THE EVOLUTION OF FOLSOM FLUTING

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The emergence and evolution of the Folsom point is analyzed in light of cultural transmission and dual inheritance theories. While the Folsom point was an outstanding techno-functional solution to Late Pleistocene bison hunting of the Great Plains of North America, archaeological data indicate that fluting was an unnecessary high-risk activity that served as much a socio-cultural role as a techno-functional one. In dual inheritance terms, the fluting of Folsom points likely gained a foothold as one piece of the “good hunter” model which was passed from elders to youths within specific cultural contexts. The demise of Folsom points during the earliest Holocene likely was instigated by a transformation of social image, from fluting as an indicator trait of success, to fluting as a measure of increased risk and waste in the face of challenging subsistence realms.

Spanish Abstract page (to be completed if accepted)

The fluted Folsom point is one of the most well-known projectile point styles in human prehistory. However, its precise role within Folsom culture has long been a topic of debate among American archaeologists. From techno-functional to socio-religious, various explanations have been proposed to explain the perplexing practice of fluting Folsom points. In this paper, I review these prior explanations for Folsom fluting, as well as introduce a supplementary explanatory model based in cultural transmission and dual inheritance theories.

The main supposition of this paper is that fluting was an unnecessary high-risk activity that served as much a socio-cultural role as a techno-functional one. In dual inheritance terms, the fluting of Folsom points likely gained a foothold as one piece of the "good hunter" model which was passed from elders to youths within specific cultural contexts. The demise of Folsom points during the earliest Holocene likely was instigated by a transformation of social image, from fluting as an indicator trait of success to fluting as a measure of increased risk and waste.

The ultimate goal of this paper is not to reject prior models of explanation, but instead to supplement them with new ideas from evolutionary theoretical approaches. As indicated by the flurry of papers on the topic (Ames 1996; Barlow 2002; Barton 1997; Bettinger et al. 1996; Bettinger and Eerkens 1999; Dunnell 1978; Hegmon 2003; Kanazawa 2004; MacDonald 2001, 2004; Luxen and Buunk 2006:898; Neff 2000; Neff and Larson 1997; Nieman 1997; O'Brien and Holland 1992, 1995; O'Brien et al. 1998; Schiffer 1996; Shennan and Wilkinson 2001; Teltser 1995), evolutionary theory has an enormous amount of potential to help explain individual decision-making in prehistory. The Folsom fluting issue provides an outstanding case study by which to evaluate the role of evolutionary approaches—namely cultural transmission and dual inheritance theories—in explanation of issues in prehistory.

Background

Since 1926, Folsom culture has been a popular topic of study among North American archaeologists (Amick 1999; Clark and Collins 2002; Figgins 1927; Meltzer 2006; Sellet 2004; Wilmsen and Roberts 1978). Not only does Folsom represent one of the earliest well-established Paleoindian cultures of the Americas, but Folsom hunter-gatherers were specialist bison hunters who utilized a remarkable projectile technology. Folsom sites date to approximately 10,900 to 10,200 radiocarbon years ago (Haynes 1993; Haynes et al. 1992; Waters and Stafford 2007:1124) or circa 12,800 to 11,700 calibrated calendar years ago (Ahler and Geib 2002:388; Fiedel 1999; Taylor et al. 1996:523). Folsom groups inhabited an area of more than one million square km, from north Texas to southern Manitoba and from Wisconsin to Idaho and New Mexico (Figure 1) (Amick 1996; Bamforth 2002:63-64).

Across this entire region, Folsom sites contain the remains of bison and occasionally other game. As shown elsewhere using evolutionary ecological approaches (MacDonald 1998; Waguespack and Surovell 2003:348), bison hunting emerged as a specialized subsistence strategy in the Late Pleistocene due to high animal populations and low human populations, resulting in little prey competition. Recent studies confirm the importance of bison in the diet of Folsom peoples, but emphasize that other flora and fauna were collected frequently as well (Bamforth 2002; Hill 2007).

In addition to being specialist bison hunters, Folsom hunter-gatherers produced one of the most diagnostic projectile points in world prehistory: the fluted Folsom point (Figure 2). Clovis (Bonnichsen and Turnmire 1991) and Goshen (Frison 1996) projectile points pre-date Folsom, with both styles having extremely fine pressure flaking and finely-thinned bases, producing minor flakes (~pseudo-flutes) that extended from the concave base into the center of the point

(Figure 2). Folsom fluting is a cultural descendent of Clovis and Goshen flaked stone technology (Ahler and Geib 2002:384; Morrow and Morrow 1999:216); however, Folsom flintknappers took Clovis/Goshen basal thinning to an extremely sophisticated level, removing a flake that progressed from the concave base to nearly the very tip of the point.

