gradients. Resource gradients include the matter and energy which is consumed by plants or animals. Direct gradients are the physiological characteristics important to a species survival, such as temperature or precipitation, but are not consumed. Lastly, indirect gradients, such as topography and latitude, have no direct physiological relevance to performance but are correlated with direct or resource gradients (Guissan & Zimmerman 2000).

Some species are stenotopic and others are eurytopic, meaning that they are ecologically intolerant and tolerant, respectively (Cox & Moore 1993; Davies et al. 2009). In this framework, species can be characterized as either specialists, or generalists. All organisms, however, can only survive and reproduce within a range of optimum. Towards the extremes of the optimum a species may survive, but only be capable of maintaining small populations. Species trapped in environmental conditions outside of the range of optimum cannot physiologically survive and will be forced to migrate or suffer extinction. For instance, a temperature gradient can limit a warm-blooded animals range as maintaining heat requires the expenditure of energy. The animal may be able to persist towards the extremes of its optimum range, albeit inefficiently, however isotherms outside the range results in disadvantageous effects (Cox & Moore 1993).

Very few organisms exhibit a continuous spatial distribution. Instead, subpopulations occur in isolated

localities as a result of dispersal or vicariance episodes (Cox & Moore 1993). Habitats have limited resources and an organism must be capable of migration once those resources are exhausted, adapt *in situ* or face extinction. Dispersal is the act of moving from one ecological space to another by crossing a pathway that before limited its distribution (Cox & Moore 1993: 7). These are known as corridors, filters and sweepstakes routes (Simpson 1953). Corridors must include a variety of habitats, so organisms living in the zones at adjacent ends would find dispersal relatively easy (Cox & Moore 1993). For instance, the Eurasian continent acted as a corridor for large-range dispersals of animals and plants prior to the commencement of the Last Glaciation (Valdiosera et al. 2007). Filters represent a more specialized dispersal zone while a sweepstakes route includes dispersal episodes across extremely different ecological habitats and thus are remarkably rare (Cox & Moore 1993). Vicariance, on the other hand, occurs when a barrier interrupts a continuous distribution, such as the uplift of a mountain range. Both promote divergence among populations and, as a result, can ensure species viability, and facilitate speciation.

Competition between organisms occupying a similar niche space is an effective mechanism in structuring communities in a state of equilibrium (Finlayson 2004). If a niche space is at carrying capacity, one organism may extract resources necessary for survival more efficiently and effectively exclude another organism from the niche space due to a limited amount of resources (Cox & Moore 1993). In this case, the excluded species may survive without adaptation, though suffer reproductive consequences. However, most species will avoid competition by developing temporal or spatial separation. Temporal separation refers to an instance where two or more species occupy and exploit the same niche, albeit at different times of the day or season (Cox & Moore 1993). Spatial separation refers to the ability

of an organism to effectively partition a niche space into a microhabitat, so similar species can coexist without competition. For instance, the subtle differences in feeding ecology among three *Haplemur* species in Madagascar displays the evolutionary result of niche partitioning between social primates (Yamashita et al. 2009).

Climate Change, Distribution and Viability

An individual's phenotype is a direct response to its genetic predisposition and the external environment (Thomas et al. 2005). Therefore, substantial climatic variability may directly or indirectly provoke selection pressures among individuals to change, resulting in both micro-evolutionary and macro-evolutionary events. Even if a species is not directly affected, the ecological niche it relies on may be which will inadvertently force unique selective advantages. Although it is apparent that climate change can affect evolution, there is no consensus as to the direct relationship between them. Vrba's Pulse Turnover Hypothesis (1993) argues that evolutionary change is contingent upon the climate, while vanValen (1973) posits that co-evolutionary mechanisms drive microevolutionary change, primarily independent of climate oscillations.

Regardless, populations do respond to climate change by shifting their distribution. As noted above, species are limited in their distribution by a series of gradients which define an ecological niche. Ecological Niche Theory suggests that a species niche is a stable constraint to distribution, even in times of severe fragmentation and climatic stress (e.g. Martinez-Meyer et al. 2004; Guisan & Zimmermann 2000; Chavez & Kenagy 2010). Therefore, the contraction of temperate habitats during cold glacial cycles resulted in a coalescence of thermophilic species in areas of Mediterranean refugium (Thomas et al. 2005). When favorable conditions (i.e. during interglacials) return plant

and animal species follow their niche to novel territories, a process known as colonization (Provan & Bennett 2008).

Previous research suggests that three primary Mediterranean zones served as refugia during the Wechselian Glaciation; Italy, Iberia, and the Balkans (Hewitt 2000). These refugium zones are topographically heterogeneous and remained a place of respite for a variety of species during cold oscillations, including what some refer to as the last stronghold of the Neandertals (Finlayson et al. 2000; d'Errico & Sanchez-Goni 2003). Recent distribution models and phylogeographic analyses (eg Sommer & Zachos 2009; Valdiosera et al. 2007; Knapp et al. 2009; Korsten et al. 2009) provide evidence of 'cryptic' refugia in more northerly areas, which suggests extremely complex population and environmental histories during the Pleistocene that are only beginning to be explored.

Climate change remodels population size and affects the genetic composition of both the subpopulation and metapopulation (Hewitt & Nichols 2005: 183). The conventional 'southern richness versus northern purity' paradigm (Hewitt 2000) suggests that glacially-induced range contraction to southern refugium resulted in higher genetic diversity throughout the southern latitudes than in founder populations, a process known as a genetic bottleneck. As a result, demographic pressure and inbreeding depression would foster unrepresentative, low allelic diversity in isolated populations (Hewitt and Nichols 2005).

However, this unidirectional scenario does not always fit the data (eg. Thomas 2005; Provan & Bennet 2008). Instead, isolated subpopulations may increase the species' genetic diversity due to either decreased migration (Hewitt & Nichols 2005), that is if the population is not isolated for a long enough time to promote a speciation event, or coalescence from multiple refugia (Provan & Bennet 2008; Chavez & Kenagy 2010). Consequently, genetic diversity

may in fact be greater in recently colonized areas. Therefore, the effects of climate change on population history may be the result of a much more complex set of factors that are still poorly understood. While there is much disagreement, it is quite evident that species under climatic stress are in a constant state of flux and fragility (Lahr & Foley 2004) whereby small population-level changes may have drastic species-level effects (e.g. Martin 1967; Stewart et al. 2004).

Debate

Published research supports a Neandertal extinction event coinciding with dynamic climate oscillations of OIS 3, specifically during intermittent D/O and Heinrich events (e.g. vanAndel and Davies 2004; Finlayson & Carrion 2007; d'Errico & Sanchez-Goni 2003). Also, there is consensus regarding Neandertal persistence in southern Mediterranean refugium, namely the southern portion of the Iberian Peninsula, long after their retreat from the Northern latitudes (d'Errico & Sanchez-Goni 2003; Tzedakis et al. 2007). While the location and climatic history surrounding the Neandertal extinction event is relatively agreed upon, the debate regarding the mechanism responsible for the Neandertal extinction event ensues.

Competitive Exclusion

Francesco d'Errico and colleagues (e.g. d'Errico & Sanchez-Goni 2003; Banks et al. 2008) argue in favor of a competitive exclusion hypothesis which purports that AMH were present in Western Europe and Northern Iberia before the onset of a severe Heinrich Event (H4). The H4 event supposedly delayed AMH colonization, but when the climate ameliorated AMH quickly colonized southern Iberia and effectively drove Neandertals to extinction (Banks et al. 2008).

The competitive exclusion hypothesis rests on four related lines of evidence including; 1) The MP-UP transition and expansion of AMH across Europe suggests increased modernity of AMH, a very brief co-existence and rapid colonization; 2) Climatic differences between Northern and Southern Iberia supported fluxed modern human populations and fragile Neandertal populations, respectively; 3) AMH limited Neandertal distribution by restricting range expansion following H4; and 4) The Neandertal extinction during OIS 3 could not be a result of climate alone given that the Neandertals managed to survive a much more hostile European environment during OIS 4 and the initial OIS 3.

Rather than being characterized as a gradual process of local adaptations to ecological constraints (Riel-Savatore et al. 2008; Finlayson & Carrion 2007), the authors propose a swift expansion of modern humans across Europe yielding a superior Aurignacian toolkit. After a brief period of coexistence, modern humans then effectively out competed Neandertals. According to d'Errico and Sanchez-Goni (2003), dates attributed to the earliest occurrence of the Aurignacian at 41-37 ka are inconsistent as they occur in controversial cultural attribution or uncertain association between the dated material and Aurignacian assemblages. Additionally, evidence of a proto-Aurignacian complex discovered at Castillo Level 18 and a possible explanation for an autonomous development of Aurignacian in the region is dismissed based on "unconvincing" evidence (d'Errico & Sanchez-Goni 2003: 781). Instead, they argue that the appearance of the Aurignacian in Northern Iberia is no older than 36.5 ka, which coincides both with the oldest evidence of the Aurignacian in France and with the onset of the Heinrich H4 event.

Based on two deep sea pollen cores taken from the Alboran Sea and off the coast of Lisbon, Portugal, d'Errico & Sanchez-Goni (2003) suggest that climatic differences

between the northern and southern Iberian Peninsula during the H4 event restricted the modern humans from colonizing the Neandertal territory. During the Upper Pleistocene, modern humans were characterized as efficient hunters with long range logistic strategies (Gamble et al. 2004). Paleoclimatic reconstructions of northern Iberia during H4 characterize the region as vast expanses of grasslands capable of accommodating large mammals and an increased biomass. Comparatively, the authors demote Southern Siberia to a desert steppe wasteland (d'Errico and Sanchez-Goni 2003). According to d'Errico and Sanchez-Goni (2003), modern humans exploited the northern Iberian grasslands until the climate changed, facilitating a sudden southward expansion into the peninsula and the extirpation of the last Neandertals.

A recent study by Banks et al. (2008) used an ecological modeling technique to lend evidence to the debate. Banks et al. used high resolution climatic data, coupled with an archaeological and chronological database of both Mousterian and Aurignacian assemblages to define and differentiate the eco-cultural niches of both Neandertals and modern humans. Using GARP, an iterative software package that creates rule sets defining ecological niches based on known presence data, the authors determined that Neandertals and modern humans exploited separate habitat zones (Banks et al. 2008). According to the model simulation, there is an apparent reduction in the geographic and ecological range of Neandertals during the interval between H4 and Greenland Interstadial 8 (GI8: 38.6-36.5 ka). However, during this interval the potential range of Neandertals actually increased while, according to archaeological data, the Neandertals exploited a small proportion of their potential range. Rather than being directly linked to climate change, the authors propose that competition from expanding modern human populations limited the expansion of Neandertals (2008: 5).

d'Errico and others (e.g. d'Errico and Sanchez-Goni 2003; vanAndel et al. 2004) also contend that the Neandertal extinction had to be driven by a factor other than climate alone. The premise follows that the idea of Neandertals surviving more severe episodes of climate instability during the First Glacial Maximum (OIS 4), but succumbed to the environment following the H4 event is not a parsimonious one. According to Tzedakis et al. (2007), the Neandertal extinction occurred during a general warming trend and temperate expansion, therefore removing climate change as the primary mechanism responsible.

Climate-Driven Extinction

Finlayson and others (e.g. Finlayson 2004; Finlayson et al. 2007; Carrion et al. 2008) suggest rapid ecological changes during dynamic climate oscillations were responsible for the extinction of late surviving Neandertals in Europe. The most parsimonious view, then, is of a hominin lineage responding to climate change through a series of range contractions and expansions throughout the Weichselian Glaciation much like mammalian counterparts of temperate Europe (Finlayson 2004). A period of climate deterioration leading up to the LGM pushed an already stressed population to the point of no return (2004). Evidence in support of the climate-driven extinction hypothesis includes; 1) Neandertals witnessed a severe contraction in their preferred habitat over the course of OIS 3; and 2) Technological innovations throughout Europe represent a spatio-temporal mosaic suggesting distinct ecological adaptations to a changing environment.

Paleoanthropological dogma suggests Neandertals were a cold-adapted hominin lineage (e.g. Holliday 1997), however several studies assert that Neandertals almost exclusively exploited Mediterranean bioclimates (Finlayson 2004), only ventured north into more continental temperate

zones during warmer interstadials (Serengali & Bolus 2008), and exhibited no thermoregulatory adaptive advantage to cold climates (Aiello & Wheeler 2004). Instead, the Neandertals are included in a suite of mammalian taxa coined the 'interglacial survivors' which retreated to southern refugia during climate variability tracking a specific habitat (Finlayson & Carrion 2007; Stewart et al. 2004). Sporting a robust, energetically costly frame, Neandertals were most likely not well suited for long range logistical mobility. Rather, evidence supports a local logistic strategy in which Neandertals exploited a variety of resources from a heterogeneous landscape (Gamble et al. 2004).

OIS 3 witnessed a steady decline in the preferred habitat of Neandertals towards the onset of the LGM and only a few areas maintained a mosaic landscape. The southern Iberian Peninsula has been identified as one such refugium (Hewitt 2000) and archaeological evidence substantiates continuous Neandertal occupation for thousands of years up to the Neandertal extinction. Instead of placing Neandertals in a cultural battle with AMH, J.R. Stewart et al. (2004) and Anthony Barnosky et al. (2004) propose that the extinction of the Neandertals was part of the greater late Pleistocene extinction event. Several other warm-adapted mammalian taxa of Europe went extinct during this interval, including *Elephas antiquus* and *Stephanorhinus hemitoechus* (Stewart et al. 2004; Barnosky et al. 2004). The fauna were significantly stressed due to repeated climate variability since the onset of the Wechselian Glaciation and a series of population-level extinctions most likely seeded their fate (Barnosky et al. 2004). Finlayson and Carrion (2007) attribute the Neandertal demise to the same process.

According to Finlayson and colleagues (e.g. Finlayson & Carrion 2004; Finlayson et al. 2006), the technological record in Europe during OIS 3 supports a climatically driven extinction event. First, they argue that

Neandertal technocomplexes during the MP-UP transition show little behavioral differences to comparable assemblages attributed to modern humans, implying that either Neandertals were behaviorally modern (whereby modern humans lacked a competitive advantage) or sufficient coexistence occurred (indicating a gradual MP-UP transition) (Carrion et al. 2008; Finlayson & Carrion 2007). Second, there is a direct correlation between technological innovations and geography, implying independent, regional adaptations to fluctuating ecological conditions on the behalf of both Neandertals (Chatelperronian) and modern humans (Aurignacian) (Finlayson & Carrion 2007). Third, there is no direct correlation of AMH to the first appearance of Aurignacian in Western Europe and d'Errico & Sanchez-Goni's (2003) direct dismissal of a potential autochthonous development in Spain conveniently denies cultural attribution to any archaic hominin lineage (Carrion et al. 2008). In fact, any evidence of AMH existence in Europe prior to 30ka is scant according to morphological (Trinkaus 2005) as well as genetic evidence (Forster 2004). Fourth, in Gilbaltar, the southern outpost of the Neandertal range, Aurignacian tools first appear thousands of years after the Neandertals went extinct (Finlayson et al. 2006).

Biogeographical Perspective

The competitive exclusion hypothesis rests on several assumptions which disregard basic evolutionary and ecological theory. From a biogeographical perspective, the competitive exclusion hypothesis can only be substantiated if the following is provided; 1) neandertals and modern humans utilized the same niche; 2) evidence of competitive exclusion during previous contact; and 3) the environment to which both groups were exploiting was at carrying capacity.

Competitive exclusion can only occur in species who exploit similar resources (Cox & Moore 1993). Countless

studies suggest Neandertals and modern humans were adapted to, and preferred, distinct habitats. (e.g. vanAndel & Davies 2004; Finlayson 2004; Banks et al. 2008). As noted above, Neandertals favored primarily Mediterranean zones which they tracked exclusively during climatic fluctuations (Seregeli & Bolus 2008), whereas evidence of modern human distribution throughout Europe was much more resilient to climate deterioration especially once the Gravettian appears on the landscape (vanAndel 2004). Modern humans were adapted to a long range logistic mobility strategy and were capable of efficient exploitation on the plains (Gamble et al. 2004). Neandertals are characterized as a short-range, locally adapted hominin group that relied on heterogeneous habitats (Finlayson et al. 2000). Moreover, Stewart (2004) showed that representative fauna at Neandertal and modern human archaeological sites exhibited stark differences in preference.

Similar species carry with them the adaptive capacity to partition niches temporally and/or spatially. As such, documenting competitive exclusion not only relies on evidence supporting similar niche preference but it also requires temporal and spatial continuity among species (Cox & Moore 2003). Recent research (Balter 2011) asserts that Neandertals and modern humans may not have been as contemporaneous as previously thought; more like ‘ships in the night’. Balter’s recent work on addressing the issues of radiocarbon dating led him to posit that Neandertals were well on their way to becoming extinct prior to 40ka, much earlier than the proposed event following H4. Moreover, Finlayson & Carrion have provided sufficient evidence regarding the presence of Aurignacian only well after the extinction of Neandertals. On the other hand, recent DNA (Green et al. 2007; Krause 2010) and established morphological evidence (e.g. Glantz 2010) argue in favor of admixture, possibly for prolonged periods in the Levant and Central Asia. If Neandertals and modern humans did inhabit

southern Iberia contemporaneously, then evidence of competition should be visible in the archaeological record. No such evidence has been reported by the competitive exclusion team.

Banks et al.'s ecological-cultural niche model (2008) which purportedly provides evidence of modern humans effectively restricting the Neandertal range is flawed for two reasons. First, the authors simulated modern human and Neandertal niche preference based on archaeological and climatic data, and found distinct preferences between the two. This basic assumption negates competitive exclusion and supports Finlayson's view that the two hominin groups exploited different resources. Second, they argue that even though the potential niche of Neandertals expanded following H4, Neandertals did not. However, Banks et al. (2008) failed to mention two limitations to ecological niche models (ENMs); 1) ENMs are unable to cope with non-equilibrium situations such as changing environment; and 2) ENM's simulate only a potential range based on indirect resource gradients resulting in overestimation of range size (Guisan & Zimmerman 2000; Richards et al. 2007; Flojgaard et al. 2009).

Selective advantages would only facilitate competition when a community is at carrying capacity (Cox & Moore 1993: 63). During states of equilibrium, many communities are at carrying capacity, however communities and ecosystems in constant states of flux and fragility rarely are (Lahr & Foley 2004). Climate models support a constant state of disequilibrium throughout Europe with widespread, ecosystem level fluctuations (vanAndel 2004). Coincident with Barnosky et al.'s claim, Neandertal populations were under severe demographic pressure throughout the Wechselian Glaciation (2004). Modern humans, too, were affected by the deteriorating climate (Lahr & Foley 2004). Physiologically stressed populations tend to avoid

competition by either increasing resource breadth or niche partitioning (Cox & Moore 1993). Additionally, current research suggests that disparate population communities of low density typified hominin groups throughout the Pleistocene (Finlayson 2004). Therefore, competition remains an unlikely cause of extinction. A more parsimonious argument would attribute the Neandertal extinction to dynamic climatic fluctuations resulting in constant states of population pressure and the eventual extirpation of small, isolated populations due to stochastic events, inbreeding depression, and genetic swamping (Finlayson 2007).

In conclusion, the null hypothesis can be overturned; substantial evidence supports the notion that the Neandertal extinction was not solely a stochastic event. In regards to the competing hypotheses, evidence in support of AMH competitive exclusion is lacking in that these models cannot unequivocally show Neandertals and AMH utilized the same resources, or that they were contemporaneously present on the Iberian landscape, both of which are required in order to propose competition between two groups of organisms. However, both sides of the debate do agree that a series of rapid, fluctuating climate events during OIS 3 in Pleistocene Europe greatly suppressed population viability of hominin and mammalian groups alike (Finlayson & Carrion 2007; d'Errico & Sanchez-Goni 2004). Therefore, the most parsimonious interpretation suggests that climate instability and resource depression was most likely responsible for the fate of the Neandertals. Attributing the Neandertal extinction event to an AMH induced affair is a post hoc analysis lacking theoretical support.

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Morphological Variation in Primate Hybrids: Insight on Hominin Evolution

Katharine Horton

Abstract- *Middle and Late Pleistocene hominin fossil phylogenetic debate continues into the 21st century due to the extreme morphological variation of hominin remains during this period. Researchers have suggested that baboons, a group of primates distantly related to modern humans, can provide analogies and insight on human evolution. Two genera of Cercopithecoids, Theropithecus and Papio, are different morphologically; however, these primates have been observed to hybridize freely and produce fertile offspring. The hybrid offspring show both mosaic and novel morphology similar to Pleistocene hominin fossils. Molecularly, morphologically, and analogously there is evidence to support that hybridization occurred between hominin fossils dated to Middle and Late Pleistocene suggesting an evolving species continuum.*

Phylogenetic debate on Middle and Late Pleistocene hominin fossils persists into the 21st century. The hominin fossil remains during this time period have extreme morphological variation with differential trait expression retaining some primitive characteristics as well as revealing novel features. Observations and research involving Cercopithecoid hybridization provide analogies and insight on human evolution.

Species Concepts

How, when, and where speciation of the *Homo* lineage occurred has been heavily debated within paleoanthropology. Defining and identifying a species is difficult in extant life forms and becomes problematic for extinct organisms. Before the 20th century, when scientists favored a theological view of life on Earth, the typological species concept prevailed defining a species as a group of organisms conforming to a common morphological plan, emphasizing the species as a static, non-variable assemblage (Mayr 1969). Charles Darwin began seeing problems with using the holotype, an archetypal specimen as defined by the typological species concept, once variation within species became apparent on his five-year voyage on the HMS Beagle. Movement away from the typological species concept began when Ernst Mayr, zoologist and evolutionary biologist, proposed the biological species concept (BSC) in his book *Systematics and the Origin of Species from the Viewpoint of a Zoologist* in 1942.

Currently, there are 24 species concepts that have been employed to define and categorize the vast array of organisms on Earth; however, none of the concept definitions fully encompass the complexity of speciation and evolution (Hey 2001). The BSC, proposed by Ernst Mayr, is widely accepted defining extant reproductively isolated organisms as separate species; however, this concept becomes problematic with sexless organisms and two species that are able to breed fertile hybrids (Cartmill and Smith 2009). In addition, the BSC is very difficult, if not impossible, to determine within the fossil record. The recognition, intermodal, and evolutionary species concepts are several other examples that define species boundaries, but are unobservable in the fossil record (Cartmill and Smith 2009). Before the recent improvements in molecular technology, the morphological species concept (MSC) was the only definition that could be applied to extinct organisms (Cartmill and Smith 2009). The MSC relies on the

anatomy of the specimens and is defined as “the smallest cluster of organisms that can be distinguished from other such clusters by consistent phenotypic traits” (Cartmill and Smith 2009). This species concept becomes problematic when the similarities of this definition and the typological species concept are assessed.

It is important to note, for the purpose of this paper, that the phenotypic clusters, morphospecies, defined by MSC are not equivalent to the reproductively isolated clusters defined by BSC (Cartmill and Smith 2009). Two morphospecies may not be reproductively isolated and vice versa (Cartmill and Smith 2009). Cartmill and Smith (2009) provide an example of the coexisting, behaviorally and morphologically distinct white-tailed deer (*Odocoileus virginianus*) and mule deer (*O. hemionus*) that will interbreed. The interbreeding deer produce fertile offspring that are able to facilitate gene flow from each species into the other (Cartmill and Smith 2009). The MSC, like the typological species concept, does not take into account the mechanisms of population genetics and evolution; however, recent molecular work has alleviated some of the flaws in this concept and should be used to compliment MSC (Cartmill and Smith 2009).

Understanding Comparisons

Knowing the differences in analogous, homologous, and homoplastic traits when comparing groups of organisms is important in phylogenetics and it is equally important to explain the logic and evidence for comparisons. Analogy is the equivalence or likeness of relations, a comparison between two things that are in some way similar (Jolly 2001). Analogy uses significant patterning of independently acquired behavioral, morphological, or physiological traits to help understand and interpret evolutionary events in adaptational and functional terms (Jolly 2001). Though Gorilla and Chimps are close phylogenetic relatives, they do not make good analogies for

hominin evolution because they are not sister taxa; however, both groups are mistakenly used frequently (Jolly 2001). The more phylogenetically distant the analogue, the more striking the coincidence and parallel adaptation becomes obvious (Jolly 2001).

In contrast to analogous similarities, homology is a similarity between organisms that is due to a shared ancestry (Cartmill and Smith 2009). A homologous character-state is a shared, unique status that derives from the inheritance from a common ancestor (Jolly 2001). Homoplastic resemblances are also a shared character-state; however, it is not derived from common ancestry hence any resemblance between individuals from separate populations is acquired independently (Cartmill and Smith 2009; Jolly 2001). The parallel adaptation of a similar function, such as ancestral patterns of relative growth independently producing similar phenotypes in two distinct groups of animals, is misleading and phylogenetically uninformative (Jolly 2001). Homoplasies have been detected in recent molecular analyses, but are hard to detect morphologically and hence have obscured real phylogenetic relationships in the past (Jolly 2001). Phylogenetic hominin relationships extrapolated from the fossil record should be assessed with caution due to the inaccurate homologous-character traits observed, molecularly found to be homoplasies.