Why Flute Folsom points?

Ahler and Geib (2000, 2002; Geib and Ahler 2002) provide an outstanding review of the techno-functionality of the fluted Folsom point. While their "utility knife" hafting method been criticized (Meltzer 2006:279), Ahler and Geib's replicative studies effectively reveal that Folsom technology was well-designed to meet the demands of a bison-hunting subsistence strategy. While the Folsom point was functionally successful, a variety of other projectile points without flutes were utilized with great success for thousands of years by Plains bison hunters (Figure 2) (Frison 1991; Hayden 1982). Despite Ahler and Geib's proposition of Folsom point superiority, a review of the cultural historical record of the Plains region deems it unlikely that the fluted Folsom point was any more functionally efficient in killing prey than the preceding Goshen points or the succeeding Agate Basin, Hell Gap, or Scottsbluff points (Bradley 1993). Each of the respective point styles depicted in Figure 2 was successfully utilized by Plains Native Americans for hunting similar prey and persisted as the preferred point form for several hundred years.

In fact, faunal remains from Paleoindian sites support the contention that Plains bison hunters were more successful using non-fluted projectile technologies. Before Folsom and after Folsom, archaeological sites yield greater numbers of bison than during the Folsom period

(Figure 3). On average, Folsom sites yield a minimum number of individual (MNI) count of seven bison (MacDonald 1998:224), compared to an MNI of 22 bison for pre-Folsom Goshen and an MNI of greater than 150 bison for selected post-Folsom Late Paleoindian sites discussed below.

Before (or contemporaneous with) Folsom, the Goshen-period Upper Twin Mountain Site in Colorado yielded an MNI of 15 bison (Kornfeld et al. 1999:655), while the Goshen-age (ca. 10,900 B.P.) Mill Iron Site in eastern Montana yielded an MNI of 29 (Todd et al. 1996:164). Well-reported excavations of Goshen-period occupations are scarce, but the data from these two sites support the contention that Goshen projectile point technology was at least as successful at hunting bison (if not more so) than Folsom.

After Folsom, most Late Paleoindian sites have significantly higher bison counts than Folsom, with a mean MNI of the selected Late Paleoindian sites discussed below of greater than 150 (Figure 3). For example, at the Agate Basin Site in Wyoming, the Folsom component yielded an MNI of nine bison (or 11 according to Sellet 2004:1556), compared to the Agate Basin-period (post-Folsom) component which yielded an MNI of 75 bison (Zeimens 1981:227).

Other post-Folsom Paleoindian sites show a similar increasing intensity of bison hunting compared to sites of the Folsom period. For example, the Hell Gap (post-Folsom) components at the Casper Site in Wyoming yielded 74 bison (Frison 1974:22), while the Hell Gap component at the Jones-Miller Site in Colorado yielded greater than 200 bison (Stanford 1978:93). Dating to the Late Paleoindian period (ca. 9800-8800 B.P.; Frison 1987:98), the Cody Complex bone bed at the Horner Site in Wyoming yielded at least 50 bison (Todd 1987:138), while Cody Complex period occupations at Hudson Meng in Nebraska and Olsen Chubbock in Colorado yielded several hundred animals each, respectively (Frison 1991:178-186). The mean MNI from these

six post-Folsom sites is over 150 bison, significantly greater than the mean MNI count of seven for Folsom. These data provide substantial support for the argument that post-Folsom technology was as good or even potentially superior to Folsom in dispatching bison.

Because of this fact, archaeologists have spent a great deal of time attempting to figure out why Folsom points were fluted in the first place. Much of this energy has been devoted to replicative studies of Folsom point manufacture. Data provided by these experiments indicate that Folsom point production was extremely wasteful and risky, with breakage rates on the order of 10-37 percent (Ingbar and Hofman 1999:101; Sellet 2004: 1558) to as much as 30-62 percent (Akerman and Fagan 1986; Boldurian et al. 1985; Ellis and Payne 1995; Flennikan 1978; Geib and Ahler 2002: 268; Gryba 1988; Sollberger 1985; Winfrey 1990). Most of these Folsom point production mishaps occurred during fluting, after expending significant amounts of energy during the manufacture of the point preform. As Bamforth and Bleed suggest (1997:133), "There appears to be no reason to suppose that the increased procurement and production costs associated with fluted points were compensated by practical benefits at other steps of the Folsom technological continuum."

Dual Inheritance Theory and Fluting of Folsom Points

Folsom Cultural Transmission

While Ahler and Geib (2000:817) suggest otherwise, it remains to be proven that the costs involved in Folsom point manufacture outweighed the benefits. Ultimately, thus, the question remains to be answered: what was the purpose of fluting Folsom points? Why would Folsom individuals flute their projectile points when it was apparently so risky and wasteful of stone, time, and energy? If the reason for fluting was not exclusively for techno-functional

reasons, than perhaps the reason lay more in the realm of socio-cultural or even religious/ritual activity (Frison 1991; Bamforth 1988; Bradley 1993; Storck 1991). Dual inheritance and cultural transmission theories explore the interplay between genetic and cultural inheritance systems among humans and may provide some answers to the Folsom fluting question (Durham 1991; Cavalli-Sforza and Feldman 1981; Hewlett and Cavalli-Sforza 1986; Boyd and Richerson 1985; Bettinger et al. 1996).

Cavalli-Sforza and his colleagues (Cavalli-Sforza and Feldman 1981; Hewlett and Cavalli-Sforza 1986) provide insights regarding the mode and the ratio of cultural transmission which are useful in understanding Folsom culture change. In another paper, MacDonald (1998) noted that there was widespread cultural homogeneity across a large geographic area and a circa millennium-long persistence of Folsom fluting in the Plains. Given this conservative and long-lived culture, Folsom individuals probably transmitted technological know-how in a many-to-one ratio and an oblique-to-vertical mode (Figure 4). Generation after generation, groups of elders transmitted knowledge to eager youths and young adults. Such a means of cultural transmission leads to little change over a wide region and for extended periods—at least 500-700 years and across more than a million square km in the case of Folsom.

Folsom Fluting and Dual Inheritance Theory

Boyd and Richerson's (1985) dual inheritance theory provides a supplementary model of cultural transmission and a succinct terminology that has numerous implications for archaeology and the nature of culture change in prehistory (Bettinger et al. 1996; Bettinger and Eerkens 1999; Shennan and Wilkinson 2001). In their model, cultural transmission occurs most commonly by biased transmission, unbiased transmission, or guided variation. Unbiased transmission assumes that individuals simply copy parents when making important life decisions. This is an unlikely form of transmission among hunter-gatherer populations as it is clear that cultural transmission is

distinct from genetic transmission in that many individuals beyond parents (e.g., grandparents, aunts, uncles, peers) influence individual selection, as reflected in Figure 4 above (Hewlett and Cavalli-Sforza 1986).

Within dual inheritance theory, Boyd and Richerson (1985) suggest that another viable means of cultural transmission is trial and error learning, or guided variation. This is an expensive form of cultural adaptation as it assumes that individuals pick from a variety of cultural forms during a long evaluation process. This mode of transmission implies that multiple technological variants and, in fact, multiple hunting strategies were available for selection by Folsom individuals. Given morphological variation in Folsom points across the Plains, we cannot absolutely rule out guided variation as a possible means of cultural transmission during the Folsom period. However, there is no archaeological evidence to indicate that a variety of projectile point and/or hunting strategy alternatives were available for selection during the Folsom period, thus indicating that guided variation was an unlikely form of cultural transmission for Folsom hunter-gatherers. In addition, such a selection process would have been extremely costly and risky for Folsom people. Folsom subsistence likely entailed a wide array of technical knowledge beyond the fluting of Folsom points; to have to achieve success in this environment by means of guided variation—or trial and error learning—would have placed subsistence success in jeopardy.

Within Boyd and Richerson's model, thus, it is most likely that Folsom individuals utilized biased transmission during the learning of culture, including the fluting of Folsom points. More specifically, indirect bias—a sub-category of biased transmission—provides a possible means to explain the adoption and spread of Folsom fluting (Bettinger and Eerkins 1999). Indirect bias suggests that those traits used by successful individuals will be copied by

youths within society. According to Boyd and Richerson, the copied traits are referred to as indicator traits of success. Because it is often unclear why an individual is successful, individuals copy many, if not all, of the successful individual's behaviors (or indicator traits).

So, imagine a population of Folsom hunter-gatherers, in which hunting methods and technology of production are taught from elders to youths in a many–to-one ratio and oblique-to-vertical mode, leading to cultural homogeneity across wide spans of time and space (Hewlett and Cavalli-Sforza 1986), as described above (see Figure 4). In this scenario, fluting of Folsom points was one of the suite of indirectly biased traits of good hunting. Learning individuals observed the successful traits and copied many if not all of them, including fluting.