Middle to Late Pleistocene Hominins

The Middle Pleistocene ranges from around 800 to 130 thousand years B.P. followed by the Late Pleistocene ending at about 10 thousand years B.P. (Cartmill and Smith 2009). Hominin fossils during this time period do not show morphologic consistency and are extremely variable within and between sites in Europe (Bailey et al. 2009; Hawks 2009; Ramirez Rozzi et al. 2009; Smith et al. 2005). *Homo antecessor*, *Homo heidelbergensis*, *Homo neandertalensis*, and *Homo florensis* are some examples of new species

identifications, frequently under debate, during this geologic time stage that this paper defines as archaic *Homo sapiens*; though, the Neandertal population will be focused on (Cartmill and Smith 2009; Bermúdez de Castro et al. 2004).

Though the label ‘Neandertal’ was first applied in 1856, the first fossil evidence recovered of this population was in 1829. Fossils identified as Neandertals found in Europe and western Asia have been dated between 200 to 30 thousand years B.P. (Cartmill and Smith 2009). Taken from the Oase 1 mandible in Romania, the earliest European anatomically modern human date is 35 thousand years B.P. and the latest Neandertal date from Vindija, Croatia is 28 thousand years B.P., indicating a period in time where the two populations coexisted (Higham et al. 2006). Improvements in dating techniques allow accurate population and phylogenetic analyses of hominin fossil sites; however, the mosaic morphology found in the fossils during this transition makes defining discrete populations and species difficult.

Hybridization Theory

Baboons homologously share many attributes of hominin structure and function (Jolly 2001). Bio-historical, phylogenetic, and functional analogues between baboons and hominins may bring insight to the paleoanthropological phylogenetic dilemmas by using similarities and differences that have evolved in different clades (Jolly 2001). Baboons and hominins three to four million years ago shared non-rainforest habitats in sub-Saharan Africa and both experienced Late Neogene climatic and biotic fluctuations affecting both groups in parallel ways (Jolly 2001).

Hybridization is the production of offspring by the interbreeding of members from separate genetic populations (Jolly 2001). Papionins, baboons, show a remarkable ability to hybridize across a wide spectrum of taxonomic levels from interspecies-group to intergeneric hybridization (Jolly 2001).

An example on one extreme side of the spectrum is rare, artificial inter-subtribe crossing with the other side of the spectrum having natural hybrid zones for two parapatric populations, allotaxa, of the same species (Jolly 2001). The natural occurrence happens often in allotaxa; however, during intergeneric hybridization an environmental disturbance to the group usually aids the copulation (Jolly 2001). Sporadic hybridization promotes gene flow from one population to another, increasing genetic diversity, and is largely guided by each group's sexual and social interactions (Jolly et al. 1997). Molecular evidence in some vertebrate studies suggests that cryptic introgression of genetic markers, a mixed ancestry in alleles, is more extensive than the initial observed primary hybridization (Jolly et al. 1997). Perhaps future genetic studies in primates will show that hybridization occurs at a higher frequency than observed in the wild and in captivity. The observation of primary hybridization between intergeneric and interspecies populations provide morphologic evidence that can be seen in the offspring exhibiting mosaic and novel morphology.

Papio and Macaca Intergeneric Hybridization

Intergeneric hybridization between the most phylogenetically distinct pair of Papionins, the rhesus macaque (*Macaca mulatta*) and baboons (*Papio*) with a divergence time of approximately ten million years B.P., has occurred artificially in a caged setting (Jolly 2001). Spontaneous labor developed in the female baboons about five weeks prematurely (Moore et al. 1999). Death of 22 infants occurred within 72 hours due to complications of prematurity, primarily from hyaline membrane disease, and 4 infants survived the newborn period (Moore et al. 1999). The 26 well-attested, viable rhesus offspring of the two genera were sterile and behaviorally abnormal (Jolly 2001).

The lone long-term male hybrid survivor of a female *Papio hamadryas* and a male *Macaca mulatta* weighed 15.42 kg at the age of 18 years old (Moore et al. 1999). Behaviorally, the male rhesus showed a mosaic of baboon and rhesus macaque traits. Baboon behaviors apparent in the rhesus were the mantle shake and eyebrow raise; however, the male hybrid did not grind his teeth, which is behaviorally apparent in all baboons (Moore et al. 1999). The hybrid lacked behaviors present in both genera such as the open mouth threat and displayed fewer vocalizations; though, one vocalization appeared to be a combination of sounds from both of the parent species (Moore et al. 1999).

Papio and Theropithecus Intergeneric Hybridization

Papio and *Theropithecus* baboons have been completely distinct phenotypically and ecologically for millions of years, yet hybridize freely in caged settings as well as in nature (Jolly 2001). Molecular and fossil evidence suggest the divergence time of these two genera to be around 3.2 to 3.5 million years B.P. (Cronin and Meikle 1979; Jablonski 2005; Jolly et al. 1997). Fossil evidence suggests *Papio* and *Theropithecus* were sympatric during the Plio-Pleistocene throughout Africa expanding into western Eurasia; however, presently *Theropithecus*' range is limited to moist highland grasslands in Ethiopia (Jolly et al. 1997).

Jolly and colleagues (1997) described the intergeneric hybrids born in Bihere Tsige Park, Addis Ababa, Ethiopia where *Theropithecus gelada*, *Papio anubis*, and *Papio hamadryas* were housed together. The intergeneric hybridized offspring, geboons, were behaviorally normal and fertile (Jolly 2001). It has been observed that female geboons attract male *Papio* producing viable backcross offspring morphologically similar to *Papio* (Jolly 2001). Observation of captive interbreeding between *T. gelada* and *P. h. anubis* or *hamadryas* has also been noted in Sukhumi, Georgia (Jolly et al. 1997;

Markarjan et al. 1974). *Theropithecus* phenotype dominates in the hybrid backcross (Markarjan et al. 1974).

T. gelada and *Papio hamadryas anubis* currently coexist in Ethiopian highlands (Jolly et al. 1997). In Bole Valley, Shoa Province, Ethiopia Dunbar and Dunbar (1974) observed the copulation of male *T. gelada* and female *P. h. anubis*. The hybrids observed were probably born and raised in the *P. h. anubis* social group where the females would remain and the adult hybrid males would migrate into the *T. gelada* population fathering other hybrids (Jolly et al. 1997). Though not observed, it has been predicted that the geboons will attract *Theropithecus* producing viable backcross offspring morphologically similar to *Theropithecus* (Jolly 2001).

Though the two populations can interbreed, there are important ecological, facial, postcranial, and dental differences between *Papio* and *Theropithecus* and the resulting hybrid, geboons. *Papio* is wide-ranging, largely terrestrial, and omnivorous whereas *Theropithecus* is sedentary, highly terrestrial, and graminivorous (Jolly 1970). *Theropithecus* has a concave midfacial lateral profile and the dorsal muzzle is evenly parabolic in coronal section whereas *Papio* has a straighter profile and the dorsal muzzle is flatter and broader superiorly (Jolly et al. 1997). The hybrids appeared intermediate in many aspects, but were absolutely larger than either parent and relatively larger in their dental, cranial, and postcranial morphology (Jolly et al. 1997). Dental casts taken from the hybrids show a longer dental arcade than both parents and an elongation of the diastema in the premaxilla (Jolly et al. 1997).

Postcranially, *Theropithecus* and *Papio* differ in limb proportions (Jolly et al. 1997). *Theropithecus* has relatively short digits and exhibits longer forelimbs compared to hind-limb length when in contrast to *Papio* (Jolly et al. 1997). Sexual dimorphism is apparent in the limb proportions of the hybrids (Jolly et al. 1997). The male hybrid was

indistinguishable from *Papio*, but the female hybrid had proportions that were intermediate between the two genera (Jolly et al. 1997).

In comparison to *Papio* dentition, *Theropithecus* has mesiodistally narrow incisors relative to height and to cheek-tooth size, hypsodont cheek-teeth that have much higher, columnar cusps, and deeper, vertical invaginations of the buccal and lingual enamel (Jolly et al. 1997). The dentition of the hybrids was intermediate with morphological combinations not seen in either parent and did not show obvious abnormalities or malocclusion (Jolly et al. 1997). *Papio*'s upper molars have a simple depression between the bulbous protocone and hypocone on the median lingual cleft whereas *Theropithecus* has a wider median lingual cleft and the margins of the more vertical and columnar lingual cusps are squared (Jolly et al. 1997). The median lingual cleft in the hybrids was similar in shape and extent to *Theropithecus* (Jolly et al. 1997). *Theropithecus* has a derived molar shape that includes well-defined shelves at the mesial and distal margins. The hybrids have a weaker mesial shelf than *Theropithecus*, but the shelf is distinctively defined on the lingual side by a well-marked cleft (Jolly et al. 1997).

Macaca Interspecies-group Hybridization

Bernstein (1966) observed natural interspecies hybridization between *Macaca fascicularis* (*M. irus* Cuvier, 1818) and *Macaca nemestrina* in Kuala Lumpur, Malaysia. The natural occurrence of hybridization between these two species usually develops if the habitat is significantly disturbed, thus Bernstein (1966) inferred that hunters killed the males of the *M. nemestrina* troop and the remaining females joined a nearby *M. fascicularis* troop (Jolly et al. 1997). The hybrid offspring functioned normally as long-term members of the *M. fascicularis* social group (Bernstein 1966). Further studies on natural Primate hybridization, such as baboon

allotaxa, have been conducted producing similar results on fertility and morphological variation (Ackermann et al. 2006).

Hybridization in Middle to Late Pleistocene Hominins

Understanding the complex evolutionary processes that led from Middle Pleistocene hominins to the emergence of anatomically modern humans is a necessity that needs to be considered from several different perspectives (Trinkaus 2006). Using Cercopithecidae hybridization as an analogy to hominin interbreeding in the Middle to Late Pleistocene is one perspective that provides insight on the morphological variation seen within the fossil record.

Hybridization occurs when both populations coexist in an unstable environment where the geographic range may be adjusting rapidly to climatically or tectonically driven environmental shifts (Jolly et al. 1997). During the transition from archaic *Homo*, including Neandertal populations, to anatomically modern human morphology, the occurrence of glacial and interglacial periods made the environment in the Northern Hemisphere extremely variable and unstable (Cartmill and Smith 2009). Primate hybrids are heterotic relative to their parental populations, highly morphologically variable, and display novel phenotypes (Ackermann et al. 2006). The hybrids show a range of morphologies, depending on dominance and epistatic interactions between alleles fixed or predominant in the parent populations, and are not necessarily an intermediate between parental phenotypic traits (Ackermann et al. 2006).

The probability that Middle to Late Pleistocene hominins interbred is well supported by molecular and morphological studies. In 2005, Smith and colleagues conducted an extensive study focusing on the human fossil record, DNA analyses on the variation in ancient and extant humans, the archaeological record, and chronometric dates associated with late Neandertal and early modern humans in

Europe and western Asia. In examining cranial features of Neandertals and early modern humans, Smith and colleagues (2005) suggest that high frequencies of several features of the cranial morphology in European fossils reflect genetic continuity involving contributions of genetic material from Neandertals to early modern humans.

Green and colleagues (2010) analyzed the nuclear DNA of 5 present-day humans and 3 Neandertal fossils. The methodology used was explained thoroughly and results from this study reveal that the genomes of Neandertals contributed to the genetics of present-day humans outside of Africa (Green et al. 2010). The results of this study also indicate that several genes and genomic regions, involved in cognition and cranial morphology, were positively selected for (Green et al. 2010). Green and colleagues (2010) contributed genetic evidence illustrating that Neandertals and modern *Homo sapiens* did share genetic data. There is a short time, before Neandertal populations disappear from the fossil record, in which anatomically modern and archaic *Homo sapiens* coexisted and interbred.

Discussion and Conclusion

A major issue with Biological Anthropology, as well as many other disciplines of science, is Linnaean classification and *Homo sapiens*' perpetual habit of categorizing information from subjective, discrete traits; on the contrary, evolution is on a continuum in time and space where organisms are slowly changing, transforming, and shifting by means of gene flow, genetic drift, natural selection, and mutation. Unlike mutation, hybridization presents a steady supply of immigrant genes into the population that are unlikely to be lethal (Jolly 2001). Most immigrant genes that are neutral in effect will disappear by drift in a few generations; however, a random minority will persist or increase in frequency (Jolly 2001). Thus, phenetic

distinctions made within the fossil record do not necessarily denote the capacity of exchanging genetic material.

Forcing organisms into a limited number of arbitrary defined categories and using reductionist definitions for all species obscures the complexity of life on Earth. There is continuous variation of organisms through time and space. The mosaic nature of Middle and Late Pleistocene hominin evolution is a prime example (Stringer 2002). The eventual disappearance of Neandertal morphology occurs within the fossil record around 30 thousand years B.P., yet the reason for the disappearance has yet to be agreed upon.

The hybridization analogy in Jolly 1970, 2001 brings insight to the dilemma. The morphological variation seen in the Middle and Late Pleistocene may be explained by the interbreeding of populations given gene flow, as well as other evolutionary mechanisms at play. As the primate group Cercopithecidae illustrated during field observations, hybrids between two morphologically distinct populations present a mosaic of traits with a large range of variability. While there are problems with the baboon analogy as well as the hominin hybridization theory, there are also problems with morphological and molecular analyses. The study of the human lineage is complex. In order to understand the intricacy of evolution, multidisciplinary and complimentary approaches need to be employed concurrently utilizing morphological examination, molecular analysis, and analogies in observable extant populations.

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Evidence of Juvenile Scurvy: A Case Study from the Lower Illinois River Valley

Anna K Trainer

Abstract- *In the last fifteen years there has been a shift in the diagnosis of porotic hyperostosis in juvenile archaeological remains. Traditionally, the causation of porotic hyperostosis, as well as cribra orbitalia, has been most often attributed to iron-deficient anemia. However, recent research on this condition has noted that anemia is not always the main causation, and some researchers have suggested that scurvy may be an alternative diagnosis for porotic hyperostosis. Scurvy, which is caused by vitamin C deficiency, has been known to cause similar lesions and features that may be difficult to differentiate from anemia. The recent work of Ortner and colleagues (2001), as well as other scholars such as Brickley and Ives (2006), has advanced the differential diagnosis of scurvy from anemia. This study attempted to extend their research and test the ability to make this differential diagnosis in juvenile specimens. This was done by examining macroscopic changes on several cranial bones as well as one postcranial area.*

The current research has applied the methods and theories of these scholars in an attempt to further the investigation of the skeletal manifestations of juvenile scurvy. Two main objectives were pursued in this research; first, to examine whether scurvy could actually be differentiated from anemia in juvenile skeletal remains in a small skeletal sample, which was dependent on the analysis of several landmarks that are considered diagnostic for juvenile scurvy. Secondly, a

comparative study examined two regional samples from the Lower Illinois River Valley and attempted to discern changes in scurvy prevalence throughout subsistence transition from the Middle Woodland time period through the Late Woodland. The times of greater nutritional stress were predicted to have a higher prevalence of scurvy; however, the research described here suggests that caution must be used in making this assumption as the results for this project were inconclusive.

Introduction

Porotic hyperostosis is a pathological condition found in human skeletal remains, especially those of juveniles, which has typically been diagnosed as a sign of metabolic disease (Steinbock 1976). In the archaeological context, skeletal material that has the characteristic lesions of porotic hyperostosis had traditionally been identified as a characteristic



Figure 1: Characteristic cranial lesions of porotic hyperostosis (from Brickley & Ives 2006)

of anemia, especially in infant and juvenile skeletons where porotic hyperostosis and cribra orbitalia seemed more prevalent than in adults. Anemia, at least in its context here, is defined as a metabolic disease caused by a deficiency of iron in the body (Ortner 2001). This, in turn, leads to a reduction of red blood cells because iron is needed to produce new cells. If the disease continues unabated, the table of the skull begins to thin, and the diploë thickens as a result of the body attempting to obtain more iron for blood cell formation (Brickley and Ives 2008).

Although the cause of porotic hyperostosis and the porous lesions resulting from it have been said to be characteristic of iron deficiency and anemia in the past, this theory has recently been challenged. Ortner and Ericksen stated that “caution is needed in attributing porous lesions of the orbital roof solely to anemia” (Ortner & Ericksen, 1997: 212-220). In the study, Ortner and Ericksen examined juvenile specimens from the United States and Europe, looking for signs of lesions that may have been caused by scurvy. Scurvy, like anemia, is a metabolic disease in which a critical nutrient that the body needs is lacking, but in scurvy, that necessary nutrient is vitamin C. Without it, symptoms of scurvy will develop which may include pain and weakness in the limbs along with bleeding and receding gums (Carpenter 1988). Unlike other animals, modern humans, or any of our closest primate relatives, cannot synthesize vitamin C and so require outside intake of the vitamin from various food sources (Brickley and Ives 2008). One of the tasks vitamin C performs is in protecting the body from infection by helping to bolster the immune system through use of antioxidants contained within the vitamin and also by helping to destroy pathogens (Brickley & Ives 2008). Another important role of vitamin C is that ascorbic acid helps to promote collagen formation which in turn maintains cellular bone strength as well as blood vessels and other structures. One of the more severe effects of vitamin C deficiency is subperiosteal hemorrhaging of blood vessels due to their weakened state. This hemorrhaging leaves characteristic lesions on bones (Wilkinson 1991). The long bones are especially susceptible to these hemorrhages, which can be the result of the trauma of bearing weight on these bones, especially the tibiae (Carpenter 1988). In the skull, these lesions are seen specifically in areas that are associated with the temporalis muscle and mastication (Ortner and Ericksen 1997).

The recent research conducted by several scholars has demonstrated that scurvy will exhibit bilateral, porous lesions in additional areas besides the cranial vault and orbits (Brickley and Ives 2006; Ortner, et al. 2001; Ortner, et al. 1999; Wright and Chew 1998), which differentiates this disease from anemia. Some of these areas include the greater wing of the sphenoid, the posterior aspect of the maxillae, the hard palate, the ascending ramus of the mandible, the zygomatic bones, the temporal bones, and the scapulae. At the same time, the characteristic lesions of the cranial vault and orbits may also be present. Of these features, the porosity (especially bilateral) of the greater wing of the sphenoid is considered to be the most differentially diagnostic feature (Ortner 1999).

Regional Perspectives

For this study, two sample groups were observed in the hopes of determining nutritional differences throughout time based on the prevalence of scurvy within each group. Between the two groups studied there was a change in subsistence patterns which may have increased levels of nutritional stress (Buikstra 1988).

The two sample groups that were observed in this research were from the same geographic region, the Lower Illinois River Valley. Since the research conducted was intended to study change in scurvy prevalence and nutritional stress over time, this area was especially good for research of this type. This is due to the completeness of the archaeological record found in the region which spans over ten thousand years (Buikstra 1988; Cook 1984). The area was an advantageous environment for the cultures of the Middle and Late Woodland periods due to the positioning between two rivers, with floodplains, high bluff crests, and forests. One cultural group was from the Middle Woodland period (50BC-400AD) and the other was from the Late Woodland (400-1100AD) (Buikstra 1976; Cook 1984).

During the Middle Woodland, the primary subsistence strategy for the Hopewell in the area was foraging, although cultivation of certain weedy plants had begun by this point and this cultivation continued to develop through the Middle and into the Late Woodland periods (Buikstra 1988). This variety of different foods would attribute to a well-balanced diet that provided all needed nutrients. By contrast, during the Late Woodland period, thanks to the intensification of maize agriculture, population numbers increased, while simultaneously the quality of life, specifically in terms of nutrition, decreased (Buikstra 1988; Cook 1984). This decrease in quality of life could be due to several factors. With maize an available food, the age of weaning may have lowered, leading to a shorter birth interval. This may have led to not only a larger population size, but also an increase in infant mortality after weaning, due to the loss of nutritional quality that would result from a diet dependent on maize (Buikstra 1976). The transition from a variety of healthy foods to a diet heavily dependent on maize could lead to nutritional stresses, deficiencies, and eventually, pathologies.

Based off of this information, this project aimed to examine the remains of several individuals from two sites. One, the Gibson site, represents the Middle Woodland period while the other, Ledders, represents the Late Woodland period. The premise examined here, based off of previous research and findings, was that the Late Woodland, with its high levels of nutritional stress due to dependency on maize agriculture, will have a higher prevalence of scurvy than the more varied nutrition of the Middle Woodland, which was mainly dependent on a foraging lifestyle (Buikstra 1988).

Materials and Methods

20 juvenile specimens from the Gibson (Middle Woodland) and 20 from the Ledders (Late Woodland) sites were evaluated for this project, resulting in an overall sample

size of 40. Each individual was aged and inventoried so that a thorough understanding of the methods could be more easily obtained. All specimens were then examined for signs of pathology, especially porosity and hypertrophic activity in the skull and porosity and areas of woven bone in the long bones. In addition to the areas that were evaluated according to the developed methods of previous researchers (Brickley and Ives 2006; Ortner, et al. 2001), the porosity of the zygomatic and temporals bones was observed although they were not scored at this time. All of these observations were recorded, as was the limits of observation due to postmortem damage or incomplete specimens. This information could not be included in the current publication due to space limitations, but is available from the author upon request.

In order to better evaluate all of the specimens in the same manner, two methods were developed for this analysis. The first was an age categorization that was designed to place each specimen into a very specific age range. It was developed from the analysis used by Ortner and colleagues (1999) and Brickley and Ives (2006).

AGE	CATEGORY	AGE RANGE
YI	Young Infant	Birth to 11.9 months
OI	Old Infant	12 months to 2.9 years
YC	Young Child	3 to 6.9 years
OC	Old Child	7 to 12.9 years
AD	Adolescent	13-18.9 years

Table 1: Age categorization of specimens

This chart enabled a thorough examination of the difference in the prevalence in scurvy between specific age ranges. Scurvy pervasiveness has been reported in the literature

to occur most often between the ages of 5-24 months, with a peak between 8-11 months (Brickley & Ives 2008). Therefore, it is important to look at differences between younger and older infants or younger and older children, as well as between overall infants and children. Brickley and Ives (2008) also discuss the effects that weaning may have on the occurrence of scurvy, so being able to distinguish these age categories may also aid in that discussion.

The second analysis that was developed for this analysis was based off of similar tables utilized by Brickley and Ives (2006) and Buikstra and Ubelaker (1994).

Specimen	Age	Orbits	Maxilla	Hard Palate	Mandible	Sphenoid	Ectocranial	Endocranial	Scapula
Ld1-118	OI	1	1	1	9	1	1	0	9
Ld1-144	OI	1	1	1	1	1	0	1	9

Table 2: Observations taken for analysis

This table shows the eight macroscopic observations that are considered to be diagnostic for scurvy. The presence/absence of pathology was evaluated for each area, including porosity within the orbits, also known as cribra orbitalia (Brickley and Ives 2008); on the posterior aspect of the maxillae; the hard palate; the ascending ramus of the mandible; the greater wing of the sphenoid; the cranial vault (both ectocranial and endocranial surfaces of the frontal, parietals, and occipital); and the scapulae. They were scored as prescribed by Buikstra and Ubelaker (1994), with a score of "0" for pathology absent; "1" for pathology present; and "9" for an unobservable feature, one that was either missing or too damaged by taphonomic events to be observed.

Several specimens were excluded from the final analysis for multiple reasons. If an individual had

unobservable features for four or more of the observations, they were ruled Unobservable overall and were not included in the sample. Additionally, if a specimen had four or more features scored as either “unobservable” or “pathology absent” it was ruled as Inconclusive and was also not counted in the final evaluation. Therefore, for the final analysis, a combination of those specimens scored as an overall “Pathology Present” and “Pathology Absent” were evaluated.

Results

Leadders: Eight of the twenty specimens initially evaluated for signs of pathology were unable to be utilized in this study due to either unobservable features or a combination of unobservable and non-pathological features that rendered the individual inconclusive. Of the remaining twelve observable specimens, four were scored as “Pathology Absent” and eight were categorized as “Pathology Present.”

Leadders

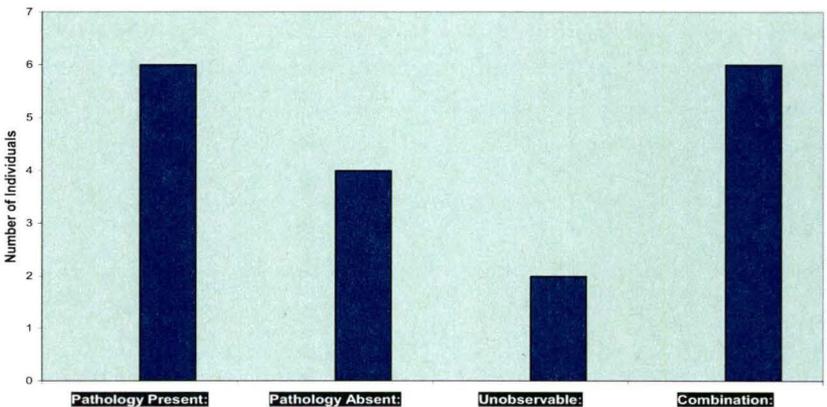


Figure 2: Results of analysis on individuals from the Leadders site

From the twelve observable specimens, eight were seen to have some sort of pathology (67%). Furthermore, it was determined that five of the eight pathologic specimens had

porosity of the greater wing of the sphenoid which identified them as possibly having scurvy; identified as "Possible Scurvy".

The specimens that were identified as "Possible Scurvy" were re-evaluated for confirmation of either normal or abnormal porosity in the greater wing of the sphenoid. The posterior aspect of the maxillae and the area immediately surrounding it were also noted. Ultimately, two of the specimens were determined to show definite abnormal porosity of the greater wing of the sphenoid and the surrounding areas and so were identified as "Probable Scurvy".

Gibson: Gibson was evaluated using the same methods and analysis that were conducted on the Ledders site. As opposed to the eight "Unobservable/Inconclusive" individuals from the Ledders site, only four specimens from Gibson were identified as "Inconclusive" and none were "Unobservable".

This resulted in sixteen individuals that were able to be evaluated, and of these, six were identified as "Pathology Absent" and ten as "Pathology Present" (62.5% show signs of pathology). Of the ten pathologic individuals, nine had shown abnormal porosity in the greater wing of the sphenoid and the surrounding areas.

Gibson

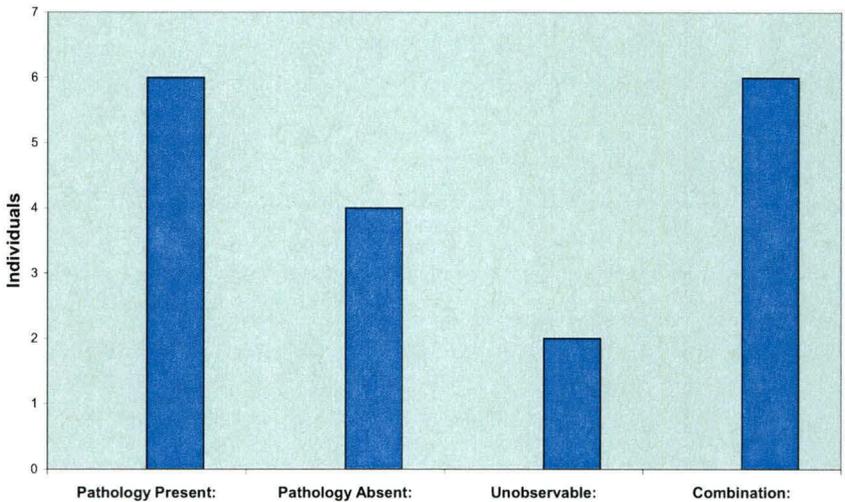


Figure 3: Results of analysis on individuals from the Gibson site

Of the nine individuals identified as “Possible Scurvy”, four specimens showed definite signs of abnormal porosity in the greater wing of the sphenoid and surrounding areas identified to be diagnostic for scurvy.

When the results for these two sites are compared, it is shown that 17% of the individuals from the Ledders site demonstrate definite signs of scurvy, compared to 25% of the individuals from the Gibson site. However, only 60% of the Ledders site and 80% of the Gibson site were able to be evaluated, and this should be noted when making any final evaluations or statements about the information gathered from the methods and analyses conducted in this evaluation.

Discussion

The methods created for the analysis of this data proved useful and relevant. All of the specimens were evaluated for unobservable as well as inconclusive features in an attempt to

limit bias. Every specimen was also able to be placed into an age category, which meant that the individuals exhibiting scurvy could also be examined to show if age was a determining factor in the prevalence of scurvy as postulated by Brickley and Ives (Brickley and Ives 2006). The results of this analysis showed that only one of the scurvy cases was a Young Infant (birth-12 months) while three individuals were Old Infants (12 months-2.9 years) and two were Young Children (3-5.9 years). These results do not correlate with what would be expected based on the previous research of several scholars, whom all determined that scurvy would occur most often between 5-24 months, with prevalence peaking between 8-11 months (Brickley and Ives 2006; Ortner, et al. 2001; Ortner, et al. 1999). It was due to the expected peak of 8-11 months that the age categories were designed as they were, with the division between Young and Old Infants, to test this scenario. In the specimens evaluated in this study, the highest prevalence occurred between 12 months and 2.9 years. Although this does not correspond with the expected results, it could possibly be in correlation with the typical age of weaning. However, more research would need to be conducted to create a valid hypothesis on this subject.

A possible causation for the lack of correlation in the ages of scurvy prevalence is the very small sample size used in this study. The largest difficulty with the results of the data collected in this study was that the small sample size had inherent bias due to the fact that one of the samples, the Gibson site, had much better overall preservation than did the other sample (Ledders). Because of this, it appeared that Gibson had more overall pathology as well as twice the amount of scurvy than did Ledders. While this may truly have been the case, this inequity in preservation may have obscured the underlying factors that created this imbalance. Dealing with small samples sizes is a problem often encountered in archaeological research. However, the evaluation performed

for this study was conducted on what was available from the archaeological record, and small sample sizes should not be a deterrent in attempting research if there is any information to be gained from the study.

The analysis that was developed proved to be extremely useful in evaluating each individual since it allowed for unobservable/inconclusive features. It would be constructive if a method could be developed to also incorporate severity of the porosity as well as scoring the presence or absence of the pathology. That way, specimens with very minimal, and possibly normal, levels of porosity could be distinguished from those with very severe exhibition of diagnostic features of scurvy. This could complement the other data and perhaps help form a more all-encompassing picture of the health of the individual, especially if more than one pathology was present.

The establishment of requirements for a specimen to be counted as overall Non-pathological, Pathological, or Unobservable/Inconclusive were also helpful in deciding which specimens could not be included for final analysis. The development of a numerical strategy in which to evaluate each specimen separately from the others helped to reduce arbitrary decisions which may have introduced bias into the research.

The original intent of this research was to consider the validity of claims that a differential diagnosis could be made that would distinguish scurvy from anemia in the skeletal remains of juveniles. Based on the information gathered from all of the differential areas for diagnosis, it seems that there may be ways to discriminate between the two metabolic diseases. The observations made in this study were all helpful in making this differentiation and this was especially true for the greater wing of the sphenoid and the posterior aspect of the maxillae. However, the greater wing of the sphenoid must be considered the most definitive means in determining which pathology is present in the specific individual in question.

This could be due to the fact that, while some other pathology such as TMJ or stresses on the dentition could affect the maxillae, there are not many other diseases that affect the greater wing of the sphenoid in this distinct way, and especially not in individuals as young as those evaluated here (Ortner, et al. 1999).

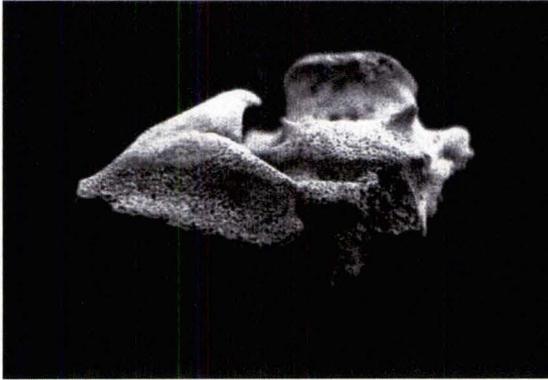


Figure 4: Super view of the greater wing of the sphenoid, exhibiting heightened porosity. (Brickley and Ives 2006)

Scholars have admitted the difficulty inherent in attempting to distinguish between the effects that the two diseases, anemia and scurvy, have on the skeleton (Ortner & Ericksen 1997). Although both anemia and scurvy cause similar endocranial, ectocranial, and orbital porosity, the diagnostic features of the greater wing of the sphenoid are present only in scurvy, and not anemia. This, along with other features such as the similar porosity sometimes found in the posterior aspect of the maxillae, the zygomatic and the temporal bones, and the ascending ramus of the mandible, help to differentiate the two separate disorders.

The second hypothesis for this research proved more difficult to assess. Based on the past research of scholars, it was theorized that the Late Woodland culture, with the growing dependency on maize agriculture which yielded lower nutritional returns as well as lowering the variety of foods exploited, as well as lower ages at weaning, leading to higher

infant nutritional stress, would exhibit more pathology than the Middle Woodland sample due to a compromised quality of life (Buikstra 1976; Buikstra 1988). However, this did not prove to be the case in the current research sample. Although the Middle Woodland sample had more available specimens for analysis, this was accounted for in that only overall percentages of pathology prevalence were evaluated. The percentages of individuals exhibiting pathology were nearly equal in the two samples, at 67% for the Late Woodland and 62.5% for the Middle Woodland. However, pathology would be expected in these samples due to the fact that all of the individuals present in the sample were young children who had died from some cause. Scurvy was the specific pathology that was attempted to be evaluated in this research, and this proved more difficult to determine in the specimens than did overall pathology.

Nevertheless, when the specimens were examined specifically for the diagnostic features of scurvy, the Middle Woodland sample demonstrated twice the prevalence than did the Late Woodland sample. The causal factors that led to this difference in scurvy prevalence can only be conjectured at this point in the current research, but such speculation needs to be attempted in the face of data that is the inverse of what previous research has concluded. The very definitions of the two time periods evaluated may need to be re-examined, as they seem to regard the cultural groups present as two very separate and distinct periods and societies that remained static for several hundred years before a sudden transition to another type of lifestyle (Buikstra 1988). The individuals represented in these samples could have died hundreds of years apart but still be represented in the same mound group. The stresses that these individuals underwent could have been extremely variable and this should be taken into account.

One avenue of study that could help create a more representative reflection of the lifestyle and stresses on the societies of these time periods could be to incorporate other

contemporary sites into the sample. Nearby sites such as Koster, which represented several occupations from the Archaic period through the Late Woodland and beyond, would be excellent to examine since variables such as geography and time would not be relevant and true pathological change through time could be assessed for this area (Buikstra 1976).

Conclusions

Further research needs to be conducted, both on the samples from the region as well as further osteological study that would create a clearer picture of skeletal manifestations of scurvy, both of which would help to better determine the pathological changes through time and to provide more conclusive evidence as to which sample, Middle or Late Woodland, suffered from more prevalent occurrences of scurvy. Research done at sites such as Koster could greatly help improve our understanding of the dietary and overall health stresses that these cultures went through. Other regions could also be studied in comparison to the cultures found in the Lower Illinois River Valley, such as comparing the Illinois Hopewell to the Hopewell cultures found in Ohio (Buikstra 1988).

Other future avenues of research could be the development of more thorough methods that would be used to evaluate pathology and the skeletal areas in which they occur. Although the methods used in the current study, proved useful, they could be improved upon. It would be of use to include other areas of the skeleton in the evaluation, in particular the zygomatic and temporal bones since they are also affected by the subperiosteal hemorrhaging of the temporalis muscle. Developing a better means of evaluating normal versus pathological porosity would also prove extremely valuable for researchers.

The progress made in recognizing scurvy and the ways in which it manifests in the skeleton has greatly enhanced our

knowledge of this pathology and its influence on past human populations (İşcan and Kennedy 1989). Over the last fifteen years, great advances have been made in the recognition of juvenile scurvy in archaeological remains. This condition has, until this point, gone largely unreported in archaeological samples. While this has probably been the result of misdiagnosis and lack of criteria for evaluating such a condition, it is unlikely that scurvy was as infrequent an occurrence in prehistoric and historic times as some scholars have suggested (Rajakumar 2001). Without a more complete understanding of the nutritional challenges faced by past populations, our knowledge of the past will remain incomplete.

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An Analysis of the Neandertal Nasal Aperture Height as a Cold Thermal Temperature Adaptation

Sarah Traynor

Abstract- *When identifying skeletal morphology in hominins, there are specific cranial and post-cranial modifications that occur due to environmental stressors, such as extreme temperatures. This paper will analyze a specific modification observed in the nasal anatomy of Neandertals. If modification of the nasal aperture is a true cold thermal temperature adaptation, then this feature will be present in other cold-adapted groups as well. Using comparative analyses of mammals, archaics, early modern humans, Inuits, Fuegians and Mongolians, it will become clear that, contrary to past predictions, the elongated nasal aperture exhibited by the Neandertals is a cold thermal temperature adaptation, whereas the wider nasal aperture is not. The narrowing of this nasal aperture as a whole causes a more advantageous exchange of heat and water vapor in the nasal cavity.*

Nasal Anatomy and Function

In order to introduce the topic of nasal adaptation to colder temperatures, the morphology of the nasal aperture as well as its functions must be understood. To accurately understand how a part of the body is going to adapt, one must know what the functional implications of those changes would be and if it would be advantageous under natural selection pressures.

Beginning at the most external portion of the nose are the nostrils, or nares. The nasal valve is the narrowest portion of the airway, which occurs two centimeters from these nares

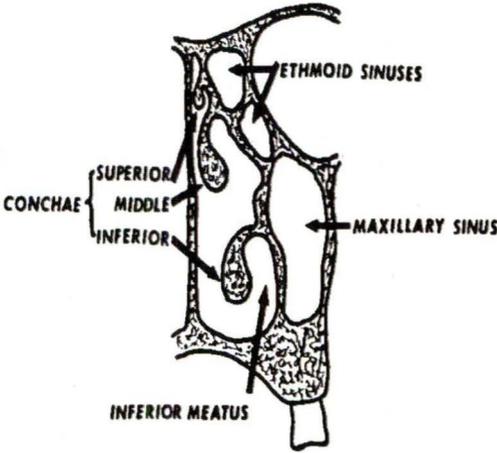


Figure 1: Internal Nasal Cavity (Shea 1977)

and accounts for fifty percent of the total resistance to respiratory airflow from nostril to the alveoli of the lungs (Mygind and Dahl 1998). The two nasal cavities, separated by a septal wall have inferior, middle, and superior conchae, also known as turbinates, placed strategically along

their lateral walls (Figure 1). Dorsal to these conchae are connections to the paranasal sinuses (ethmoid, maxillary, frontal and sphenoid) and the nasolacrimal duct. These conchae function as humidifiers and temperature regulators of the inhaled air from this narrow nasal valve. From here, the air continues through the nasal cavity to the lungs to oxygenate the blood in the capillary beds located in the alveoli. Without regulation of the temperature and humidity of air, the function of the alveoli is severely compromised (Franciscus and Trinkaus 1988). The narrowness of this internal nasal cavity promotes resistance from the nasal valve and the conchae creating an eddy effect of the air trapped in the nasal cavity. This promotes the transfer of airflow from smooth and laminar to rough and turbulent, thereby increasing the exchange of heat

for longer periods of time (Taylor 1981; Franciscus and Trinkaus 1988; Churchill et al. 2004).

This nasal cavity is lined with mucosa that is heavily innervated by arteriovenous anastomoses. There is more blood flow per cm^3 in this mucosa than in the muscles, the brain or the liver (Mygind and Dahl 1998). This vast amount of blood flow throughout the mucus lining surrounding the conchae is extremely efficient at exchanging heat and water from the capillary beds to the incoming air. To put the air-conditioning potential of this mucosa into perspective, Ingelstedt (1956) performed an experiment demonstrating that when room temperature air (23.3 degrees Celsius with an average humidity of 30 percent) entered the nose, the minimum temperature of the air became 32.2 degrees Celsius and 98 percent humidified. Under colder temperatures (0 degrees Celsius and relative humidity of 50 to 60 percent), the inspired air reached a minimum temperature of 30.7 degrees and was 100 percent humidified.

The blood flow of the nasal mucosa is dependent on the thermoregulatory response of the body. The blood flow increases when there is vasodilation of the blood vessels. This increase in blood flow cools the venous blood through the transfer of heat from the veins to the arteries located in the anastomoses. Baker (1979) indicates that slight changes in the temperature within a dog's nasal venous blood will change its brain temperature due to the vital connection of the arterial blood supply from the nose to the brain. In other words, regulation of blood flow in the nasal mucosa can influence not only the temperature of the airflow entering the respiratory system, but the temperature of the brain as well. In order to survive in chronic cold thermal temperatures, the body's physiological response of vasodilatation and vasoconstriction of the blood vessels is vital not only for the warming the inspired air, but also for regulating the core temperature of the

body to around 37 degrees Celsius through the constriction of peripheral blood vessels.

Not only is the nasal cavity important for warming and humidifying the air during inhalation, but it is also critical for the capture of heat and water while exhaling as well. The body conserves the vast majority of water through the efficient retention of moisture while exhaling warmed air from the lungs. This additional heat from the warmed air is transferred to the vascularized mucosa before exiting the external nose altogether (Mygind and Dahl 1998; Holton and Franciscus 2008; Franciscus and Trinkaus 1988).

In addition to humidifying and warming the air in the nasal cavities, the mucosa lining also provides the body with particle filtration and immunity protection acting as the body's first defense against incoming pathogens and particles in the external environment. This mucosa serves an integral role as part of the immune system.

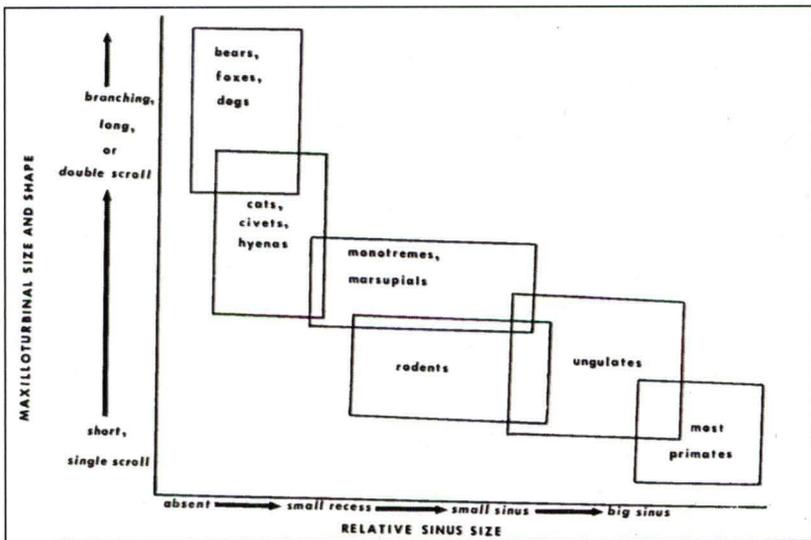


Figure 2: Conchae size and shape versus size of nasal cavity (Shea 1977)

For many mammals, olfaction is heavily relied upon for survival. For example, dogs, cats, and rodents are highly dependent on their olfactory glands within the nose as opposed to non-human primates that rely mostly on sight rather than smell. These olfactory-dependent mammals have extremely dense conchae labyrinths that contain olfactory receptors. The decreased reliance upon the olfactory system seen in primates has allowed for the reduction of the number of conchae, thereby limiting the amount of surface area for olfactory receptors. Similarly, in modern humans, the conchae are reduced.

The olfactory receptors in humans are located above the superior nasal concha (Shea 1977). The increase in the relative size of the nasal sinus of most primates (Figure 2) demonstrates not only a different morphology when compared to other mammals, but a different nasal physiology as well. Having drastically different nasal conchae morphology and function permits primates (hominins included) to adapt differently to cold thermal temperatures than other mammals, specifically in the internal nasal cavity (Shea 1977).

Rae and colleagues (2006) performed an experiment in which the developmental response to cold thermal temperatures in rats was studied. In this experiment, rats were reared in both warm (22 degrees Celsius) and cold (5 degrees Celsius) temperatures. This research demonstrated that the temperature in which a rat is raised can significantly change the shape and morphology of not only the external nasal structures, but the internal nasal cavity as well. The results suggested that when rats are raised in a colder temperature there is a reduction in nasal volume, independent of skull size. The results are contradictory to what is seen in the natural world of primates. When primates, like Japanese macaques, are in colder temperatures, there is a significant increase in the size of their nasal cavities (Rae et al. 2006). This experiment supports the evolutionary differences that are known between non-primate

mammals and primates, and can now be viewed in terms of nasal function and morphology in hominins as having notably different adaptations to the same environmental stressors than most mammals.

Predicting Cold Thermal Temperature Adaptations in the Nose

There are specific cranial morphologies that have been suggested to signify cold thermal temperature adaptations of humans. Some of the more prominent cranial morphologies, such as facial robusticity, prognathism, and dental variation, are fairly well preserved in the fossil record; this is ideal when studying macroanatomy. For features such as the delicate internal nasal structure, or emissary veins, paleoanthropologists are at a disadvantage when studying the fossil record; therefore, many comparisons are made between living modern populations and the remnants of ancestral hominins. Neandertals are a rarity among the hominin record because the roots of the conchae and the nasal aperture and sinus are identifiable. This being said, the findings are limited at best.

Nasal characteristics have been associated with natural selection due to their functional relationship with thermoregulation. Because the external nasal morphology is in direct contact with the external environment, there are selective stressors influencing this structure. This paper will recognize natural selection as the main influence of nasal anatomy, and will demonstrate why it is not the width, but rather the height of the nasal aperture that is influenced by cold thermal temperatures.

Plesiomorphic Constraints

Countless comparisons have been made between Neandertal populations and modern populations when assessing the functional significance of a wider nasal breadth. The prototypic Neandertal living in cold thermal temperatures

has mid-facial prognathism, accompanied by a wide and elongated nasal breadth, what appears to be large conchae (or at least the roots of the conchae), and a voluminous internal nasal cavity. The pattern demonstrated by *most* modern humans living in the subarctic and superantarctic is an elongated nasal aperture and a narrowed nasal breadth. The difficulty in making direct comparisons between Neandertals and modern humans becomes clear when one assesses each of their humble beginnings. Reflecting back on the population history of the Neandertals, it is known that a population separated from an African population of archaic *Homo* around 300 kya and traveled through the Levant into Europe, persisting there until about 30,000 years ago. The Neandertal cranial morphology displays definite plesiomorphic, or archaic, characteristics such as robust facial features, larger dentition, and large brow ridges.

Modern humans have a completely different ancestry that brings into question the comparison of the two groups. Modern humans today do not find their closest ancestors to be the archaic *Homo*, but rather, an anatomically modern population that left Africa about 100 kya. This modern morphology was drastically more gracile than that of the archaics not only in the post-cranial anatomy, but the cranium as well.

The evolution of a population is restricted, so to speak, when it selects for a trait because natural selection can only perpetuate or terminate traits that are already present in the individual. This is known as descent with modification. Recognizing that Neandertals are the descendents of archaics and modern humans are the descendents of early anatomically modern humans, one may ask if the two groups can really be compared. The answer to this is *yes*, because they are both descendents of an African population that did interbreed. This can be supported by the genomic similarities of Neandertals and modern humans discovered by Green and his colleagues

(Green et al. 2010). That being said, there are plesiomorphic constraints that must be taken into consideration when comparing the two groups. With this in mind, it can be assumed that Neandertals evolved their own set of adaptive traits in addition to retaining those plesiomorphic traits.

Modern Humans and Their Own Form of Cold Thermal Temperature Adaptation

Studying the morphology of modern human populations in some of the most extreme locations around the world can facilitate deciphering the morphological cranial variation observed within *Homo sapiens*. When compared to modern populations living in equatorial regions that exhibit a wider and lower nasal aperture, these cold thermal temperature adapted groups demonstrate how much an environmental stressor can modify a specific morphology.

Measurements of Inuits, Fuegians, and Mongolians can further the discussion of nasal breadth versus nasal height.

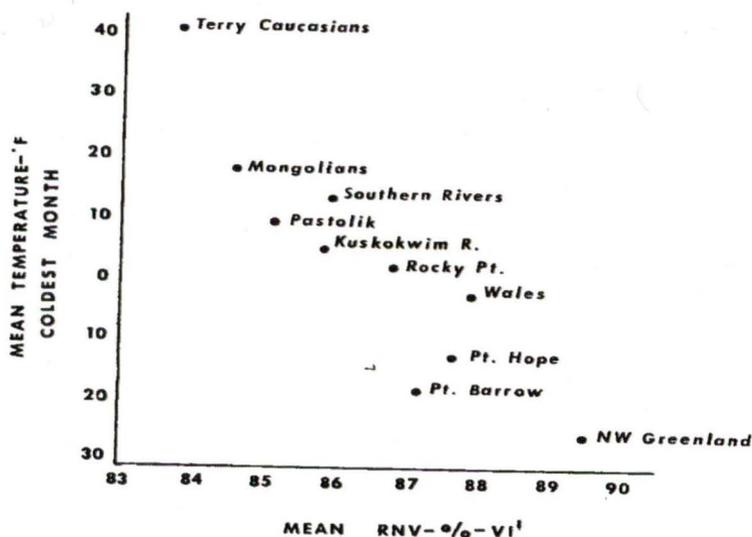


Figure 3: Coldest month mean versus the mean nasal volume (Shea 1977)

Shea (1977) researched seven Inuit populations along the Alaskan coast and compared them with a population from northwest Greenland, the Mongolians and Caucasians in the United States. This study demonstrated that there is a correlation between cold thermal temperatures and a large internal nasal volume (Figure 3). The significance of this nasal volume expansion is that this cavity consumes a relatively large space within the mid-facial region (Shea 1977). This pattern was also compared in a study by Wolpoff (1968), which measured the nasal breadths of similar Alaskan Inuit populations. It was observed that the average nasal breadth of both males and females was 23.75 mm, whereas the nasal height was an average of 52.3 mm. Inuits have adapted to the severe Alaskan climate by decreasing their nasal breadths, increasing the height of the nasal passage, and consequently increasing the size and narrowing the shape of the nasal cavity itself.

This observed increase in volume of the nasal cavities has a functional significance related to humidifying and regulating the temperature of the frigid air entering the external nares. The enlarged volume of the sinus allows for surface area expansion of the three conchae. This signifies that a greater amount of mucus will surround the conchae. This relationship creates more anastomoses, which are then readily available to exchange water and heat with the inhaled air in addition to capturing more water and heat during exhalation. Similarly, a narrower cavity leads to increased efficiency of the exchange.

In addition to the Inuits in the north, four hunter-gatherer groups in Tierra del Fuego, located in southern Chile, have observable adaptations to the colder thermal temperatures. Historically, Fuegians have very poor clothing compared to Inuits, but it is important to understand that clothing does not protect the nose from freezing air flowing into the lungs. This is why physiology alone must adapt to these harsh conditions.

There were 180 skulls measured in this Tierra del Fuego study, which demonstrated that the Fuegians have some of the highest craniofacial dimensions including a nasal height of 55 mm along with a nasal breadth of 24 mm (Hernandez et al., 1997). In other words, they have the narrowest cavities compared to other modern human populations. In a multiple regression analysis, the nasal height was more likely to be attributed to a cold thermal temperature adaptation than the nasal breadth. This analysis supports the idea that a wide nasal aperture is not as vital in cold thermal temperature adaptation compared to an elongated aperture. Elongating the nasal aperture seems to reflect a human adaptation to cold thermal temperatures (Hernandez et al. 1997).

The Mongolians are unique because they have a wider nasal breadth than what is known for other modern human populations living in cold thermal temperatures. The Mongolians and Buryats from northern Siberia are the exception to the trend when referring to the modern cold-adaptation pattern. These groups actually have larger nasal breadth *and* nasal height measurements. Even though they have wider nasal apertures, as seen in Figure 3, the Mongolians do fit the nasal volume trend. Because of this already wide nasal breadth, the Mongolians have increased nasal height thereby increasing overall volume, and still achieving the same effect of narrowing the cavity and allowing for more surface area for mucosal arteriovenous anastomoses. That increase in sinus volume is occurring on a smaller scale in populations from the south to the north as well (Hernandez et al. 1997). It is expected that when traveling from lower to higher latitudes; or from warmer to colder thermal temperatures, there will be an increase in nasal height because there will be more climatic pressures and consequently, a more narrow and voluminous nasal cavity.

How Did the Neandertals Adapt to the Cold Thermal Temperatures?

Some of the major cranial features exhibited by the Neandertals are: enlarged brow ridges, forward-projecting zygomatic arches, larger conchae, an increased distance between the nasion and nasospinale, and a wide nasal aperture (Figure 4). Compared to modern cold-adapted populations, with the exception being the Mongolians and Buryats, this wide nasal aperture is unusual.

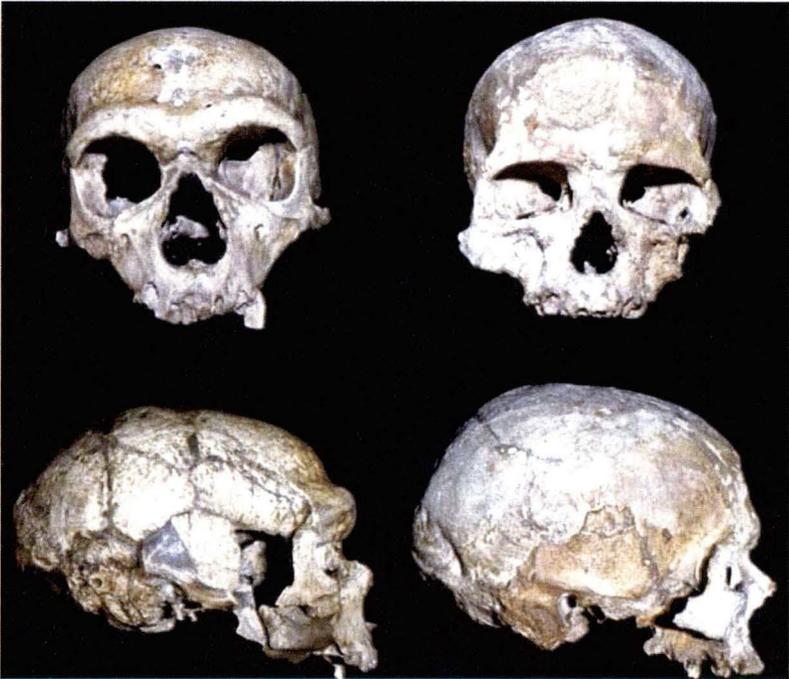


Figure 4: La Chapelle aux Saints (Neandertal) on left; Cro-Magnon (modern human) on right (Weaver, 20094)

Nonetheless, Neandertals do share a trait with the modern populations mentioned earlier, and that trait is an elongated nasal aperture, or an increased distance between the

nasion and nasospinale when in reference to the cranial osteometric points.

When Franciscus (1999) measured the nasal breadth of a large sample consisting of: Non-Neandertals Archaics, Neandertals, Early Modern, Late Modern, Mesolithic, Holocene, and modern individuals from around the world, his results indicated that the mean nasal breadth of Neandertals is within the range of archaic individuals living in Africa, Spain, and Israel (Table 1). The wide nasal aperture confirmed by the variation in archaic and Neandertal samples suggests that this

Sample	n	Mean, mm	SD, mm
Non-Neandertal, Archaic	13	33.4	4.3
Neandertals	14	32.4	3.2
European, Early Modern	23	26.0*	2.1
European, Late Modern	13	23.8*	2.0
Western European, recent	112	23.4*	1.9
Central European, recent	109	24.0*	1.8
Near Eastern, recent	72	24.2*	2.3
North African, Mesolithic	30	27.4*	2.1
North African, recent	68	24.1*	2.0
African, Early Holocene	8	26.0*	2.3
African Bantu, recent	119	27.1*	2.1
African Khoisan, recent	43	25.8*	2.1

†, $P < 0.05$ (significant differences from the Neandertal mean).

Table 1: Nasal breadth measurements (Franciscus, 1999)

morphology presents itself as a plesiomorphic trait. Neandertals exhibit the largest nasal height and nasal breadth in the genus *Homo* (Holton and Franciscus, 2008). Assuming nasal height is under natural selection, the presence of this morphology in Neandertals indicates that Neandertals were influenced by the environment and consequently adapted to the inflicting stressors. The evidence suggests that because the Neandertals were limited by the archaic plesiomorphic

characteristic of a wider nasal breadth, they increased that nasal height, a characteristic of all cold-adapted humans. By increasing the nasal height, a narrower passageway was created for airflow and more mucosal interaction with the air for heat and water exchange was possible. The selective pressure was acting to increase efficiency of the exchange rate.

The Neandertals have been known to have a considerable amount of anterior dental wear associated with using their anterior dentition as a "third hand" to assist in everyday activities. Yoel Rak and Erik Trinkaus developed different biomechanical models to account for this stress on the craniofacial structure of the Neandertals (Trinkaus 1987). A wider nasal breadth has been attributed as a secondary effect to this anterior dental loading in these models. If anterior dental loading caused an extreme shift in the mid-face of the Neandertals, this should be present in the Fuegians because they use their teeth like third hands as well. The wear patterns on the anterior teeth of the Fuegian tribes are the remnants of past activities of holding bone, wood, leather, and opening shells with their teeth. They have the similar behavior of anterior dental loading, but they exhibit some of the narrowest and highest nasal apertures seen in modern humans. The extreme use of the anterior dentition did not widen the nasal apertures seen in the Fuegians; therefore, the question of whether the Neandertal nasal aperture was affected by this same behavior is unresolved.

Conclusions

Through the comparison of Neandertals with modern, cold-adapted populations around the world, it can be concluded that the Neandertals do exhibit a cold thermal temperature adaptation to environmental stressors. All of these groups demonstrate similar patterns of elongating the nasal aperture and thereby narrowing the nasal cavity. This trait is under selective pressures because the temperature and water

exchange between the anastomoses and airflow requires an efficient physiological process. The efficiency is accomplished through the increase of turbulent flow in the narrowed nasal cavity, along with an increased surface area, allowing for mucosal anastomoses. Lastly, among the nasal characteristics mentioned is nasal breadth. Contradictory to previous predictions, the nasal breadth is not shown to be under selective pressures and is simply a plesiomorphic, equatorial characteristic demonstrated by Non-Neandertal archaics as well as Neandertals.

The mid-facial prognathism demonstrated by Neandertals is a significant morphology that warrants an explanation. When there is an increase in the volume of the sinus, there would have to be a prognathism of the region including the zygomatic and maxillary bones. Due to this nasal cavity expansion, the external morphology of the mid-face would protrude, explaining the mid-facial prognathism exhibited in Neandertals.

When examining past skeletal morphologies, it is advantageous to know the function of the morphology that is under investigation. Laitman and colleagues (1996) stated, "Chewing, walking, reproducing, thinking are all fine, but first one has to breathe. Anthropologists sometimes seem to forget about this; evolution never does." Being conscious of the physiology of breathing and the morphology of the Neandertal nasal aperture allows for more clarity when studying morphological variation within hominins. Changes in facial features can identify the specific functions achieved via the modification. In this case, a more efficient regulation of temperature and humidity, in and out of the respiratory tract, required an elongation of the nasal aperture, which both narrowed and increased the nasal cavity.

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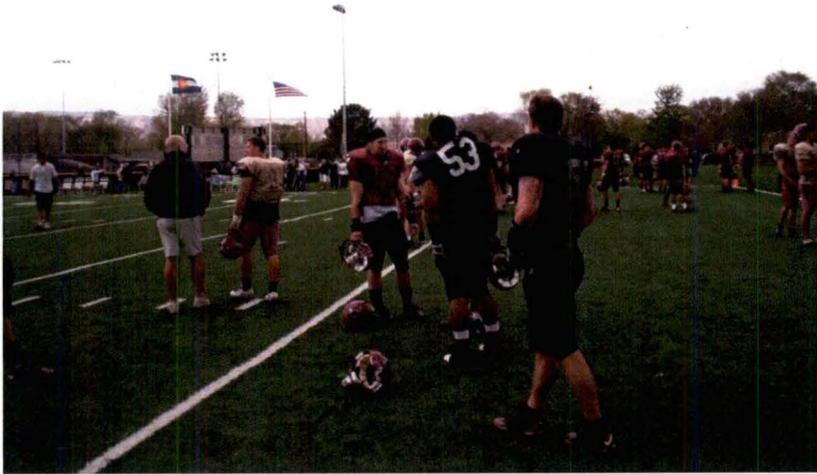
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I. Cultural Anthropology

Every Football Player Dies Twice: A Story of Division II Football

Greg Batchelder



Abstract- *The following is an ethnographic account of the Mesa State Mavericks, a Division II football team representing a small college on the western slope of Colorado. Background research revealed that student-athletes face added pressures, and these are magnified on the football gridiron. For most Division II players, their senior year would signify the end of their athletic careers. I would spend the 2009 season with the*

team, using the hermeneutic method for my research. It was my quest to discover why these young men push themselves so hard and sacrifice so much for a sport which will come to an end all too soon.

Prologue

I had butterflies. Was it because I was meeting JR, Head Coach of the Mesa State Mavericks football team for the first time? Or was it walking across that practice field, that artificial turf artificially green in the cold February sun? I hopped across the mud puddles leading to the temporary modular units housing the football staff's offices while the Saunders Field House was being remodeled. I was relieved to find the coach's office immediately to my right. JR was on the phone talking about a recruiting prospect. I imagined him having this type of conversation all the time, breaking down a young male's weight, speed, knowledge of the game, heart, determination, and character. I wanted to make a good impression; after all, he was my gatekeeper, providing me access to his players, trainers, and coaches.

He hung up the phone and waved me in. "Come on in, sit down, relax," he said with a welcoming smile and his hand outstretched to grasp mine. I introduced myself and sat down, relieved to be made so welcome. I started telling him about my plans for a semester-long ethnography focusing on the football team. I wanted to know about the players' backgrounds, goals for the upcoming season, fears, and what football means to them. This is Division-II football; none of these young men are going pro. Why sacrifice so much for a game? This is where the coach laid a jewel on me, "Every football player dies twice." Wow. That statement says so much. The idea that a person would equate leaving this game to dying is a powerful analogy. Why do young men, who are not being paid or developing their careers as professional football players, put so

much energy, so much of themselves into a game that they equate leaving it to dying?

Working on a college campus, I hear both sides of the debate on the usefulness of football. Generalities about sport are magnified for football. It is easily the most masculine of sports played in the United States. Butterworth (2008:259-260), states that football promotes masculinity through controlled violence and social bonding. The role of women is regulated to trainers, cheerleaders, and spectators. Football, more than any other sport, is a man's game. Many complain about the time student-athletes must devote to their sport, while others complain that colleges spend too much on football programs. On the other side, people argue that football programs actually make the institutions money and add to the college's pride and students' sense of belonging to a larger whole.

There exist challenges that all student-athletes face. Extreme time demands, the culture of athletics, and the relationship between academics and athletics in the college environment all contribute to the difficulties athletes must reconcile. Jolly (2008:145-151), states that the schedules athletes must adhere to are a major cause of stress, particularly among freshmen. Jolly continues by stating that athletes very often segregate themselves; they work out together, room together, and take many classes together. One half of student-athletes surveyed reported feeling discriminated against by professors because they were athletes (Jolly 2008:147).

Student-athletes must balance their roles as students and as athletes. Yopyk and Prentice (2005:329-336) found that they assume different identities depending on the task at hand. These changes occur instantly as student-athletes move from situation to situation. They also found in an experiment, that when student-athletes were primed with their athlete role, they performed worse on a math test than when they were primed with their student role.

In other research, it has been found that the less discrepancy a student-athlete has between his two roles, the greater his sense of well-being and higher life satisfaction. This suggests that when these two roles are integrated in a meaningful way, the more the individual experiences positive adjustment and satisfaction (Killee-Jones 2006:168). Harrison and Lawrence (2003:390), state that it is important for student-athletes to be encouraged not only to identify with their athlete role, but also to focus on their student role to help with transitioning to life after sport. The authors also call for personnel of athletic departments to encourage black athletes to prepare for their life after athletics and to acknowledge that they have acquired valuable skills for their lives in the "real world."

Because of the extra pressures that student-athletes face, Gill (2008:85-87), calls for social workers to become more involved in the lives of student-athletes. He states that because of their physical prowess and temporary privileged status, athletes are often overlooked as a population in need of mental health services. It is estimated that as many as 10-20 % of college student-athletes struggle with depression (Gill 2008:85).

It is obvious that student-athletes face added pressures, and these are magnified on the football gridiron. It was my quest to discover why these young men push themselves so hard and sacrifice so much for a sport which will come to an end all too soon. I wanted to hear in their own words what football means to them and what they have overcome to pursue football glory. Between February and May, 2009, I would conduct twelve interviews with players and coaches. In addition to this, I would attend various workouts and practices. This is a journey I wanted to embark on with the team, walking this path of discovery together, a journey I feel will end too soon for me also.



The Lawn Bowl

4/25/09

On a cool, overcast morning, the Mesa State Mavericks held their annual spring intra-squad scrimmage game, affectionately known as the "Lawn Bowl." It is a college tradition at the end of spring workouts for the football team to play a scrimmage game, pitting the offensive units against the defense. At some major Division I schools, students and families fill the massive stadiums for an advance look at the team who will carry the responsibility of bringing their schools a championship on their broad shoulders. Here at Mesa, it is the same, although on a smaller scale. It is a tradition here that fans set up lawn chairs on the sidelines to get a close look at the team who will be competing in the fall for the Rocky Mountain Athletic Conference (RMAC) title. I arrived a few minutes before the scrimmage was supposed to start and set up my lawn chair amongst the parents, siblings, and girlfriends

who lined the west sideline. The team was doing their warm-ups, stretching their overworked muscles in the middle of the field while an assistant coach barked out orders only the players understood. From there, the players broke off into their separate groups. The linemen went to the north end-zone, firing off the ball, in their classic stance, ready to hit or be hit by the opponent across from them. The offensive skill players (quarterback, receivers, and running backs), gathered at the twenty-yard line and ran through formations and passing routes. The defensive backs practiced dropping into coverage and reacting to the ball. I took this opportunity to take some photos of the players and talk with some of their parents and fans.

The players finished their warm-ups, and the ball was placed on the twenty. The players now had a chance to show the coaches, their parents, and fans just what they were made of. The offense started quickly, getting a first down on the third play from scrimmage. This year, the Mavericks will be running the "West Coast" offense. This particular form of offense was popularized by 49ers coach Bill Walsh in the 1980's. The "West Coast" runs counter to the football tradition of establishing the running game to open up the vertical passing attack. In the "West Coast," the offense emphasizes a short, horizontal passing attack to stretch out the defense and open up running lanes. In this style of offense, the quarterback must make extremely quick reads to determine which receiver will be open, then must deliver the ball in an accurate, timely fashion. Managed effectively, the "West Coast" provides the offense with the opportunity to make big plays and to score a lot of points quickly. It puts a lot of pressure on the quarterback to be accurate and intelligent with the ball. It speaks to the confidence the coaches have in the abilities of their two red-shirt freshmen quarterbacks that this offense is being entrusted to them.

After their first down, the offense bogged down, and it was forced to punt. It had the same result on the next three series, neither quarterback having success against the Mavericks swarming defense. The maturity of the defense really showed, with its abundance of returning seniors leading the way. Every time an offensive player touched the ball, he was met viciously by four or five maroon-clad defenders. The offense was able to connect on some big plays, though. After five punts, quarterback MM connected on a big pass downfield, putting the offense in field goal range. On the next series, the other QB, RR, not to be outdone, moved the offense downfield and scored on a pass down the sideline.

The morning wore on, with the offense struggling to move the ball on the stingy Maverick defense. The sounds of a ladies' softball game echoed from the field next door. The Mavericks finished their scrimmage by working on goal-line plays, and then met at the center of the field to hear from their coaches. Afterwards, the players and coaches mingled with parents and friends, and I approached some of the players with whom I had gotten familiar in the past weeks. Assistant coach AB gave the defense a "...B, I thought we did a good job in run support and being disciplined. We got a lot of potential, but room for improvement. For a good defense, you need to get a lot of hats to the ball, which we did."

I next looked for center RS, who, with his brick-house build and big smile was pretty easy to find. I waited as he gave a teammate a bear hug, then approached and asked him how he felt about the scrimmage.

We did a lot of improving. This spring we've come a long way. Some guys, when their number was called, they really stepped up. Our defense is a really good defense; nobody in the RMAC can hang with us. On offense, if anything, we're thinking too much. We're a physical team, a strong team, a lot of teams can't hang with us. On the offensive side it takes a lot of mental ability, sometimes on the offense we

think too much, we just need to line up and play. It felt good today.

I walked up to quarterback MM, with his golden hair and Elway-esque demeanor, looking as if he'd be just as comfortable on a surf board as running the Mavericks' offense. It was fun to get into a game situation. This is what you live for right here. Get to play and go through the offense instead of just practicing. We got some stuff to work on, but I think overall we came a long way this spring. I'd give the offense a "B". We made a few mistakes, but we protected the ball real well.

The other red-shirt freshman QB, RR, felt the same way. "I felt pretty good out there. We're young on offense. They're an experienced defense, with a lot of seniors. We got five or six red-shirt freshmen starting on offense. I need to stay in the pocket a little more." When asked what it's like to have two red-shirt freshmen battling it out for the starting job he replied, "It's fun. Competition makes you better."

As I walked off the field, I couldn't help feeling a sense of incompleteness. I had a desire to continue this journey with the team. How could I quit now? How could I leave the team before their ultimate goal is realized, winning the Rocky Mountain Athletic Conference and contending for a national title. Or having the season end abruptly, with a loss on a cold winter field? I thought back to the first day I met with the team, back in late February, nervous and unsure of where this project would take me.

"I won't let myself fail"

2/23/09

On a wet day in late February, to start my interviewing, I walked into the cavernous temporary weight lifting facility that the team was using while their digs at Saunders Field House were being renovated. This massive concrete building had been used earlier by the local City Market as their

warehouse. It was cold and wet in spots, with plywood walls and banks offlorescent lights hanging from the ceiling. It smelled of wet plywood and cement. "Tool" was blasting away on a boom-box while players, dressed in an array of workout clothes, stretched out to warm up for the weight-lifting routine which the coaches would push them through. I situated myself in the hallway with my recorder and notebook and asked the first player I saw if he wanted to be interviewed for my class paper.

CR is a tight-end who will be fighting for a starting spot this year. He attended Smokey Hill High School in Aurora, Colorado where he was a stand-out athlete, being awarded All-Conference on both the offensive and defensive lines. In spite of his success in high school, he "didn't plan on playing college ball until coach JR gave (him) a shot here." When he was growing up, football meant everything to him, and coming to Mesa to play college ball was a dream come true. He said it was good for him to leave the Denver Metro area and his family and friends to come to a place "where (he) could grow up as a man and play football." I asked CR about his goals for the upcoming season.

The RMAC championship is the goal utmost on our minds. We'd love another shot at the Division II playoffs. I, myself, I don't have any goals other than the team and helping them win the RMAC. I'm not the kind of guy who focuses on individual success. I just like to play.

CR said his biggest fear was being injured, and that "I won't let myself fail." When asked what his ultimate football fantasy was he replied, "Scoring the winning touchdown. Catching a pass on a circle post, scrambling down the field, breaking tackles, scoring the touchdown, and winning the championship for my teammates." I told him about how coach JR had told me that "every football player dies twice" and asked him what that meant to him. "It's always gonna leave you. There will always be a day when the game will not be

able to be played by you. When you can't play football anymore, it's a part of you that's lost."

CR was very friendly, cooperative, and respectful almost to the point of embarrassing me. I could tell he had done interviews before; he was adept at saying all the right things. I was most impressed with how he talked about leaving home to grow up as a man. I rode my bike home from the interview feeling not only good about getting my first interview with a player, but also about what a respectful, humble, and thoughtful person CR appeared to be. I was excited about meeting more of these young men and hearing their stories.

"Give back to the kids"

2/25/09

I met AB on the "quad" at Mesa State. I had decided, for this interview, to just glance over my list of questions and then put them away. I told AB the interview would be more like a conversation. I feel this method allowed me to slow down and focus on what AB was saying. AB grew up in California and was a stand-out wide receiver and defensive back who still holds records for receptions and total yards at Soledad High School. After playing football at a junior college, he was recruited to come to Mesa to play defensive back for the Mavericks. After a distinguished career with the Mavericks, he played two years of arena football, and then was asked to return to Mesa to be an assistant coach. "Football had become a business, and I knew it was time to move on." He said that when he quit the game, he rediscovered his sense of self through coaching. Now AB's goal is to impact young players and use football as a tool to build relationships with the next generation. After he gets his teaching degree, he wants to return to California to teach and coach at the high school level. "I want to give back to the kids who are growing up on the same streets as me, and football is a way to do that because it

teaches all the lessons of life." When I asked AB what his biggest fear was, he replied, "Not taking the opportunity to help someone in need." That really summed up the interview for me. It reflects AB's attitude of using what he had accomplished to impact the lives of people in a positive way. He would have a chance to show this to me in a personal way in the following weeks.



"God, my family, then football"

3/02/09

Five years ago, RS, starting center for the Mavericks, never thought he'd be here. "It came outta nowhere." He didn't start playing football until his junior year of high school, but he obviously made an impact, because he was recruited by Mesa and started for them as a sophomore. He describes himself more as a student-athlete than an athlete-student. "I want to get a good education, and if football's the tool to get me there, then

so be it." RS surprised me by having such a balanced perspective on his football career. This challenged my view that football was everything to these guys. "If I had to make a list of my priorities, I'd say God, my family, then football." To him leaving the game will be "another chapter, I'll be flipping the page of my life. As long as I've given everything, I can walk away happy." He says that through football he has learned to be grateful and has become mentally strong. "If you can get through some of these workouts, you can get through your homework." When I asked him about his biggest football fantasy, he replied, "Winning the championship with my team. I love my teammates."

Tragedy

3/04/09

I was walking my dog down the alley in the early morning before the sun came up when my phone rang in the pocket of my hoodie. It was strange to get a call so early in the morning. It was my brother. His son, Justin, had been in a car wreck late last night and was in intensive care at St. Anthony's Trauma Center. He was currently in surgery, as the doctors were removing his fifth cervical vertebrae and putting in a man-made one. Justin had no movement or feeling in his extremities, and his life was in danger. Justin would remain in the ICU for five weeks. During this time, I would often see AB on my way to class. He would always ask how Justin was doing and give me a fist-pump saying, "Stay strong." Justin is now at Craig Rehabilitation Center, and even though he has not regained movement of his arms and legs, he is positive, strong, and committed to doing all he can to make the most of what he has been dealt. I had first thought I might cancel some of my interviews when the accident happened, but I'm glad I didn't, because the attitudes of the players I spoke with had a positive effect on my attitude and outlook. They talked of teamwork, sacrifice, and family, and I felt I wasn't alone in my grief.

"This is our big-time"

3/20/09

I met coach JR back in his office for my second interview with him. We started off talking about his past and about what had led him to be the Head Coach of a Division II football team. JR grew up in Steamboat Springs, Colorado and went to college at the University of Wyoming where he started 47 consecutive games for the Cowboys. From there he went on to play for the '85 Chicago Bears, the team that won the Super Bowl. He was injured in training camp and tried to come back, but was unable to pass the team physical the next year. "I knew my playing days were done. It's a hard thing to move on, but I was able to put that energy into coaching." JR knew at an early age that he was going to end up coaching. His dad was a wrestling coach, and JR was blessed with good coaches throughout his playing career. Now, he had an opportunity to instill what he learned into the program here at Mesa. "I want to provide the opportunity to be successful, not only on the football field, but also in the classroom." To him football is "a way of life. The camaraderie you build with people is amazing. It's life, relationships, going to work to accomplish something." JR spoke at length about his goals for the football program.

Our number one goal is to get guys through here to get an education. I want to make sure coaches care about the student-athlete and make it a positive experience. Don't get me wrong, we're gonna work, and work extremely hard. We wanna win. This is our big time. I dream of championships, being able to win a national title. I think we're blessed here at Mesa. We have guys who are here for the right reasons, making this our big time. I want good people, those who know we're not special, that we're not above anybody else, who treat people how they want to be treated. Just be good to people man. When we get on the field you don't have to be so good, but when you're in society, do things right.

As my interviews went on, it became very obvious that the attitude of JR had permeated his team. The players I spoke to exemplified their coach's desire to "do things right." At the same time, they treated this as their "big time" and wanted to get the most out of their experience. They all wanted to win the RMAC for the team. They were always respectful and accommodating to me. For an outsider, I was beginning to feel welcome and that somehow I belonged with them.

"It's all about fun"

3/23/09

The team was back at their regular weight room in Saunders Field House doing "testing." The players were being timed in the 40-yard dash, their height and weight were recorded, and finally they were tested on weight and repetitions on the bench-press. As a player would lay on the bench, preparing to push the weight up as many times as his body could possibly muster, his teammates would shout encouragement. And I do mean shout. The gym was a cacophony of noise: grunts, pants, yells, weights banging against each other and their stands, metal on metal. Although I recorded my interview with RW, as I had been doing with my other interviews, when I listened to it later it was mostly unintelligible because of all the noise.

RW was a stand-out linebacker for Glenwood Springs High School and even though he was not recruited by the Mavericks, he found a spot on the team through his work ethic and knowledge of the game. He got into football in middle school because his friend was into it. For RW, it is all about fun. Through football, he could "be with the guys and have fun." Now, as a senior, his main goal is to help the team win the RMAC championship. He spoke about the difference between Division I programs and football at Mesa. Here, Coach JR "gets to know everyone personally. In Division I, the coaches don't even know your name when you're a

freshman. Coach JR would do anything for you." We talked about what it will be like to leave the game. "You put nine or ten years into this sport, you put a lot into it, and when it's over, it hurts bad. It's hard to walk away."

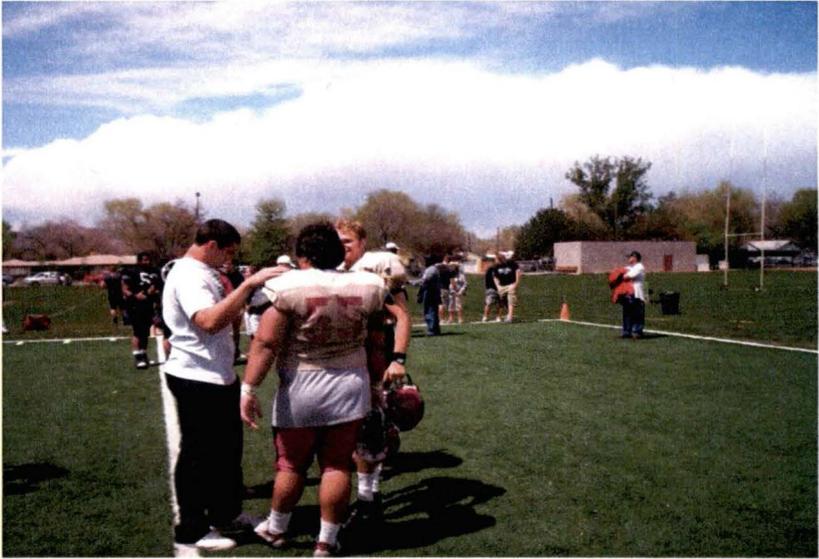
"Appreciate everything you have"

3/30/09

On the first day of spring practice, it was cold in Grand Junction. It had been snowing off and on all day, interrupted briefly by glorious sunshine. I was freezing my tail off in my sweats and hoodie while the players practiced in shorts, jerseys, and helmets. Their only source of warmth was their exertion and attitude. The players were constantly reminded by the coaches that "we're not quite live" to get them to quit hitting each other at full speed. After weeks of weight lifting and studying their playbooks, the players were enthusiastically playing the game they love so much, even if it was only against their own teammates. At the end of practice, the coaches gathered the team together. "Let's practice discipline in everything we do. Go to class. Hold each other accountable."

Afterwards, I grabbed senior wide-out JM for an interview. This time I didn't take notes, and I feel this helped me focus in on JM and practice more active listening. JM was quiet and reserved, but he exuded a confidence that impressed me. When I asked him about his goals, he was very explicit. "First of all, we always want to win the championship. Go undefeated in the RMAC, get 1,000 yards receiving, 50 catches, and a couple of touchdowns." JM started for the Mavericks as a freshman and was second team All-Conference as a kick-returner. Then during his sophomore year, he broke his leg. Rehab was "a tough thing to go through. Life can be short. Everything can be taken away just like that. You got to appreciate everything you have." When he was growing up, football was a way to hang out with friends and have fun. Although players now are bigger, faster, and stronger, "nothin's

really changed. I'm just out here having fun." I asked him what his biggest fear is. "Not being able to continue what I love. Sooner or later you're gonna have to quit playing football. I don't know what I'll do without it, it'll be rough."



"Knowledge eliminates fear"

4/13/09

MM is one of the two red-shirt freshmen battling it out for the starting spot at quarterback. This young man was coached by Colorado legend John Elway in little league. It is easy to tell that Elway's mentoring had an effect. MM is poised, confident, and well-spoken. I would have no problem trusting my team to his leadership. His goals this season are to win the starting quarterback spot and "get better." He said that even though they have a young offense, with the "West Coast" they have the opportunity to be explosive and put a lot of points on the board. "With the offense we have, we have the potential to do something really special." I asked him how it feels to be the quarterback, the recognized leader of the team.

"The leadership role comes naturally to me. At QB, you're the field general. It's fun to go out there and hit people, but at QB it's different. I have to think a lot more." MM was recruited by the Mavericks out of high school where he led Thomas Jefferson to an undefeated season his senior year. His twin brother played center. He says football now is "more like a job... It's more competitive as you get older, and the stuff it teaches you about life becomes more important." MM's biggest fear is not living up to his own expectations.

Knowledge eliminates fear. If you know where everyone's supposed to be on the field, it helps to eliminate that fear.

You have two lives. Everyone makes mistakes. It's how you learn from that mistake which determines if you are alive or dead. If you don't learn, you're dead.

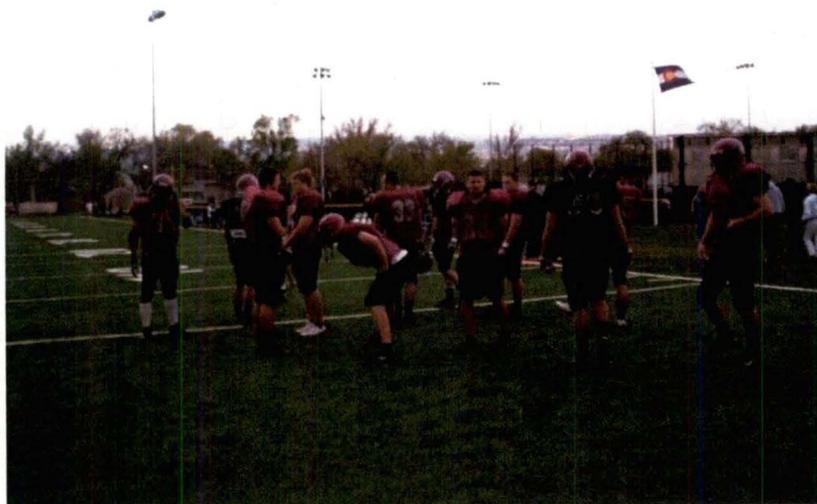
MM's fantasy is "going all the way and making it to the next level, being the next John Elway."

Epilogue

It has been two weeks since the "Lawn Bowl." I sit at my desk, staring out the window, reflecting on this project. I was able to speak at length with players and coaches about their backgrounds, goals, and feelings about playing the game of football. I ask myself: "Did I follow the hermeneutic method? Did I accurately portray my informants? What did I learn?" In dialogical hermeneutics, a researcher attempts to come to an understanding of the group being studied through shared dialogue. In this method, the power lies with the informants, and validation is reached through verification by informants. I did my best to not "make a case," instead relying on my informants to report what seemed most important to them. I also attempted to report what I saw and heard without interpreting things from my perspective, but instead relying on the players and coaches to determine the meanings for me. Looking back, I can identify several themes which ran through my interviews. First and foremost, everyone spoke of

"winning the RMAC." It is notable that this is a team goal. No one person can accomplish this on his own. A few players also added the modifier "for my teammates". Many of the players I spoke with mentioned being thankful for and capitalizing on the opportunity to get an education. Most of the players noted that it was going to be difficult to "walk away" from football. Both coaches I interviewed mentioned that after their playing days were done, it was good for them to put that energy into coaching. One player said that leaving the game would just be turning another page of his life, a notable difference from the other players I spoke with. Several players mentioned how fun it is to play the game. I initially thought it would be hard to gain trust with the team and be welcomed at their workouts and practices, but they always made me feel accepted. They also were easy to talk to, helping me to understand what it meant to belong to their group.

After the "Lawn Bowl," it became clear to me that this was a transitional moment for them. The players would focus on classes and passing their finals in the last two weeks of school. They would then go their separate ways for the summer, some sticking around and working out together over the summer, and some staying with their families spread about the country. They shared something, though, that I was not a part of: the fact that they would regroup weeks before school starts in the fall to start two-a-day practices and begin their season in earnest. Walking off that field, I felt alone. I didn't know if I would be back with the team, following their quest for a RMAC Championship, or if I'd be relegated again to the role of a fan, cheering from the bleachers while these young gladiators battled it out under the hot, August sun.



End Note: I was granted access to the players for the 2009 season and given a press-pass for the home games.

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Volunteers for Exile: Survival and the Embedded Economy of the Northern Shoshone

Amanda Bills

Abstract- *Despite the fact that innumerable societies around the world have been studied in detail, many people still consider all other cultures through the lens of capitalism. As the fur trade was beginning to expand its influence on the Great Plains at the end of the eighteenth century, the Northern Shoshone abandoned their home on the plains and sequestered themselves in the Bitterroot Mountains. Though many of the choices they made concerning subsistence, including their annual buffalo hunts in enemy territory on the Great Plains, seem irrational to students of classical economics, this paper suggests that the Northern Shoshone did not follow a capitalist system like that introduced through fur traders. Rather they had an embedded economy, one of many different economies that indigenous groups around the world continue to employ as an alternative to capitalism. This embedded economy allowed the Northern Shoshone to be resilient to the many changes effected by Europeans, and helped their society to endure after those around them began to falter.*

In 1787 Chief Gros Pieds of the Lemhi Shoshone gathered his tribe together and told them that life on the Great Plains had become too difficult. He encouraged them to move to the mountains and build a new life in the shelter of the peaks. They picked up their camp and left the very next day, leaving behind their strong social ties with other Plains groups and their relatively secure sources of food. They left behind their entire

lives in the hopes that they would find more security in the mountains.

Population migrations are continually present throughout the historical record, but what is uniquely intriguing about the story of the Northern Shoshone is how their economy allowed for the migration to the mountains when many other groups were finding it difficult to separate themselves from the increasingly European-influenced life on the Plains. In his book *The Great Transformation* Karl Polanyi describes an embedded economy as one in which cultural institutions deal with the production and distribution of goods using individual motives, and that “among these motives gain was not prominent” (Polanyi 1957:57). While leaving behind everything they knew seems like an irrational move for the Northern Shoshone to make, because they had an embedded economy they were able to make the transition with relative ease, and build a new life in the mountains.

As Douglas Bamforth notes in his book *Ecology and Human Organization on the Great Plains*, “a society’s historical background largely controls the way in which that society can exploit a given environment...and human adaptations necessarily integrate historical backgrounds and environmental realities” (Bamforth 1988:3). To completely understand how the Northern Shoshone were able to successfully relocate to the mountains their original move to the Great Plains must be considered. The earliest origins of the Shoshone come from the Great Basin of modern day Nevada and Utah. However by the sixteenth century because of competition in the Great Basin some bands of Shoshone were beginning to make their way onto the Plains by 1500. At this time the Shoshone split into three subgroups, the Eastern, Northern and Western. Each group was made up of many different bands. Though the focus of this study is the Northern Shoshone, the lives of the other two subgroups cannot be discounted.

While there were many different groups of Shoshone, there were also myriad groups that were formed by splitting from the Shoshone. Perhaps the most important of these to this study was the Comanche. The Great Plains is a massive ecosystem spanning from Canada, through the United States all the way south to the Mexican border. The Shoshone spent their time on the northern half of the Plains and when they first arrived they were able to span a vast area, even before the introduction of horses, occupying the Plains from Wyoming to the Canadian border (Bamforth 1988:89). The Shoshone reached this northern limit of expansion in the seventeenth century and in the eighteenth century they began to press southward, driving various groups off of the land. Although the specific reason for a split is not clear, in 1726, the southernmost Shoshone became known as the Comanche, a word meaning enemy in Ute. The Comanche range ventured much farther south than their Northern Shoshone relatives and they were soon coming into contact with Spanish settlements in modern-day New Mexico (Bamforth 1988:91).

While the Comanche were making conquests in the southern Plains, the Northern Shoshone remained on their land in Wyoming and Montana. The great distance between the two groups was not enough to break their connections, however, and the Shoshone and Comanche maintained trade relations with each other. These connections would prove extremely beneficial to the Northern Shoshone.

Shoshone subsistence on the Plains revolved around the buffalo hunt. Buffalo hunting has always been a communal activity, but before the introduction of horses it was essential for large numbers of people to be available to help with the hunt.

Communal hunting is not only "a direct response to the labor requirements of controlling and processing large numbers of animals, but also a mechanism that permits human aggregations to occur and provides the means for sustaining them" (Bamforth 1988:25). These hunts allowed groups who

often lived autonomously for most of the year to band together. Aggregations during the hunt could help with meat and hide processing, but they also helped to perpetuate long held alliances between the groups. Hence, the buffalo hunt was much more than simply a method of survival, it was also an important social event. Once a group had gathered together they went through a preparation stage that could involve anything from scouting for herds to quarrying stone for new tools. Each band would integrate with the others, and allegiance during this time was to the group as a whole, in this case the Northern Shoshone, rather than the individual bands. Once everything was prepared the hunt would begin and the main method for buffalo hunting was entrapment. Once the animals had been killed the processing of meat and hides began, and the social events continued (Bamforth 1988:8-9). The introduction of horses onto the Plains, though important in many ways, did not have a drastic effect on the organization of buffalo hunting, indeed, despite the changes that horses brought to hunting, “the aggregation of people under a temporary leader, choice of a location for this aggregation, and careful advance preparation were still necessary to a successful hunt” (Bamforth 1988:9). There was still a massive amount of meat and hides that had to be processed at the end of the hunt, and the need to maintain social ties was ever-present as well. The movement of horses across the Plains was indicative of the many trade relationships between different Indian groups, and works well to show how easily trade goods could travel great distances quickly. Horses arrived on the Plains through the Spanish from the south. Though some historians argue that a few stray animals from Spanish expeditions allowed for the creation of equestrian cultures among the Plains Indians, others assert that horses were obtained through direct contact with the Spanish because a few strays could never have produced the quantity of horses that appeared in just a few short decades on the Plains. More evidence supports the theory that horses were

acquired directly from the Spanish because of the knowledge that many Indians had concerning training and handling horses (Haines 1938b:112-113).

Spanish settlers in modern day Mexico and the United States both hired and enslaved Indians, which brought tribes into contact with horses. The Indians learned that horses had multiple uses, and they learned how to care for them. However, the Spanish banned Indians from riding horses because it was feared that the Indians would use the animals to raid the Spanish communities. Interestingly, missionaries delegated all of their work to Indians, and because of this their servants learned how to ride and handle horses (Haines 1938a:429-430).

The Indians forced into labor by the Spanish were often horticulturalists with a sedentary lifestyle, however they still understood the benefits that horses could bring to their societies. As news of the animals spread, nomadic Indians also realized that these animals could present a new way of life on the Great Plains. Before long Indian workers and slaves began to steal horses and escape back to their villages. As more and more horses appeared in the southwestern Indian tribes, other nomadic groups began to desire the animals as well. The Apache would bring war captives to Spanish settlements and trade them for horses. Other tribes gained horses by stealing or trading with the southwestern tribes. Soon horses were appearing throughout the Plains (Haines 1938a:431).

The Comanche were one of the first tribes to have access to horses, and because of their close social and familial ties, the Shoshone were able to gain horses through their southern neighbors. The Comanche acquired horses from Caddoan tribes by 1700 and had traded these animals to their Northern Shoshone relatives by 1730 (Bamforth 1988:94).

At the same time that horses were spreading throughout the Plains from the south, another European import was diffusing onto the Plains from the east. Firearms were attained by trading with English and French fur companies around

Hudson's Bay. The Spanish were not allowed to trade firearms with the Indians so the movement of guns on the Plains was centered on the upper and middle regions. Just as social and familial ties had allowed for the diffusion of horses, these same ties moved firearms across the Plains. By 1730 the Blackfeet living in modern day Montana, Alberta, and Saskatchewan had gained access to these new weapons.

The Blackfeet had been engaged in warfare with the Shoshone since 1725, before either group had access to horses or firearms (Bamforth 1988:88). The Shoshone gained horses first, and began to use the hunting ranges that had previously belonged to the Blackfeet, who at that time were still pedestrian. The Blackfeet realized that they needed firearms to maintain their place on the Plains. They were able to acquire both guns and horses, and there was little the Shoshone could do to prevent a seemingly unending barrage of attacks. Often the battles were means for the Blackfeet and other tribes to raid the Shoshone herds to supplement their own growing equestrian society, and without guns the Shoshone had a difficult time maintaining their lifestyle on the Plains. By 1750 the Blackfeet were fully mounted as a result of their raids (Bamforth 1988:94). The trading connections that the Shoshone participated in were located to the west and the south. Although they had been beneficial during the scramble for horses, they were almost completely useless when it came to acquiring guns.

Indian access to firearms was controlled by fur traders, and because of this strict control as well as the intricacies of trade relations, the Blackfeet only had a few guns by the 1730s. However, the introduction of both horses and guns "paved the way for Euro-American-driven fur trade and capitalist penetration," (Hämäläinen 2003:833) and in 1763 the British gained control over the entire northern fur trade and the number of guns diffusing across the Plains increased greatly, especially among the Shoshone's enemies (Bamforth 1988:94-

95). The Blackfeet did not have any direct contact with fur traders, however they made connections with Assinboines and Crees who acted as middle-men in the firearm trade (Hämäläinen 2003:848). Because the Shoshone had expanded their territory from north to south rather than west to east, they had not made contact with Europeans, and they had not made alliances with tribes to the east. Trading for firearms was almost an impossibility.

Zenas Leonard, a fur trapper who travelled the Plains from 1760-1776, noted the destructive use of guns, The Shoshonies, were once a powerful nation, possessing a glorious hunting ground on the east side of the mountains; but they...have been almost annihilated by the revengeful Blackfeet, who, being supplied with firearms were enabled to defeat all Indian opposition (Newcomb 1950:322).

Although the Shoshone were still present on the Plains while Leonard was in the area, he noted that this constant pressure from the Blackfeet had put a great strain on Northern Shoshone society, and the individual bands were breaking away from the greater tribe and scattering throughout the Plains desperately trying to find some way to protect their herds and their people. In 1787 the Blackfeet and their allies led a particularly devastating campaign against a group of Northern Shoshone, the Lemhi (Calloway 2003:300). The details of the battle are missing from the historical record, but its aftermath is uniquely represented. The memory of this battle stuck with the Shoshone for many decades and when a fur trader named Warren Ferris visited with a group of Lemhi in the 1830s the story of the battle and its repercussions were told to him by a man named Faro, who had been a young child during this transitional time. He remembered being in constant fear of the Blackfeet when he was young, and many members of his tribe truly believed that the firearms wielded by their enemies could only have been supplied by the Great Spirit. After the battle in 1787 Chief

Gros Pieds of the Lemhi Shoshone assembled his people and said,

My heart tells me that the Great Spirit has forsaken us; he has furnished our enemies with his thunder to destroy us, yet something whispers to me, that we may fly to the mountains and avoid a fate, which, if we remain here is inevitable. The lips of our women are white with dread, there are no smiles on the lips of our children... I see no face but is sad, silent, and thoughtful... Arise, let us fly to the mountains, let us seek their deepest recesses where unknown to our destroyers, we may hunt deer and the bighorn, and bring gladness back to the hearts of our wives and our children (Ferris and Phillips 1940:49)!

The Lemhi Shoshone abandoned their camp on the Plains the very next morning and made their way to the Salmon River country of the Bitterroot Mountains of modern day Idaho and Montana. They were not the first group of Northern Shoshone to be pushed from the Plains, and they would not be the last.

The Northern Shoshone, however, were uniquely suited for life in the mountains. Though they had built a society on the Plains, they had spent every winter in the mountains seeking shelter from the elements (Hyde 1959:126-127). Such seasonal movements were common among Plains Indians, and were seen as part of everyday life to the Northern Shoshone. The only difference of this move compared to the previous ones was that they would not be returning to the Plains when the snow melted. However the abundance of resources was enough to assure the Shoshone that they could survive, and possibly even thrive in this new terrain.

The Shoshone seemed to make the transition to mountain life with relative ease and when Faro recounted his childhood to Warren Ferris he noted that as soon as his band arrived in the mountains the women began to set up camp while the men went out to discover the territory. They were

tremendously pleased to find large amounts of game available, and they could not help but be excited that the river was teeming with salmon (Ferris and Phillips 1940:49).

Additionally both the women and men had knowledge passed down from their ancestors concerning which plants were edible, and they found a generous supply of berries, roots, and other comestible plants.

Although it seemed that they had plenty of food sources in the mountains, the Northern Shoshone made biannual trips to the Plains to hunt for buffalo when the salmon disappeared from the river (Trenholm and Carley 1964:23). As they had on the Plains the Shoshone continued to spend most of their time in the mountains autonomously, but during these excursions onto the Plains, “for political as well as economic reasons the Shoshonis discovered that their strength lay in banding together” (Trenholm and Carley 1964:19). They would join with other bands of Northern Shoshone, as well as the Flatheads and sometimes the Nez Percés for these “communal hunting excursions into hostile territory” (Trenholm and Carley 1964:19). Even with the support of their allies, the Shoshone only stayed on the Plains long enough to replenish their supply of buffalo meat and hides. They knew that there was no longer a permanent place for them on the Plains, however resources from buffalos were too valuable to completely give up.

To consider these hunting trips as quick and easy would be to discredit the entire enterprise. Just as when they lived on the Plains, buffalo hunts were undertaken with great care and preparation. The greatest difference was that the aggregation of the bands and the preparation, such as quarrying for stone to make tools, would take place in the mountains rather than on the Plains. It was important to limit their time in enemy territory to protect their tribe. Though their herds had been severely depleted by raids, horses were still an invaluable part of any hunt. To have a successful buffalo hunt while living in the mountains each hunter needed three horses – one for the

hunter, one for his wife, and one as a pack animal. However children were not left behind, and therefore needed a horse of their own to travel the distance to the Plains in a timely manner. Additionally a successful hunt would require more than one pack horse, therefore one hunter usually took two or more pack horses on a hunt. Hunters also preferred to have horses specifically trained for buffalo hunting, and these horses would not be ridden at any other time. Therefore one family needed at least six horses to complete a successful hunt (Murphy and Murphy 1960:331).

Although horses were individual, private property (Murphy and Murphy 1960:331), many of the Northern Shoshone still had enough horses to allow for the biannual buffalo hunts. Those who were able to attain the required number of horses went on the hunt understanding that both the possible risks and rewards awaiting them. To venture onto the Plains was of course dangerous because of their enemies. There was always the possibility that they would be raided before they were able to hunt which would make the journey back to the mountains difficult. Additionally, there was the possibility that they would be raided after the hunt. If this happened they could lose both horses and buffalo meat and hides. However, food was private property in Northern Shoshone society, and a hunter understood the value of buffalo meat. When they returned to the village in the mountains, the buffalo hunters would have something very valuable to trade with. Unfortunately not every family had enough horses, and unlike when the Shoshone lived on the Plains, not everyone could participate in the hunt. The distance was too great to allow for pedestrians to join in the hunt, and therefore those who were unable to produce the required number of horses stayed in the mountains (Murphy and Murphy 1960:331). Their time was not spent in leisure, however, as they continued to hunt for wild game and gather edible plants. When the hunters returned

with buffalo meat it would be traded with those who had stayed behind.

To consider these biannual buffalo hunts is to consider the economy of the Northern Shoshone. As Karl Polanyi noted, an embedded economy is one in which cultural institutions deal with the production and distribution of goods using individual motives, and that "among these motives gain was not prominent" (Polanyi 1957:57). Personal gain seems to be absent from the societies of the Northern Shoshone of the late eighteenth and early nineteenth centuries. However, to truly understand the economy of the Shoshone during this time period it is important to understand what their motives were. The migration of the Shoshone onto the Plains, the growth of their Plains equestrian society, and their subsequent relocation to the mountains has been detailed above. From a formal economic view, many of the choices of the Northern Shoshone were irrational. However, they were not seeking personal gain, that icon of formalist economies. Their true motives ran much deeper than personal economic prosperity.

Many historians assert that the autonomy of the Northern Shoshone was such that they rejected any efforts to organize as a whole and preferred instead to live separately with their band, or even on their own. However, the communal buffalo hunt and the activities surrounding it seem to shed new light on the subject, and "it must not be inferred that Shoshone families or family clusters were isolates living outside a realm of broader association" (Murphy and Murphy 1986:292). Undoubtedly, centralization was difficult because political institutions such as chieftancy that allowed for tribal conglomeration were weak (Murphy and Murphy 1960:332). Still, even without a strong political center, enduring connections were constantly being made between bands of Northern Shoshone as "a broad network of ties resulted from shifting residence, intermarriage, feasting, visiting, and extensive migration" (Murphy and Murphy 1986:292).

Additionally there were few if any communication or interaction barriers. The Shoshone were able to move freely from one band to another, and this was helped by the numerable connections that they had within each band (Murphy and Murphy 1960:334).

If a man did decide to relocate to another band, his property came with him. Horses were a unique addition to Northern Shoshone society because they were private property. In a society that had always dealt in reciprocity, the idea of owning a horse, or even a small herd, was life changing. Indeed, "each man was to a large extent his own master and acted accordingly" (Murphy and Murphy 1960:334). The introduction of horses, and the Shoshone reaction to them, gives interesting insight into the embedded economy.

In his book *The Great Transformation* Karl Polanyi discussed the double movement of the economy. This double movement is characterized by two poles, the embedded economy and the disembedded economy. The focus of the embedded economy is social protection with an emphasis on humans, while the disembedded economy is focused on liberalism and money. A disembedded economy is one in which the economy is independent from humanity. Economic history has seen a constant battle between the disembedding and the reembedding of the economy. When an economy moves too far towards the disembedded pole, social institutions work to pull it back to the other side. The same thing occurs if it moves too far towards the embedded pole (Polanyi 1957:136). Horses certainly put a strain on the embedded economy of the Northern Shoshone as men learned that they could profit by acquiring large numbers of horses. However, this idea of personal gain was not enough to disembed the economy. For the Northern Shoshone profit was not a great motive in economic transitions. Rather the maintenance of social ties proved to be the leading cause for economic decisions. A perfect example of this can be seen in the biannual

buffalo hunts that took place while the Northern Shoshone were sequestered in the mountains. Undoubtedly the most successful hunt would be one in which hunters returned with the most meat to trade with their band. However, the Northern Shoshone engaged in communal hunts. Of course their ultimate goal was to acquire buffalo meat and hides to take back to the mountains, but they did have other concerns as well.

Additionally, however, these communal hunts were viewed as something of a goodwill mission. By joining with other bands, the Northern Shoshone were putting their trust in them. To accept an alliance for a hunt was to accept another group without hesitation. It was agreed that each group would protect and aid the other groups while on the Plains, and it was understood that the hunting prowess of one group could drastically affect the outcome of the hunt. The Northern Shoshone were willing to suffer a bad hunt if their social ties would remain intact.

Rationally, formalists (those who support movement towards a disembedded economy) would argue that the Northern Shoshone would gain much more by making hunting forays with only their own individual bands. The risk of attack would be outweighed by the reward, in the form of meat and hides, that the bands would get to keep for themselves. However, the Northern Shoshone instead banded together to maintain social ties between their groups that cultivated mutual protection and respect. In this way, the economy of the hunt was about social gain rather than self-interest.

The embedded economy of the Northern Shoshone endured in part because of the lack of European contact. The movement of guns and horses throughout the Plains has been detailed above, but it is important to also look at what European influences followed these items. Horses brought many Indians into contact with the Spanish, and of course there were those who had greater access to horses and could profit from their

position. Guns had a similar effect. These two items had the ability to disembed Plains Indian economies.

The idea of personal gain was foreign to most Plains Indians before the arrival of Europeans. Like the Shoshone, many groups had an embedded economy based on reciprocity and redistribution. Economic ventures were undertaken for various reasons that often had little to do with gain. However the presence of Europeans in Indian territory began to change things. Many tribes continued to be isolated geographically from the outside world, but were still able to acquire guns, horses, and other European commodities even without ever having seen a white man.

Interestingly it was horticulturalists and not nomads who gained control of the horse trade early on. Caddoan-speaking groups such as the Arikara, Wichita, and Pawnee, had long held trade connections with the Spanish and they acted as middlemen in the horse trade. The Arikaras held the most well-known trade position along the Missouri River where they could control the movement of both horses and guns (Holder 1970:79). While Polanyi's substantivist approach is enlightening when the economies of Plains Indians are considered, a world-systems approach is perhaps better when considered these important trade relationships between Europeans and Indians. The Europeans were acting as the core of the economy who controlled production and many Indians became part of the periphery from which resources were taken to assuage the needs of the Europeans. These groups were fully exploited and received little benefit. However, there were a select few groups who managed to leverage their geographical position in such a way that they became a semi-periphery able to benefit from both the core and the periphery and avoid complete exploitation. The Arikara were one of these groups. Their location on the Missouri River made them accessible to both Indians and Europeans. Other groups realized the power that the Arikara were gaining and often tried to take control of

the trade, but the Arikara “were anxious to remain middlemen and siphon off trade goods” (Holder 1970:82). They and a few other groups were able to create an economic blockade on the Plains where movement of goods only took place through them.

Although these groups were able to control the trade, the Europeans still had great power over the people on the Plains who used guns because, The native user was with difficulty able to repair, perhaps even to maintain, his new tool, but without accessory supplies the gun was not even a good club. Powder was perishable and was always maintained in small amounts by the supplier. The man with the gun was at the mercy of the European, at however great remove (Holder 1970:115).

Firearms were desired as weapons in battle, but most tribes had little use for the persnickety pieces during a hunt. Though they may have thought they were in control, the Arikara and groups like them were actually at the continued mercy of the Europeans.

Indeed European influence had a devastating effect on Plains life starting with the horticulturalists who had to endure depopulation from European diseases. With the growth in European horses and guns, nomadic groups took to raiding the horticultural villages, destabilizing these societies (Holder 1970:131). Having built a society around trade with Europeans and personal profit, the Arikara had begun to disembed their economy in pursuit of a more liberal society. However, the loss of social control connected with an embedded economy was felt when their society began to falter.

The nomads were not immune to these European pressures either. They were able to escape the major depopulation resulting from European diseases that so debilitated the horticulturalists, but their European connections would be their undoing. Working with the Europeans they

began to exploit the buffalo herds to sell meat and hides. Eventually the Europeans began to expand across the Plains and further decimated the remaining buffalo herds. With no food to subsist on, the nomadic groups on the Plains declined.

While all of this was happening on the Plains, the Northern Shoshone were continuing their life in the mountains. They maintained their social ties through the biannual buffalo hunts, and survived on the mountains' resources. Because they had only been in contact with Europeans briefly during their time in the mountains, the Shoshone had maintained their embedded economy, and their social ties continued to rule their economic ventures. Indeed, as the nomads and horticulturalists on the Plains were seeing their way of life come to an end, the Northern Shoshone were able to leave the mountains and reestablish their society on the Plains briefly.

The effects of European society on the economies of Plains Indians can be seen clearly, however it is impossible to know how the Shoshone would have adapted to these changes if they had been able to remain on the Plains. It is likely that they would have succumbed to European influences and assisted their own downfall through the further exploitation of the buffalo. Because they moved to the mountains, however, the Northern Shoshone were able to continue living much as they had before. They had secure sources of food and strong social ties. Though they had to sequester themselves in the mountains for protection from their enemies in the late eighteenth century, they were eventually able to move back to the Plains. The embedded economy of the Northern Shoshone allowed them to be resilient to the many changes effected by Europeans, and helped their society to endure after those around them began to falter.

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The Double Movement on Pine Ridge: Embedded Art Working in a Disembedded Economy

Patrick Dorion

Abstract- *The economic route to survival must be carefully managed by Lakota people today, and is confounded by a history of economic assimilation. The Lakota remain inextricably attached to a capitalist market that has been imposed upon them, but pushed to its fringe. "Traditional," socially-based activities have protected Lakota people from the constraints of market interactions that have failed to provide for Lakota families. The negotiation process Lakota people engage in can be explained as existing between two poles: the "disembedded market" and a "socially embedded" economy. The economic historian and philosopher Karl Polanyi names this process "the double movement." This paper specifically concerns Lakota artists in relation to the double movement. To this end, fieldwork is presented in which 111 Lakota artists were interviewed on the Pine Ridge and Cheyenne River reservations about the barriers that affect their livelihoods. Preliminary analysis reveals there are significant infrastructural limitations for reservation artists that center around several access issues: transportation, materials to create, and opportunities to sell. In order to contextualize the study, a brief history of Native art is offered, and a discussion of "traditional" Native economies is undertaken. Polanyi's theory is used a lens to interpret both the complicated history that Lakota artists are a part of, as well as the data gleaned from the interview process.*

Introduction

Lakota people today must navigate a complicated economic process in order to survive, formed by the mixing of history and contemporary reality. Inescapably the Lakota are subjects of a colonial past that pushed them towards assimilation, writing the European economic system into the very fabric of their lives. On the Pine Ridge Reservation today, one can readily observe the effects of this market system. Cash is exchanged for all types of goods and services in convenient stores, businesses, and restaurants. One can also readily observe the failure of the market to sufficiently provide for the Lakota population. This is nowhere more evident than in the disheartened and jobless men and women filling the booths of *Big Bats* convenient store.

Certainly, it has been the process of integrating the market into Lakota life that has led to this fractured economic state. On one hand, the Lakota are inexorably attached to the market, and must engage with it. This “unnatural subversion” of society to economy has resulted in significant “social costs” for Lakota people (Polanyi 1944). On the other hand, the Lakota are involved in a number of practices separate from the market. These traditional activities help mitigate the market’s shortcomings, and hold social relationships above economy. Lakota people today are in a constant process of moving between the market and tradition in order to survive. This interaction is described by Polanyi as “the double movement” (Polanyi 1944).

This paper specifically attempts to discuss how Lakota artists are engaged in a “double movement” by bringing to the front important elements of Polanyi’s theory. I use the terms “disembedded market economy” and “socially embedded economy” (Polanyi 1944) to define the opposite poles of the double movement model, where “disembedded” refers to impersonal liberal capitalism, and “embedded” refers to an economic system based on social relationships. I discuss the

social costs endured by Lakota people both stemming from history and situated in the present. Through ethnographic fieldwork, I connect Lakota artists to the rapid transformation to a market economy that Polanyi discusses. Finally, I present the ways in which Lakota artists engage in the socially embedded economy of the reservation, and interact with the disembedded outside market. In order to build a proper context for analyzing fieldwork data, I first outline a basic history of Native art, and discuss what is meant by “traditional” Lakota economy.

Methods

The data presented in this paper was collected in seven weeks in June and July 2010, predominantly on the Pine Ridge reservation, but also in the town of Eagle Butte on the Cheyenne River reservation. A total of 111 artists were interviewed; including 61 women and 50 men, with an average age of 45. Artists were involved in a wide array of art forms, including painting, sculpting, carving, beadwork, quillwork, leather work, ledger art, and quilting. Snowball sampling was used as a methodology, as artists on Pine Ridge are a hidden population. Interviews were based on a survey tool that was constructed in partnership with two outside groups: *First Peoples Fund* in Rapid City, South Dakota, and *Artspace* in Minneapolis, Minnesota. The survey used both quantitative and qualitative methodologies in order to comprehensively ascertain the barriers and limitations reservation artists must contend with. Because interviews largely occurred on the Pine Ridge reservation, Pine Ridge alone is referenced with respect to analyses. This is not to exclude Cheyenne River from the conclusions being made, but to simplify the discussion.

The History of Native Art

A brief history of Native art is necessary in order to understand the particular context Lakota artists live in today.

Art can be seen as a natural extension of Native American ideology both historically and presently, and is considered by many contemporary artists as “a connection to ancient beliefs and long-held values” (Hirschfelder & Montano 1993:146). One important theme found in North American Indian art is the spiritual bond between humans and nature, exemplified by the Lakota relationship with the buffalo to be discussed in detail below. The respect Indians have for nature is found in the terminology used to describe it, and is steeped in ritual. For instance, spiritual beliefs and reciprocity are tied together in the Lakota worldview. *Mitakuye oyasin* is a Lakota expression meaning “we are all related” (Hirschfelder & Montano 1993), embodying the ultimate connection of all things and the moral responsibility to care for them.

That art is an integrated feature of Native culture is exemplified by the variety of practical items historically made by Indians. These include but are not limited to pottery vessels, baskets, blankets, teepees, clothing, weapons, and pipes. Thus the concept of “artwork” may have meant very little to a Native American before European contact. Art was merely considered “a by-product of workmanship” (Wade 1986: 119).

It is important to note that Indian groups had long been in contact with one another before colonialism, both mixing biologically through interbreeding (Churchill 1999), and culturally through diffusion (Hirschfelder & Montano 1993). The spread of art among Native American groups chronicles the process of adopting new ideas to be incorporated uniquely into tribal life. Change and adaptation, then, have always been a practice of Indian peoples. When Indians found themselves in contact with white Europeans, they began to adapt their artwork to take advantage of new trading opportunities. It is well documented that Indians were encouraged by whites to begin painting on easels, in order to supply interesting works in a familiar European fashion (Ewers 1981; McCoy 1992;

Neuman 2006; Wade 1986). At the turn of the twentieth century there was an upsurge of interest for these painted depictions of “primitive” life, and a burgeoning market for Native American art developed.

The term “traditional Native art” must be deconstructed in light of this history. Since it was westerners who created and defined the market, “traditional Indian art” is a western term that frequently refers to the flat, two-dimensional paintings done on canvas and buffalo hide (Ewers 1981; Neuman 1986), Plains ledger drawings (Neuman 2006; Rushing III 1995; Wade 1986), or art resulting directly from European contact (Hirschfelder & Montano 1993).

“Traditional” from an Indian standpoint may include any form of art associated with history, due to the constant absorption of new ideas into Indian culture. For instance, Lakota quillwork is ancient and sacred work among Lakota people. Early in the nineteenth century when Europeans brought glass beads to the new world, they were rejected by artists because they were not “alive” like porcupine quills (Hirschfelder & Montano 1993). However today in Pine Ridge and Cheyenne River, both quillwork and beadwork are considered sacred and “traditional” by artists. Not surprisingly, the history of Native art parallels the historical proliferation of the disembodied market economy on Pine Ridge. As Native art became available for purchase, Lakota people slid further away from the protection of a socially embedded economy, towards a detached and disembodied market.

One side note of interest is that Indian artists did not sign their work or take individual ownership of it until white collectors wanted to know (Caldwell 1999; Ewers 1981; McCoy 1992; Neuman 2006; Wade 1986). I make this point because it epitomizes the collective and social Lakota mind of “tradition” described in the next section. Since integrating with the market, Native artists have necessarily adopted the neoliberal value of individualism. Signing their work today is

representative of the movement towards disembeddedness, but an essential act if Native artists are to provide for themselves.

There is much debate over what constitutes traditional Indian art in the present day. Some Native artists see contemporary work as a loss of tradition, and others see it as being rooted in the past despite its contemporary expression. To be sure, "Native American art is as diverse and as up-to-date as the artists who produce it (Hirschfelder & Montano 1993:144)." Of course artists themselves are not just artists, but have multiple identities wrapped up in a wider society.

The "Traditional" Practices of the Lakota

Polanyi asserts that before the nineteenth century, economies were always socially embedded (Polanyi 1944). Embeddedness explains that the driving force behind economic practice revolves around a complex set of social relationships, obligations, and actions. The "traditional" economy of the Lakota manifests this social embeddedness in its many representations.

Lakota people may engage in traditional practices because market inadequacies push them to, but they are also pulled towards traditional practices because it is what they have always done. The buffalo is the centerpiece for the Lakota, who historically were hunters and gatherers. Communal buffalo hunting has been identified as the most prevalent subsistence practice of the Plains Indians. Communal hunting denotes a greater yield of buffalo from a single hunt, and requires a large number of hunters to be successful (Verbicky-Todd 1984). The community aspect of buffalo hunting had profound social significance in the past in two ways. First, the greater yield of buffalo only became possible with a planned, collective hunt, which served to feed and clothe the larger collection of Indians (Verbicky-Todd 1984). This collective mobilization of work exists within Lakota society today in the form of large family units called

tiospayes (Pickering 2000a), as well as more immediate family units participating in household economic activities (Sherman 1988). The second social significance of communal buffalo hunting was that it provided increased protection against enemies, as Indians had to live in greater proximity to one another to communally hunt as well as share the buffalo (Verbicky-Todd 1984). I posit that this sense of community is still strong among Lakota people living on the Pine Ridge and Cheyenne River reservations (Pickering 2000a, Sherman 1988), and is something I will discuss later with respect to Native artists.

The material uses for buffalo also provide a connection to traditional Lakota economic practices, and is particularly instructive in the case of artists. Verbicky-Todd has contributed an exhaustive list of the uses that Plains Indians had for the hide, hoofs, horns, hair, tail, sinew, internal organs, bones, and teeth of the buffalo. Buffalo products furnished Plains Indians with clothing, housing, storage containers, ceremonial objects, bows and arrows, and tools (Verbicky-Todd 1984). In short, nothing was left to waste. Although there may be less need for these products today, the practical uses for buffalo in the past have translated into material uses in the present: Lakota artists frequently use natural materials to produce their art. Sculptures are made from buffalo jaw bones and elk antlers, hides are used to make drums, moccasins, and ceremonial dress, and animal sinew is used widely as thread. The ancient Lakota tradition of quillwork (Hirschfelder & Montano 1993) requires porcupine quills to be processed and colored. In this way artists have a hand in keeping their culture connected to the past, as well as a socially embedded economy.

Many of the above materials cannot be purchased—they are found and shared by the community. Artists rely on the reciprocal exchange of items to complete art pieces for sale. The importance of nature to Lakota people as represented by the buffalo shows how the components of Lakota culture are

woven together. The embedded Lakota economy does not exist as separate ideological, political, or social parts, but is highly integrated. An example from my fieldwork illustrates this integration. One man from Kyle brought me to his backyard where a recently acquired buffalo hide was being stretched. He had given away most of the meat to other families in need, extending his generosity and creating social ties. The hide was to be given to an artist who could use it, in the hopes that something Lakota would be created from it.

Redistribution and reciprocity have a long history among Lakota people, and gift-giving is an essential part of these processes. Grobsmith has stated that gift-giving has been observed as early as the 1890's, and that it is "a fundamental principle in Lakota life" (Grobsmith 1979:124). Through gift-giving, Lakota people are provided with a kind of social insurance by creating a series of reciprocal obligations. An important note is that exchanges take place between non-kin (Grobsmith 1979). Reciprocal exchanges taking place outside the family unit build a wider network of social relationships for a Lakota to lean on in a time of need. Pickering has attested that a form of gift-giving, "giveaways," frequently take place in present day Lakota life for a myriad of reasons, like memorials, pow-wows, and graduations. Of interest is the high cost of hosting a giveaway. Many Lakota people suggest it may take two years to stockpile enough wealth for a giveaway, which not everyone can do (Pickering 2000a:58). In the late nineteenth century, the cost was so high that an individual who gave away most of their possessions had to be "reincorporated into the community by being given the bare necessities to begin to exist once again" (Grobsmith 1979:128). The value of generosity is paramount in Lakota culture due to the social prestige gained from being generous. While conducting my fieldwork in Pine Ridge, I was offered food, drinks, and other items during interviews. I visited one man who carved sculptures from antlers and buffalo jaw bones. He had no front

door, but gave me his carving knife when I showed an interest in his work. In my experience, any sense of poverty among the artists I spoke with was outstripped by the Lakota value of generosity.

Householding is another aspect of the socially embedded Lakota economy. In a study of traditional micro-enterprise activities in Pine Ridge, Sherman reported that 83% of his interviewed sample was involved in some form of home-based activity, and that 30% of the sample received more than half of their income from these activities (Sherman 1988). Sherman uses the term “informal” and “traditional” to categorize home-based activities, which can be extended to our discussion of the double movement. Household production helps Lakota people mitigate the pressure of the disembedded market by supplementing incomes (Pickering 2000a), and is necessarily socially embedded due to the nature of household work. It requires the collective participation of family members to be successful. Many of the artists I interviewed would work together to fill an order for a deadline, participating on a rolling basis until the work was done. Working from home, creating art must be folded into the running of the household unit so that art production takes place while doing other things. Caring for children or grandchildren is one potent example for artists who are grandmothers or grandfathers. One woman from Allen explained that working through the night was not uncommon because it was the only private time she had. Raising children in Pine Ridge necessitates a familial flexibility to ensure that the cost of having a child is not placed solely on a mother or father (Pickering 2000a:11-12). One older artist from Eagle Butte confessed to me that because his grandchildren were now old enough to care for themselves, he could spend more time creating new beadwork designs and going to art shows.

A division of labor is occasionally undertaken by artists. When forced to sell their art door to door, some artists

who felt uncomfortable pitching their work to the public would employ the help of a family member to do the actual selling. Household family units have the ability to absorb more work, be more efficient with time, and play to the strengths of its members.

Consumer choices reflect the preponderance of householding on the reservation, as many Lakota people exchange goods and services in lieu of cash (Pickering 2000a:67). Furthermore, Lakota consumption seems to be rooted in the socially embedded economy. The most valued items tend to reflect the social relationships important to a Lakota. This remains true even of non-reservation Lakota (Isenhour 2003), which is a powerful statement about how economics are framed for Lakota people in general.

With the context of these art and economic histories, we can appropriately situate ourselves in the present. Reflecting on the acculturation process weathered by Lakota people will help to illuminate the tensions of identity that exist on Pine Ridge today, where artists have multiple identities intertwining within a wider Lakota society.

Acculturation

The Lakota people have endured substantial social costs at the hands of the disembedded market. According to Polanyi, market liberalism is a force that rapidly bends society to its will, creating a complete abasement of human life in its wake (Polanyi 1944). It is not difficult to understand why Shannon County consistently ranks as one of the poorest counties in the United States (Pickering 2000; Sherman 1988; U.S. Census Bureau 2009). The government has been trying to force the Lakota into the market system for 150 years.

One cost the Lakota have endured is a weakened sense of self-determination, which has been stifled by dependency on federal aid. Fostering dependency has been a strategy employed by the U.S. government to push market liberalism on

Lakota people. In Polanyi's terms, the government accomplished this by creating "fictitious commodities" of land and people (Polanyi 1944). These alien concepts do not exist in a socially embedded economy, and have caused a fragmentation of Lakota life.

Federal land policy has commodified tribal lands and encouraged Lakota dependency. When the reservation system was put in place in the late 19th century, traditional subsistence practices became difficult for Indian people to maintain. Over the years as Pine Ridge reservation lands became smaller and smaller, Lakota connection to the land was severed. Hunting migratory buffalo became nearly impossible, and thus disconnected the Lakota from an integral part of their economic, spiritual, and social livelihoods. The Dawes Act of 1887 pushed the Lakota even further from the land. By privatizing ownership into individual allotments and selling the unused surplus to white ranchers (Carlson 1981), the western concept of land as a commodity replaced the idea of communal land held by Lakota people (Pickering 2000a:64). The act attempted to create farmers out of the Lakota, but failed miserably (Carlson 1981), resulting in further alienation from their traditional subsistence practices.

The government also tried to turn Lakota people into commodities and create dependency through the introduction of wage work. Biolsi discusses how OIA (Office of Indian Affairs) wage work on the Rosebud reservation in the 19th century tried purposely "to instill labor discipline in Indian men" (Biolsi 1992:27). Employment opportunities with the OIA offered a significant amount of work, and in the early 20th century, this work was largely per diem. This program of Indian employment was meant to eventually detach Indians from government rations, but did not succeed when jobs inevitably dwindled due to insufficient federal funding to the OIA. The unemployed Lakota had again to rely on meager government rations (Biolsi 1992: 25-29). Later in the 20th

century, Indian boarding schools would push vocational training for basic wage work instead of an academic education. Indians were expected to participate in activities that “subsidized” the cost of running the school (Pickering 2000a:24). The lack of education did not prepare the Lakota to be competitive in the market for jobs (Pickering 2000a: 223-25), putting them in a precarious position on the periphery of the disembedded market. Unemployment is a persistent issue on Pine Ridge. In 2009 the unemployment rate was 51.6% (U.S. Census Bureau 2009). In 1990 the U.S. Census put unemployment at 32.7%, but a more accurate number from BIA figures just one year before states that the rate was 73% (Pickering 2000a:15). Sherman supposes that in 1988 the rate could have been as high as 96% (Sherman 1988:18). There are also compelling statistics on underemployment—the 1990 U.S. Census reports that 57% of the employed on Pine Ridge only had work for half of the year (Pickering 2000a:16).

It could be argued that the imposition of certain western conceptions and understandings also serve to disembed Lakota society, and anchor the attempt to make Lakota people fictitious commodities. The Temporary Assistance to Needy Families program (TANF) implemented in Pine Ridge is a contemporary welfare program that presses for adherence to wage work. This can only force the Lakota into economic roles that are discordant with their traditional practices so vital to their survival, especially considering the lack of job opportunities available on the reservation (Pickering 2000b). Development policies like TANF aimed at battling Lakota dependency may have the reverse effect. Roche makes the point that tribal tax laws and social services “create incentives to avoid the formal economy” (Roche 2000:2). As they work more inside the disembedded economy, the social services a Lakota person may receive decreases (Roche 2000). This situation is reminiscent of Polanyi’s description of

Speenhamland, which accidentally discouraged the lower class from working (Polanyi 1944).

Time is also a value-laden term that assumes complete obedience to the disembedded market. From a western view, time is inexorably attached to discipline and morality in a wage work setting (Pickering 2004). Although many Lakota people have wage work experience, they tend to follow a concept of time that reflects the “task-oriented” economy of various subsistence practices (Pickering 2004). To demand loyalty to the stringent western definition of time is to belittle the socially embedded economy that Lakota people rely on to survive.

With the introduction of the Native art market at the turn of the 20th century, producing art became a strategy for Indians to earn money in their rapidly changing lives (Ewers 1981; Neuman 2006; Rushing III 1995; Wade 1986). The disconnection from the land and traditional practices brought on by federal land policy and acculturative western knowledge systems left few options for Lakota people beyond complying with the open market. A paradox ensued: on the one hand, art served as a connection to a Lakota heritage recently put under great strain, and on the other hand this heritage was now available for sale to those perpetrating the anxiety. Lakota culture, as well as Indian cultures in general, came to be commodified. Extending Polanyi’s “fictitious commodities” to include Native art is not a stretch when pondering the implications of selling something so deposited in a people’s way of life. Producing and selling art today in Pine Ridge is literally a lifeline for some Lakota people. It is a micro-enterprise (Sherman 1988) that keeps them from being consumed by poverty.

Art production and distribution has been complicated on Pine Ridge (and other reservations) by contemporary U.S. policy. The erosion of social capital is another cost Lakota people have had to pay as a result. The Indian Arts and Crafts Act of 1990 was created to stem the misrepresentation of

Indian arts and crafts in the United States. The act has severe penalties, as foreign imitations of Indian goods steal ten to twenty percent of all sales (Parsley 1993:489). The large problem posed by the act is that it has forced Indians to prove that they are Indian, either by blood quantum or by membership to a tribe (Hirschfelder & Kreipe de Montano 1993; Osborne 2000; Parsley 1993). Although the act was meant to increase Indian sovereignty, the resultant alienation of some Indian artists would have the reverse effect. It forces these alienated artists to contend with legitimizing their identity on yet another level—to other Indians. Fighting between Indian peoples has ensued, and ironically the act has had negligible results. The Indian Arts and Crafts Act of 1990 has only served to fragment Indian culture, and causally Indian artists. This factionalism amidst a socially embedded economy undermines the social relationships that an embedded economy needs to function.

But the erosion of social capital has been occurring long before 1990. According to Pickering, the Indian Reorganization Act of the 1930's may have laid the groundwork for ethnic distinctions among Lakota today. The U.S. government followed the biological determinism prevalent at that time in history, and pushed the Lakota to define themselves genetically. In order to be an enrolled tribal member from then on, a person would have to establish they held at least one quarter Indian blood. These types of biological distinctions help perpetuate the ethnic stereotypes of "full-blood" and "mixed-blood" among Lakota, and affect tribal politics and decisions about reservation issues (Pickering 2000a: 82-83). However, "mixed-blood and full-blood issues almost invariably turn on economic distinctions" (Pickering 2000a:85). A Lakota person may be culturally categorized as mixed or full-blood with direct reference to their economic behavior—do they enact the values of a socially embedded economy, or do they accept the values of a disembedded

economy? Perceptions of differences in blood degree were occasionally offered during my fieldwork. As a white man, I would be cautioned about speaking with a full-blood artist; the impression was that a full-blood artist would be more “traditional” and resistant to my interview. Factionalism has also led to new dichotomies. Some artists from Wounded Knee were very territorial about “the shade”—a place where art can be sold off of highway 27. They wouldn’t allow Lakota artists from other towns to set up. Ironically, they proudly identified with being a member of a *tiospaye*, a traditional kind of family organization, but neglected Lakota generosity and reciprocity in the face of earning money from the disembedded market.

Art on Pine Ridge

As mentioned above, producing and selling artwork is a survival strategy for Lakota people. The prevalence of art in Pine Ridge is palpable, observed on the exterior through door-to-door selling at businesses like Big Bats, Lakota Funds, or the hospital. It was difficult to get an inside view of the reservation art world as an outsider. On a few occasions, I was able to interview artists as they physically worked on their art, which provided a context I could not have gotten otherwise. Snowball sampling proved to be very successful, as interviewed artists would readily give the names of family members, other artists in town, or even artists whose work they had seen and remembered. On average there were two artists living in every household I visited. As one woman states, on the reservation, “everyone is an artist in some way.”

More compelling is the time that artists spend participating on their art or in art-related activities. Nearly all interviewed artists workers state that they work on their art every week. Seventy-five percent declared that they work at least 20 hours weekly to produce and sell artwork, a part-time job by western standards. A full quarter of the artist sample

work at least 50 hours per week. This means that Lakota artists average a 40 hour work week with respect to their craft. This is significant from both a Lakota perspective where time may be more fluid, and a western view of structured clock time.

Seasonality is a factor to consider in any discussion of Lakota art sales. Artists agreed that they sold most of their work in the spring and summer months, in part because it is tourist and *wacipi* (pow-wow) season. This fact notwithstanding, three quarters of all interviewed artists continue to sell their art all year long.

Some final statistics help in illuminating just how important art is for reservation artists. Over half of the sample reported an annual household income of less than \$10,000. Frequently, this income must be distributed to meet the needs of large families. On a few occasions, I interviewed artists who were responsible for 8 or 9 children. The mean household size of the sample was 6. This means that \$10,000 a year has to feed, clothe, shelter, and warm 6 people for 12 months. Even in the face of such numbers, a full third of the artist sample declared that more than half of their entire income was obtained solely from art sales.

Polanyi asserts that the market replaces traditional economies before new coping mechanisms are set up (Polanyi 1944). The infrastructure of Pine Ridge reflects this rapid transformation of embedded economy to disembedded market. Underdeveloped systems of transportation and accessibility create barriers for Lakota artists.

The distance an artist must travel to maintain an art business is complicated by the general lack of reliable transportation on the reservation. There is no public transit available to Lakota people, and finding an affordable and road-worthy automobile is difficult. In order to contend with the transportation difficulties on Pine Ridge, Lakota people are forced to interact with another iteration of the disembedded market system: credit. Pickering asserts that buying a car is the

main reason Lakota people will take out a loan. She further reports that border town used car salesmen capitalize on the difficulties Lakota have on keeping up with their payments—once a payment is missed, a cycle of reselling questionable cars at high prices becomes possible (Pickering 2000a:69). The term “rez car” is an example of the local self-deprecating humor surrounding the transportation issue, encapsulating the instability of automobiles on Pine Ridge. Several houses I visited had yards with multiple cars in various states of disrepair. I passed by a “rez car” every time I drove from Kyle to Potato Creek. It was barely off the road, and had been stripped of all useful parts, including the wheels.

The difficulties of transportation are exacerbated by sheer distance. In a reservation the size of Connecticut, towns are often 30 miles apart. This is problematic when adding in issues of accessibility to materials and supplies that artists need to create their work. Sixty-four percent of artists either do not have access to resources to create their art, or must travel more than 30 miles to get them. The average distance an artist must traverse for access to materials is 40 miles. This means that in general, supplies are not sought in neighboring towns, but past them. Accessibility issues are even more pronounced with regard to selling artwork. 65% of artists either do not have access to resources to sell their art, or must travel more than 30 miles for them. A noteworthy 64 miles is the average distance an artist must travel to make a sale. This data reflects the lack of businesses found on Pine Ridge. Even with artwork to sell, Lakota artists are limited by the inaccessibility to formal art markets connected to the disembedded economy.

Travel and resource accessibility are intertwined, and impose a hefty limitation on Lakota artists. Transportation and access is so widespread a problem that it resurfaced many times during interviews. Artists must be creative in dealing with these issues—they might pay someone to drive them where they need to go, or barter for supplies. A group might

pool their resources so that basic material needs are met, or send one delegate to sell the work of multiple artists in one trip, thereby diffusing costs. It is worth noting that many strategies employed by Lakota artists to mitigate the infrastructural limitations of the reservation tend to be socially embedded. The stability gained from using such strategies offsets the cost of transportation so that necessary interaction with the outside market can take place. Trips to Rapid City can be weekly or monthly occurrences, as it offers a more stable connection to a disembedded market, at least for the artists who know what items are in demand.

Finally, figures 1 and 2 qualitatively portray the infrastructural issues of transportation and access in terms of what Lakota artists believe. Figure 1 presents “access to materials and resources” as the number one perceived need of the artistic process. Figure 2 plots the Lakota perception that “access to physical markets” is the primary barrier to selling artwork in Pine Ridge. These needs voiced by the community of Lakota artists illuminate the fact that the Lakota have been forced into a disembedded economy without the means to deal with it.

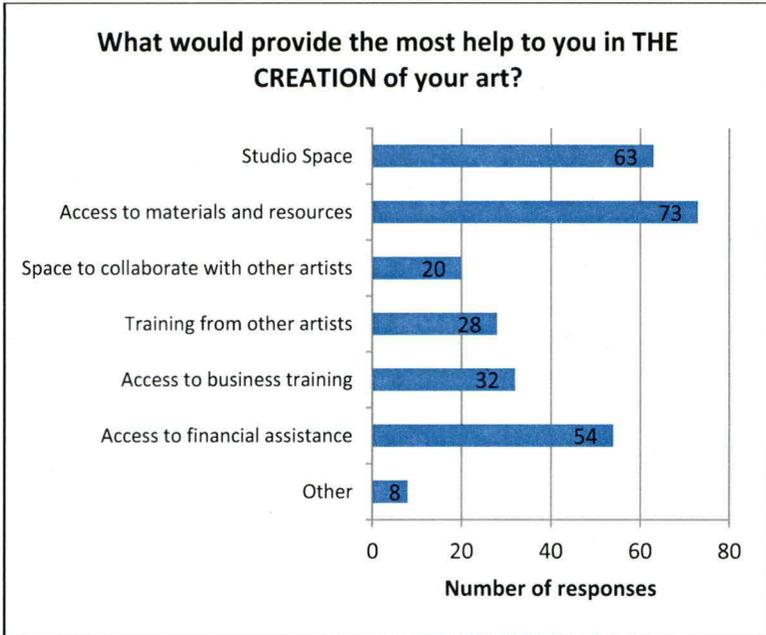


Figure 1

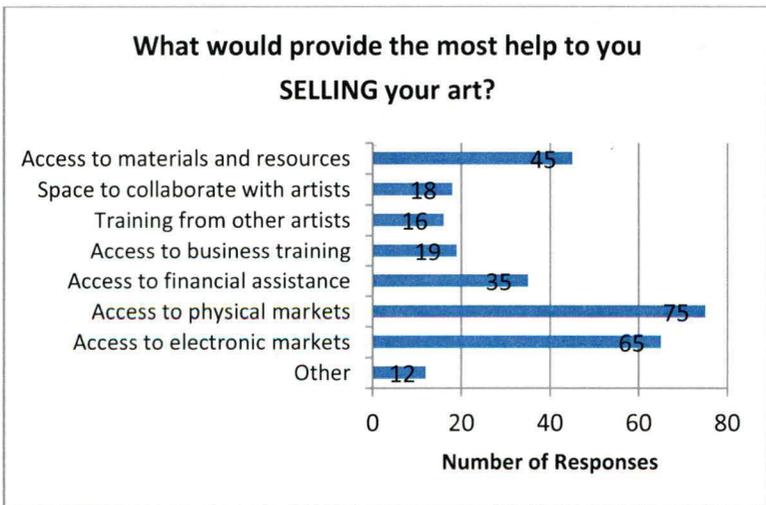


Figure 2

That art is socially embedded in Lakota society is substantiated by fieldwork data. The process of passing on knowledge is one way this embedding occurs. Artists were presented with a list of institutions, and asked “have you had any business training (formal or informal) from the following resources or places?” Business knowledge may be defined as anything an artist might learn concerning the creation or selling of artwork. This might include knowledge of obtaining supplies, any skills required for production, what items to sell and where, or any other intricacies of the artistic and business processes. Again I distinguish between formal and informal institutions through the concept of embeddedness. Formal institutions are representative of the disembedded market, and include banks, businesses, and local non-profits. Informal institutions are socially embedded, and include friends and family, elders, and other artists. Figure 3 shows the assembled data. Although it should be noted that business knowledge is generally lacking on Pine Ridge, artists were twice as likely to have received their knowledge from informal sources. This means that largely speaking, Lakota artists rely on socially embedded relationships for information about how to run an art business. Put another way, the connection to a disembedded market does not imply the transmission of knowledge Lakota artists find most useful.

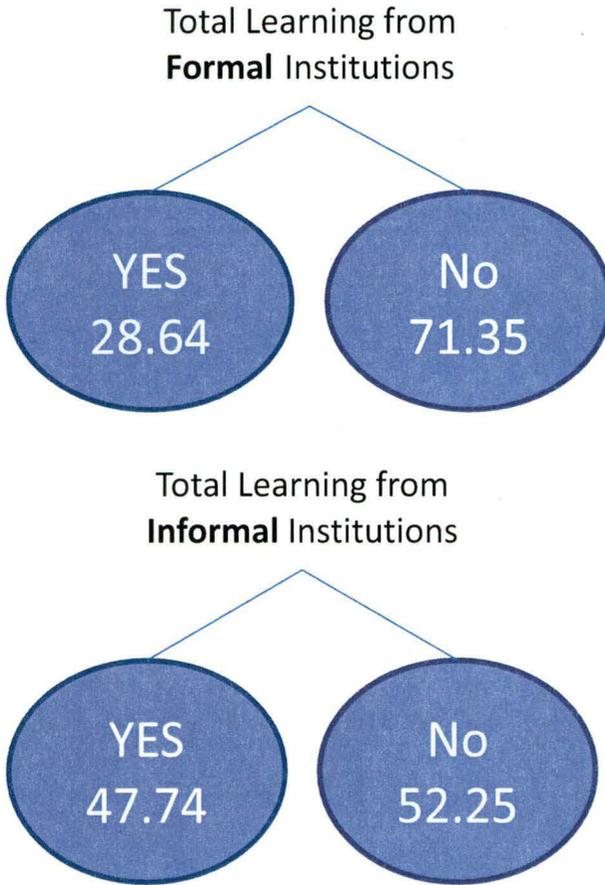


Figure 3

That art is embedded in the reservation community is also reflected qualitatively. Artists were first asked “Is there a local art community on your reservation?” Those who responded positively were prompted with “How would you define the art community on your reservation? Who is included? Is it formal or informal? What makes it a community?” Listed below are some selected answers artists gave:

"Everyone is an artist in some way."
"The entire reservation is an art community."
"It's very informal, but it's there."
"It is an informal community; we are all trying to make it."
"My family, I can't speak for anywhere else."
"It is open to anyone who is willing (mostly reservation people)."
"I think all artists are a part of a community."
"Being an artist is part of life."
"Lakota tradition--ties to culture."

The above responses suggest an encompassing and holistic view of art. As I have established above, words like “family” and “informal” are indicative of a socially embedded system. There is also an inclusive understanding of artists, the reservation, and being Lakota. I offer that the perceptions artists have of the art community are deeply rooted in reservation life, which is consistent with art being an iteration of a socially embedded economy.

In fact, a powerful statistic arises when controlling for perceptions artists have of themselves in relation to their art community. Artists who affirmed the existence of a reservation art community and believed themselves to be a part of it compiled twice the amount of informal knowledge than did artists who felt they did not belong. This means artists perceiving themselves as belonging to an art community have more access to the social relationships and support of an embedded economy. In the double movement model, those artists who do not feel part of an art community operate nearer to the disembedded market, which provides them fewer opportunities translatable to a reservation economy. This implies that in Pine Ridge, art as an institution functions greatly on the necessity of social networks.

What artists say about bartering may also help to illuminate that art is socially embedded. Bartering has been identified as an integral part of reservation life in other studies (Pickering 2000a; Sherman 1988), and its prevalence is reflected in survey data. Only 17% of artists declared that they never participate in bartering. A full 83% of artists reported that they engage in bartering, even if infrequently. A more telling statistic is that 53% of artists involved themselves with bartering “sometimes,” “often,” or “all the time.” Additionally, artists were asked to expound on the reasons they barter. Responses were coded into five categories and counted: for supplies (51), for other art (25), to support family (18), for marketing reasons (4), and to support other artists (4). The data shows that beyond any other reason, artists barter to get what they need. Because of the infrastructural barriers of access to materials outlined above, Lakota artists have to be creative in making things work. Bartering among artists provides an example of reciprocity working on Pine Ridge; it is a socially embedded system that can fulfill needs and stabilize interactions with the disembedded market.

I have advanced that Lakota artists mediate the stresses of a disembedded market by counterbalancing their economic lives with socially embedded relationships important to their survival. But the prevalence and importance of social ties among artists does not preclude their involvement with the disembedded economy. In fact, artists cannot exist completely outside the market. The historical process of assimilation to a market economy injected into Lakota society has ensured the anchoring of the market on Pine Ridge. Lakota artists must make choices about how to navigate their economic lives on a rolling basis. They must weigh the costs of engaging in market relations against the possible benefits it could produce. I have already outlined the infrastructural barriers to access that Lakota artists contend with, which is integral in this process. An artist who needs to make a sale for cash must be able to

recoup the money they spend traveling to make the sale. Some artists have developed relationships with trading posts or shops that minimize making trips in vain. A lot of artists have no choice but to make the trip with no guarantee of sale. A few artists spoke to me about times they were almost stranded in Rapid City after an unsuccessful attempt selling their work to local businesses.

When artists can have positive interactions with the market (when they can make money), the negative aspects of the disembedded economy may momentarily dampen. This is reflected in how artists feel about tourists. Although most artists in the sample assert that they sell art year-round, it became clear to me over the course of my fieldwork that the spring and summer months are times when artists can make the most sales. The survey asked artists “What role do tourism activities have on supporting and promoting Indian artists?” Most commonly, artists identified tourism as having a significant impact on their lives. The table below shows some selected responses about how artists perceive tourism as being beneficial:

“HUGE! It isn’t people on reservations that support artists (for the most part, it’s non-natives that buy art).”
“Great, if not the greatest role in my career.”
“Tourism makes profit possible, it plays a role.”
“A lot. It’s number one on the rez.”
“A big role. They buy our stuff and you get better prices from tourists.”
“Biggest deal of all. Tourists help us survive, without them we wouldn’t survive.”

Connections in Pine Ridge to the embedded or disembedded economy are characterized by the phenomenon of “Indian pricing.” Essentially, Lakota people may use two

separate pricing systems: one for reservation inhabitants and one for non-reservation people. Indian pricing reflects the values of generosity and reciprocity among Lakota, which enables them to procure needed goods and services affordably (Isenhour 2003; Sherman 2000a:40). Tourists, then, represent a firm connection to the disembedded market where Lakota artists can demand full price for their work. This theme of getting a “fair” price was something I encountered multiple times during interviews.

How Lakota artists choose to sell their artwork is also instructive to a discussion of Lakota connection to the disembedded market. A series of questions were posed to respondents, asking where they sell most of their art, where they are most comfortable selling art, and where they find it most challenging selling art. Artists were asked to rank their top three choices from a list of six categories. The table in figure 4 shows the data after responses were weighted (x3 for 1st choices, x2 for 2nd choices, and x1 for 3rd choices) and totaled. That “selling door to door and/or direct to buyers” is as prevalent a method for selling art as “from your home—buyers/individuals come to you” is significant. This supports that Lakota artists are necessarily opportunistic, and utilize a variety of approaches to make money.

	Where do you sell most of your art?	Where are you most comfortable selling your art?	What methods of selling your art are the most challenging?
From your home - buyers-individuals come to you	128	116	35
Door-to-door and/or direct to buyers-individuals	128	101	133
Pow Wows and/or local cultural events and activities	97	104	80
Retail - galleries, tourist shops, etc.	101	87	104
Internet	15	12	67
Other	88	87	41

Figure 4

I posit that figure 4 portrays the very real duality Lakota artists navigate between embedded and disembedded economic systems. Selling from home is ranked first in terms of where artists feel most comfortable in the sales process. As discussed above, the household is the site where “informal” activities representing the socially embedded economy take place. Having buyers come to their house supposes that an artist has the social connections required for such a method to be successful. This contrasts with the fact that selling directly to people, although a top choice as an approach to selling, is identified as the most challenging method for artists. The paucity of businesses in Pine Ridge, the limitations constraining access on the reservation, and the need to make ends meet converge on Lakota artists to produce difficult interactions with the market. The interpretation I would like to put forth is that Lakota artists simultaneously engage in embedded and disembedded economics to improve their chances of success.

Conclusion

Although the disembedded market is inconsistent and rife with hardship, Lakota artists are nevertheless connected with it. Whether this connection is based on U.S. hegemony and their history of assimilation, or the fact that poverty necessitates employing all available tools for survival is irrelevant. The double movement model is not an either/or scenario that seeks to abolish the disembedded market, or realistically place a socially embedded economy as the single method of economic distribution the world over. It is an explanation for the complex intertwining of market and human in history. What is relevant is the double movement’s ability to interpret the Lakota response to human suffering that has accompanied the proliferation of the open market on Pine Ridge and Cheyenne River. The social costs Lakota artists contend with have forced an inevitable movement towards

protection that can be observed as an adherence to tradition. Reciprocal relationships are still pervasive among Lakota people, and I have documented some of the ways these relationships play out. Lakota artists also participate in the market by necessity or when opportunities arise. Together, the occasions for earning cash in the disembedded market and the social support derived from an embedded economy make it possible for Lakota artists to survive.

Although this paper offers no prescription for alleviating the pressures and costs associated with the market, future studies of economic development on Pine Ridge may be informed by this study. By investigating the ways in which Lakota people have been impacted by market forces, more culturally appropriate and meaningful approaches can be taken towards addressing poverty. Art is ever-present among the Lakota, and everyday artists are forced to confront some very tangible barriers of access, as reported in this paper. One conclusion we may draw from this juxtaposition is that reservation economies stand to benefit greatly from improvements made to any of these barriers.

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Incommensurability and Revitalization: Land Development and its Effects on Native American Sovereignty

Mark R. Steinbuck

Abstract- *This paper makes connections between the historical development of land tenure policy in the United States since the Dawes Act of 1887 and its subsequent effects on the Native American condition. The relationship between the U.S. government and Native American tribal lands is analyzed using critical perspectives derived from political-economy/ecology, post-colonial theory and cognitive anthropology. Through looking at opposing generalized cognitive frames of animist subsistence cultures against that of Western modernist culture, the argument for a fundamental incongruousness between capitalist and indigenous land tenure systems is made. The land tenure system of "allotment" or parcelization along with neoliberal economic policy has desacrilized indigenous cultural landscapes in multiple sites across America. This paper argues that this ongoing form of development is more akin to international colonialism than internal ethnic oppression. In response to the effects of colonialism, some indigenous peoples have retained their traditional relationships to land in an effort to revitalize their own communities from political violence and assert their own sovereignty to ancestral lands. The Lakota Sioux's Black Hills of South Dakota, the Navajo Nation's Dine Bikéyah in the New Mexico, and the Sokaogan Chippewa's Mole Lake in Wisconsin are all used as case studies to show how indigenous*

American subsistence culture is treated as an obstacle to colonial development initiatives. As a conclusion, it is suggested that alternative and indigenous frameworks of human-environment relationships be encouraged in effort of both cultural and environmental sustainability.

Introduction

In 1887, the General Allotment (Dawes) Act authorized U.S. President Cleveland to divide the commonly-held lands of the Native Americans on most reservations into privately-owned parcels that were then evenly distributed amongst nuclear families (Chang 2011: 108; Zontek 2007: 53). Although touted as a mission of compassion, one that would instill the benefits of developed civilization onto a destitute and backwards race, the Dawes Act was really an intentional colonial policy of slow, nonviolent land-grabbing that infringed on the national sovereignty of the Indian Nations and explicitly intended to tear apart traditional communities and tribal bonds (Chang 2011: 109). Under this new policy, native land holdings were reduced from 137 million acres in 1887, to 52 million by the time of World War II (Chang 2011: 108), and the indigenous Americans themselves were reduced to a population of 200,000 down from estimated millions (Zontek 2007: 66). What was left of the Indian population was forced into becoming yeoman farmers, laborers with parcels of land that was alienable through debt or sale in the foreign system of the American capitalist market, and by the time of the New Deal, 90,000 native people were entirely landless (Chang 2011: 110).

The long history of the Native American genocide and land-grab has been recast in various new ways in the past decade or so in response to emerging and now-established social theories with a critical perspective stemming from the socio-economic concepts of globalization (Appadurai 2012; Inda and Rosaldo 2002) and postcolonialism (Milholland

2010), to more individually-focused theories on indigenous animist cognition (Ingold 2006; Hornborg 2006) and ecological knowledge systems (Parlee et al. 2006). The theories presented interrelate to form a multifaceted critique on the modernist discourse of development in the context of indigenous America.

Heeding the trend of cultural anthropology's interest in advocating for indigenous worldviews rather than overlaying rationalistic, disembodied Western understandings of cultural practice (see Rosaldo 2012; Ross et. al. 2011), this paper follows the history of modern development as sympathetic to the worldview of the "undeveloped," a process which ends up looking something uncomfortably close to ethnocide – being the intentional destruction of an ethnicity (but not necessarily the biological group that lives said ethnicity).

This paper will argue that indigenous animist cognitive frameworks are antithetical to neoliberal/modernist/capitalist development projects. As Ingold (2006) and Hornborg (2006) show, animist worldviews have different values and goals for society which focus on concepts of the sacred, whereas economic/ecological development projects, as shown by Chang (2011), Fenelon and Hall (2008), Pickering and Jewell (2008), and Kuokkanen (2011), focus on a falsely proclaimed neutral understanding of economics through the framework of neoliberal market forces. Historical conflicts of interest between indigenous American Nations and the United States as focused on in this paper relate to land development – historically referred to as "allotment" – which is in contention with worldwide indigenous models of commons stewardship.

Study sites used in this paper are contested sacred lands historically connected to North American indigenous groups: the Lakota Nation and the Black Hills (*Paha Sapa*) in South Dakota, the Navajo Nation and the *Diné Bikéyah* in New Mexico, the Doyon Corporation (Gwich'in Alaskan Natives) and the Yukon Flats in Alaska, and the Sokaogan Chippewa

and Mole Lake in Wisconsin. As a case study, this paper will investigate the cultural and historical role of bison on the Lakota Sioux Pine Ridge Indian Reservation in South Dakota. As a conclusion, I will explore the Indigenous Stewardship Model (Ross et al. 2011) as an alternative to traditional and neoliberal development.

The Political Economy of Globalization and Development

A review of recent case studies involving Native Americans and development issues reveals a trend of conclusions explicitly suggesting that many liberal development projects are designed in such a way that makes them fundamentally incommensurable to the values of the project's target community (Chang 2011; Fenelon and Hall 2008; Ganapathy 2011; Kuokkanen 2011; Milholland 2010; Nesper 2011; Zontek 2007). When speaking about development topics relating to Native Americans, it is important to keep in mind that Native American reservations should usually be seen politically more akin to an ethnic majority of a third world country such as Bolivia than an ethnic minority in South Dakota, New Mexico or Wisconsin, all the while still retaining the peculiar handicap of having to funnel many economic and political decisions through the U.S. federal government. The complexities of the histories of the Indian Nations removes from the popular imagination the reality that Indian reservations are technically sovereign nations circumscribed by the state authorities of the United States and Canada; Indians are not analogous to a single group that partially constitutes multi-racial America, but actually many independent nations "confronting colonialism" (Chang 2011: 116).

And so with development in mind, many anthropologists and other social theorists have used theories of globalization and postcolonialism to understand the Native American situation. The concept of incommensurability is

presented in Milholland's "In the Eyes of the Beholder: Understanding and Resolving Incompatible Ideologies and Languages in US Environmental and Cultural Laws in Relationship to Navajo Sacred Lands," (2010). Milholland asserts that Western constructs of society, language, order or any other imaginable construct have the potential to be entirely incompatible with those of non-Western groups, and given the fact that Western groups in modern times have always been the power holders, the cultural values of the target group become marginalized in favor of the values of the dominant (2010: 107). Milholland gives for example an idea that is central to the cognitive theories discussed later in this paper, being the Western distinction of human cultural productions from natural phenomena in contrast to the indigenous American understanding of the two categories being fundamentally integrated (2010: 108). Even this very basic distinction has huge consequences in how lands are linguistically codified as sacred or not sacred, where previously such a distinction did not exist (Milholland 2010: 108). Incommensurability is a critical component of postcolonial theory which "raises skepticism about the value neutrality in Western Institutions" and aims to show how even though formal colonialism has ended in liberated territories, colonial institutions of government, education, media and church still remain to promote hegemonic values (Milholland 2010: 107).

As such, law and government in Indian lands can only be understood as a relationship of domination instigated by the colonizing United States government over tribes. Lawmakers in Washington have structured property law around dominant values that equate land ownership with power (Milholland 2012: 106), with the end result of creating a disadvantage to those who do not equate physical place directly with market economies (Milholland 2012: 108) or intensively use bounded land parcels in an effort to accumulate personal wealth. The Bureau of Indian affairs, for example, sees hunting and

gathering activities as unproductive and an underutilization of land (Pickering and Jewell 2008: 153), which is an *a priori* value association on what exactly land is good for and how to labor it.

Rauna Kuokkanen's work "Indigenous Economies, Theories of Subsistence, and Women: Exploring the Social Economy Model for Indigenous Governance" uses the economic anthropological theory of Karl Polanyi to show how the institution of the market economy is necessarily antithetical to and requires the destruction of traditional social structures that utilize communal organization and kinship-based redistributive gifting economies in order to survive (2011: 230). The globalization of land development, as enacted primarily through the world market economy which favors privately owned extractive land use to gain capital for export or consumption, can be seen as a hidden war against subsistence practices which are at the heart of traditional economies.

The fetish of modernity is wage labor, money, and materialism, which leads to contempt for subsistence lifestyles which, historically, required none of these things (Kuokkanen 2011: 224). Indigenous people worldwide are pressured and dominated by globalized consumption patterns and the privatization mandates of neoliberal economic policy (Fenelon and Hall 2008: 1874) which strongly push for "... profit-driven development projects such as logging, mining, hydro, and oil and gas..." while marginalizing these communities to western land-tenure systems that have no practical application for subsistence practices (Kuokkanen 2011: 217).

The heart of the disconnect with development is not necessarily the selfish, evil soul of neoliberal policy makers, but a broader misunderstanding of human nature and the fallacy of social evolution which sees humanity as a singularly natured organism on a linear path towards the perfection of the liberal ideology of luxury, freedom, individualism and property. Indigenous economics are seen as a backwards

“obstacle” on the road to socio-economic uniformity which can facilitate global trade and capitalism (Kuokkanen 2011: 220-221).

The emic perspective, as shown in Fenelon and Hall’s (2008) “Revitalization and Indigenous Resistance to Globalization and Neoliberalism,” is the American Indian desire for cultural sovereignty and the right to practice traditional ways of life that include language, spirituality, traditional land-use, and communal kin-based social organization (2008: 1872). These ways of life are denied by the processes of neoliberal land development, as it is by the nature of reorganization of national economies and government that Native communities are subsumed, spatially redistributed, and in the end oppressed and marginalized all in a postcolonial context (Fenelon and Hall 2008: 1873).

Animist and Objectivist Cognitive Frames

To understand in greater depth the historical conflicts of developmental interests between Native American groups and the West, it is imperative to understand the cognitive frameworks of animism – which is the generalized worldview/religion of indigenous, subsistence-based cultural groups – versus that of modern objectivism. Anthropologist Tim Ingold’s (2006) “Rethinking the Animate, Re-Animating Thought” and Alf Hornborg’s (2006) “Animism, Fetishism, and Objectivism as Strategies for Knowing (or not Knowing) the World” are complementary pieces that shed light on the primary issue of why development, as it happened to Native Americans, is a problem to begin with. Ingold illustrates that, unlike the dominant Western culture believes, what is considered alive and what is considered dead or inert is not a universal discrimination (2006: 10). Hornborg elaborates that this binary is a peculiar influence of the epistemology of modernity, which fetishizes the creation of boundaries around all constructed categories so that they essentially do not

intersect and fundamentally oppose each other (2006: 21). Through this framework of Cartesian-style boundaries and separations, the Western mind further separates what is natural from that which is symbolic, cultural, or human in origin (Hornborg 2006: 21).

The bifurcation of the symbolic from the natural is the philosophical underpinning of the knowledge tradition of western science, as it strives towards the seemingly impossible goal of objectifying and understanding the observable world without actually connecting to it (Ingold 2006: 19). This objectification reduces the “other”, be it a rock or a pronghorn deer or the sky, as a material formation without meaning, and this interpretation is the sole property of modernity (Hornborg 2006: 27). Although the reliance on objectivism does not entirely eliminate meaning and politics from the world, the economic model of capitalism (which is embedded in modernity) reifies the distinction between nature and culture (Hornborg 2006: 22), which can be seen as an ideological illusion that subjugates all relationships between people as if they were relationships between inert objects (i.e. traded materials) (Hornborg 2006: 29). The language of science results in a lack of recognition of the sacred, and as such environmental and cultural relations are codified and protected through scientific bureaucracies like the National Historic Preservation Act (NHPA), the 1906 Antiquities Act, and the Archaeological Resources Protection Act – all of which treat sacred relationships, places, religious objects and even ancestral remains as property (Milholland 2010: 106).

The concept of modern objectivism is crucial to the understanding of land development because it is the hegemonic ideology that nearly eradicated the Great Plains of not only open pastures and bison in the 19th century, but also of the animist worldview which was previously steward to the land. Animism is often simplified as ghosts inhabiting rocks and trees, thus making landscapes sacred and ready to be

worshipped. A better understanding of the animist lens is of a mutually created existence between humans and places (Ingold 2006: 10), or a reciprocal co-origination as represented by the Lakota greeting *Mitakuye Oyasin*, meaning that all existence is related (Bowen 2005: 126), or half-way across the world, the fundamental Buddhist doctrine of reality embodied in the sanskrit term *pratitya samutpada*, translated as “interconnected co-origination”. Whereas religion and biology have little to do with each other in the western tradition which necessitates the separation of modes of knowledge, the cosmology of animism automatically encodes an ecological knowledge and morality which are not separable (Hornborg 2006: 25). This automatic knowledge does not originate from a biologically innate understanding of the world, suggesting that indigenous people somehow have a natural gift for living in harmony with the environment as suggested by romantic “ecological Indian” arguments, but rather that the longstanding, interdependent and adapted relationship between indigenous *cultures* and their physical environments have become mutually sustaining. This concept is antithetical to western definitions of nature that are hinged on the relative absence of humans (Pickering and Jewell 2008: 136). Ingold suggests that animism sees nature in a more holistic sense better described as a “domain of entanglement” (2006: 14) than “environment”, which suggests that these domains are necessarily involving humans and cultural production.

Where material objectivism sees the world in forms with boundaries, animism sees the world as consisting of flux: movements, intersections and relationships that directly affect meaning and growth (Ingold 2006: 14). Through this worldview, all physical externalities are seen more as subjects and less as objects, and as such naming in animist languages encodes for movement and relation by using verbs instead of nouns (Ingold 2006: 14), and artistically can be represented as

arcs, lines or tracks suggesting not a bounded object but a trajectory of movement (Ingold 2006: 14, 15).

Although the topic of spirituality may seem abstract and irrelevant to the topic of land development in America, in reality the generalized worldview of the indigenous American is important for understanding why exactly development has turned an otherwise healthy continent of communities into the peripheral Indian Nations of today. By understanding indigenous culture at least in generalities, it can be learned that the connections to place and landscape are fundamental to their cognitive categories; relationships to place are sacred, collectively stewarded, ecologically symbiotic, and not economically driven, all of which are in direct opposition to capitalist values of production (Fenelon and Hall 2008: 1875, 1876).

According to a quantitative domestic survey published in "Nature is Relative: Religious Affiliation, Environmental Attitudes, and Political Constraints on the Pine Ridge Indian Reservation," conducted by Pickering and Jewell on the Lakota Pine Ridge Reservation, those members which adhere exclusively to traditional Lakota spiritual practice (in contrast to Christianity or atheism) "consistently reflect greater involvement with and concern for nature and natural resources," (Pickering and Jewell 2008: 140). As opposed to the more traditionally oriented Lakota who find great value in wild resources, Christian Lakota tend to value marketable plants over wild ones (Pickering and Jewell 2008: 145), as the American Christian tradition has direct correlation with capitalist ethics that presume the inherent domination of humans over nature and animals (Pickering and Jewell 2008: 143).

Assertions of Sovereignty and Resistance/Revitalization

According to both globalization theory and world systems theory, free market capitalism has created a core set

and a periphery set of nations throughout the world and arranged it so that the core dominates the periphery for the purposes of consumption and production (Inda and Rosaldo 2002: 13). But unlike the more simplistic discourse of cultural imperialism and world systems theory, globalization theory does not necessarily understand peripheral communities to be in the position of passive consumers, ready to absorb and be changed by the hegemonic forces of western capitalism (Inda and Rosaldo 2002: 15). Rather, peripheral communities around the world actively reinterpret and re-codify the social texts of ideology, values, and life-style (Inda and Rosaldo 2002: 16) that are broadcasted to them. In this way, indigenous communities worldwide all have agency to critique, reject and rebroadcast local understandings of community, ecology, and development.

Native Americans in particular have had a very disappointing relationship with the U.S. government because of their historical, cultural and geographic subjugation to incommensurable ways of life. In contemporary contexts, extractive industry, commerce and recreation all threaten the sacred relationships of indigenous traditional culture (Milholland 2011: 104). Many tribes today are fighting overtly racist initiatives that desire to buy off sacred landscapes in an effort to solve the hazardous problems of the capitalist machine.

The well-known historical movement of the Ghost Dance by the Lakota people in the late 19th century is an example of how dominant states react to assertions of cultural sovereignty as acts of political violence, where many indigenous movements are actually emically viewed more as revitalization than resistance, and this revitalization is understood to be both a local and a global process (Fenelon and Hall 2008: 1873). The Ghost Dance of 1890 was a ceremony acted out with the intention of attaining four goals relating to land stewardship: that the earth would regenerate, that the

buffalo would return from the intentional slaughter by the U.S. military, that the white man would leave the Great Plains, and that the Indian population would multiply after the genocide committed by the government (Zontek 2007: 27). This movement ended at Wounded Knee Creek in South Dakota in 1890 with the massacre of 350 Lakota men, women and children (Zontek 2007: 26).

Although the original Ghost Dance movement was ultimately doomed to failure, the conflict and ceremony was revisited in the 1970's and 80's as the Lakota people attempted to regain ownership of the Black Hills under tribal authority as originally agreed upon in the 1868 treaty that established Oglalla (Lakota) territory and Lakota-U.S. relations (Ostler 2010: 172-174). In the Supreme Court, a cash compensation was offered the Oglalla Sioux, yet was rejected unanimously among tribal members (Ostler 2010: 174), as money is incommensurable with a sacred relationship to land.

Currently, the Western Shoshone Nation in Nevada is fighting a similar battle to protect its sacred Yucca Mountain from transformation into the United States' "central repository of nuclear waste" (Milholland 2011: 104), which is also planned to be compensated with a cash settlement. All the while the Aleuts of Amchitka Island, Alaska are still struggling with the effects of nuclear radiation on their selves and subsistence bases from nuclear bomb tests in the late 1960's and early 1970's (Burger et al. 2009).

Most often, resistance by indigenous communities worldwide are not media-friendly political spectacles with charismatic leaders as with the American Indian Movement (AIM) of the mid- to late 20th century (see Fenelon and Hall 2008; Ostler 2010), but rather community- or kin-based decisions to reject hegemonic forces and return to lives of subsistence and domestic socioeconomic entanglements. Subsistence, as noted by Kuokkanen, is neither capitalist nor socialist, and is explicitly anti- both (2011: 226). She notes

further that subsistence as a form of revitalization empowers people, especially women, at the local level in that they gain agency over their own means of production (2011: 228). Subsistence-based localities that become self-sufficient at the community-level or household-level necessarily have to reengage with the land and as such revitalize traditional practice while at the same time resist participation in the global capitalist economy.

To briefly relate a few examples of indigenous resistance to contemporary land development projects, the Navajo and the Mole Lake Ojibwe (Chippewa) have had significant conflicts relating to land rights and National sovereignty. The Navajo (*Diné*), for instance, reside on a now fragmented sacred landscape known as the *Dinétaah* which spans several hundred square miles, mostly in northwest New Mexico (Milholland 2011: 111). The land is not managed according to the traditional Navajo philosophy of *hozho*, which animistically frames landscape as a cosmological system that ties together physical land features and relationships between animals, plants and humans (Milholland 2008: 104, 115). Instead, the land is politically divided and culturally nullified as a set of physical territories that is managed by either the federal or state government, private landowners, or by the Navajo nation (Milholland 2008: 111). Where the *Dinétaah* to the Navajo is a place where humans can conduct cultural/ecological/spiritual relationships, to the Bureau of Land Management in 2003, it was seen as a site that suited large-scale oil and gas resource development (Milholland 2008: 111). The Navajo nation rejected the BLM approval of the development proposal, as they vehemently expressed concerns over a lack of environmental precautions, as well as the almost certain negative spiritual effects that the development would have on the Ch'ool'ii and Dzil Na'oodilii mountains (Milholland 2008: 111).

Since the 1980's in northern Wisconsin, the small Mole Lake band of Chippewa have fought for their right to their local subsistence foods of wild rice and riparian fauna in the face of the Exxon corporation's interests in developing the Crandon Mine, which contained billions of dollars of zinc and copper deposits that would take decades to extract (Nesper 2011). Although the Exxon corporation did environmental impact studies, their report showed that there would be negligible impacts to the unproductive Rice Lake, which in any case only contained "lake weeds," which turned out to be the band's primary form of subsistence: wild rice (Nesper 2011: 154). However, as the Mole Lake Ojibwe understands it, all lakes in their territory are physically connected, and so what is done to one lake is done to them all (Nesper 2011: 159). To combat the looming ecological and spiritual destruction of their subsistence base, the Mole Lake band used legal loopholes to change environmental laws which regulated water quality; by their new standard, no detectable alteration in water quality was permissible, and so no mining could be performed (Nesper 2011: 155). In this case, after a two-decade long court battle, Exxon withdrew its development project and sold its interests to another company, which then in turn eventually repatriated stewardship of the Crandon Mine area to the Mole Lake band and has been left wild ever since (Nesper 2011: 161).

Case Study: The Lakota and the History of the Buffalo

The small but important victories managed by the aforementioned tribes are inspiring, yet uncommon. The results of most battles for sovereignty, the right to subsistence and the practice of traditional culture free of intrusion by modern development are ambiguous at best. This is the case for the Lakota people inhabiting the Great Plains of the American West.

Shannon County, South Dakota, where the Lakota reservation of Pine Ridge is located, has been the poorest

county in the United States since 1980 (Fenelon and Hall 2008: 1870). The Rosebud Lakota reservation, also in South Dakota, reported an average per capita annual income of \$5,967, and it hosts a 57% unemployment rate (Bowen 2005: 127-128). These numbers are certainly bleak, but the numbers alone hide an otherwise complicated and surprisingly hopeful future for the Lakota reservations. Even after the unending gestalt of genocide, ethnocide, allotment, and compulsory Christian boarding schools, a Lakota elder named Albert White Hat, Sr. looks towards a promising future as he recounts, "A long time ago, elders were the foundation of the home, sharing wisdom and teaching the grandchildren. Government housing programs separated the families. Now, we live together again, and the elders teach the children; we just don't tell the government," (Bowen 2005: 131).

Albert's words relay many of the complexities facing Lakota people today: that of a fractured and violent past and still having to answer to the government that committed this violence, as well as the opportunity to subversively resist government hegemony in favor of traditional lifestyle. To Albert and many traditionally-minded Lakota, the extended kin network called *Tiyospaye* is the key to indigenous survival (Bowen 2005: 127). It is through the informal institution of the *Tiyospaye* that subsistence and domestic products flow – and so it is essentially the networking principle of traditional economy on Lakota reservations, and therefore the mode by which the difficulties of being at the periphery of the global capitalist economy are mitigated (Pickering and Jewell 2008: 138).

Subsistence economy on the Lakota reservations has had a particularly turbulent past, as it is largely based on the interdependent relationship of the Lakota and the bison. As is told in Ken Zontek's "Buffalo Nation: American Indian Efforts to Restore the Bison," it is shown in the archaeological record that Native Americans and buffalo have interacted and

thrived symbiotically for as long as 10,000 years (Zontek 2007: 3). Not only the Lakota, but also the Ute, Crow, Cree, Arapaho and likely other tribes tell in their genesis stories that they are created from the blood clot of a buffalo (Zontek 2007: 3), and so the deep interdependence of the two nations (Lakota and buffalo) can be surmised.

However, following the invasion of the American frontier by the U.S. cavalry, buffalo were nearly exterminated in the territories, and by the 1880's both white and Indian farmers had begun to dominate the land and subject it to fencing and private ownership, which continued until the open range of the American West was history (Zontek 2007: 26). Bison were replaced with cattle, and the land access and migratory lifestyle that was crucial to the ecological and spiritual health of the bison, Lakota, and the Great Plains ecosystem was rendered impossible by 19th century impositions of land privatization and capitalism (Pickering and Jewell 2008: 151, 153).

Fast-forwarding a hundred years and after repeated attempts by the government to further destroy the remaining wild bison herds in Montana and Wyoming (see Zontek 2007 for more details on the slaughter of bison on Flathead Lake and Yellowstone National Park), the ITBC (Inter-Tribal Buffalo Cooperative) is created to reinstate the traditional indigenous/bison relationship predicated on the wild and free-range existence of the *Pte Oyate*, or Buffalo Nation (Zontek 2007: 79). The mission statement of the ITBC reaffirms that the subversive act of reclaiming traditional subsistence-based spiritual relationships with landscape and fauna is very much about cultural revitalization (Zontek 2007: 76-77). Bison, commonly-held open pasture and a reliance on traditional economies leads to a counter-development that can potentially reverse the damaging effects on identity and community that modernist economic development has imposed.

The ITBC herd has grown from hundreds of heads of bison in the early 1990's to more than 9000 by 1999 (Zontek 2007: 75). Although it is too soon to say what the long-term affects of reestablishing commons and spiritual relationships with sacred landscapes, the fact that the buffalo has strong support from as well as is tended by a community of over 50 tribes (Zontek 2007: 75, 78) shows much sustainability and potential. Lakota tribal member Richard Sherman reports that currently "...75% [of bison producers] distribute surplus animals for family or ceremonial use... [and] 65% of the producers rely on family, friends, neighbors or tribal members to help with the herd," (as quoted in Pickering and Jewell 2008: 153). The proliferation of bison meat is being incorporated into community health programs in an effort to combat diabetes (which exists in 1/3 of some reservation populations [Zontek 2007: 88]) as well as feed the elderly (Zontek 2007: 79), and this shows that the program merits more accolades and consideration than any western development program to date.

Conclusion: Stewardship as Indigenous Development

For the tens of thousands of years leading up to the Dawes Act of 1887, Native Americans established extremely close relationships with the wild landscapes of North America. Following the period of colonial contact resulting in laws of western domination, modernist development projects have systematically removed indigenous people from their sacred lands as well as the sacred relationships that are the foundation of animist cognition. Indigenous people worldwide, from the Zapatistas of Mexico (Fenelon and Hall 2008: 1871) to the Gwich'in of Alaska (Ganapathy 2011) or the Saami of Scandanavia (Kuokkanen 2011), have had to face and resist the hegemonic discourse of development.

Recently, development theories have been cooperatively challenged by innovative models created by indigenous people, academics and bureaucratic land managers.

As shown in Ross et al.'s (2011) "Indigenous Peoples and the Collaborative Stewardship of Nature: Knowledge Binds and Institutional Conflicts," there are emerging alternatives to land management that privilege indigenous knowledge systems. These collaborative models accommodate traditional subsistence practice and the domestic production (Ross et al. 2011: 243) and eliminate postcolonial institutions which have deleterious effects on physical and spiritual health, traditional education and autonomy.

By reexamining the foundations of modern knowledge systems and recognizing the fundamental disjuncture between scientific objectivism and animism as well as the disjuncture between capitalism and subsistence economies, it becomes evident that the postcolonial institutions dominating indigenous communities have a lot to do with the social problems many Indian reservations face today. The fundamental differences in how the West manages and perceives landscape and place is incommensurable with the highly adapted indigenous ecological relationships of North America. The pertinent social and environmental issues that face not only indigenous communities today, but all people on Earth, have very strong connections to capitalist, especially neoliberal, modes of production and policies of land tenure.

This paper suggests that only through the revitalization of traditional subsistence cultures in indigenous populations can ecologically sustainable environments incorporating nature and people in North America be regained. The deep history of indigenous knowledges worldwide has enormous application outside the reservations, and on the reservation is inarguably the strongest assertion of sovereignty and resistance.

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