Folsom youths, thus, likely viewed good hunters (including many of their family members and hunter-gatherer band members) as their models of choice. As Boyd and Richerson (1985: 243) state, "It is easy to see why indirect bias might be adaptive…It may be difficult to evaluate the best hunting practices from among the myriad of possibilities, so just copy the most successful hunter. Since it is difficult to determine exactly which of his techniques makes him successful, one might imitate everything that is plausibly connected with his hunting success…." Boyd and Richerson (1985: 156) continue by stating that "once enough people use a specific marker to choose whom to imitate, anyone failing to display the indicator will be effectively ignored in the process of cultural transmission."

In all likelihood, good hunters held prestige and enhanced social status within Folsom culture (Hildebrandt and McGuire 2003:791). While there is little archaeological evidence to support this suggestion for Folsom, evidence from contemporary hunter-gatherer groups suggests increased social status associated with good hunting. This is especially true among populations reliant on meat-provision for a substantial portion of their diet (Barlow 2002:82; Hewlett 1988;

Hill and Hurtado 1996; Patton 2005:140; Smith and Bliege Bird 2000:253), as has been shown to be the case for Folsom (Ahler and Geib 2000:816; Bamforth 1988:160-161; Hill 2007:423; Janetski 2002:398; MacDonald 1998:223-226; Todd 1991:230-231). As proposed by Bamforth (2002:439), "at least in tribal societies, higher-status men seem universally to have higher reproductive success than lower-status men…[with] routes to high status…[including] hunting success." These individuals were also more likely to be community leaders and decision makers and effective transmitters of cultural information (Patton 2005:139; Smith and Bliege Bird 2000:252-253). It is altogether possible that successful hunters had achieved similar enhanced-status roles in Folsom society. As such, fluting would surely have contributed to the hunting success message.

Spatial Segregation of Folsom Fluting

One means of discerning whether or not fluting of Folsom points was considered a special activity would be the presence of discrete fluting production areas at Folsom sites in the Plains. Data from two sites in North Dakota—Bobtail Wolf and Big Black—and one in Wyoming—Agate Basin—appear to have spatially-segregated fluting activity areas. Bobtail Wolf and Big Black represent spatially separated components of a single large Folsom occupation—Site 32DU955—within the Knife River Flint quarry region of western North Dakota (Root et al. 1999:147). At Bobtail Wolf, individuals conducted predominantly early and middle stage reduction of Folsom preforms, with comparatively little fluting activity (Root 2000:354). In contrast, individuals at the nearby Big Black Site focused their energies on fluting, with comparatively little evidence of early and middle stage preform manufacture (William 2000).

Some individuals at Big Black (and other sites on the Plains; Akerman and Fagan 1986:3) even fluted their projectile points from both the distal and proximal ends of both faces (William 2000:190). William (2000:187) explains such double-fluting as simply a variant of the typical Folsom reduction process. However, it does not fit ideally within the Folsom point manufacture sequence (Flennikan 1978; Geib and Ahler 2002; Sellet 2004), indicating a possible socio-cultural role for fluting. The fact that the double fluting at Big Black occurred within the context of a fluting activity area may indicate that it was conducted as a teaching guide or as a means to show-off to peers gathered at the location.

This spatial organization of knapping activities at Bobtail Wolf and Big Black resembles that of the Folsom component at the Agate Basin Site, where channel flakes clustered in two discrete production areas, including one area that was clearly separated from daily activities (Sellet 2004:1559-1560). The spatial separation of Folsom fluting at these Plains Folsom sites places the practice squarely in the realm of specialized activities, perhaps associated with teaching or other socio-cultural processes used by Folsom people.

Summary: The Rise of Folsom Fluting

In summary, Boyd and Richerson's indirect bias concept helps to explain how and why Folsom fluting emerged in the Plains approximately 10,700 years ago. In addition to its functional benefits (Ahler and Geib 2000, 2002; Geib and Ahler 2002), the Folsom point may have contributed to a "good hunter" model within Folsom culture. While fluting originated during the Clovis period as a functionally-efficient basal thinning technique to facilitate hafting, it took on a more symbolic role in Folsom culture. Good hunters, thus, fluted the entire length of the point, perhaps as a means to show-off (Patton 2005:139-140). As discussed above, the comparatively high concentration of Folsom fluted points and channel flakes at Big Black

compared to the nearby Bobtail Wolf, as well as the spatial segregation of fluting activities at Agate Basin, indicates the possibility that fluting was a specialized activity, perhaps conducted as a pre-hunt ritual or other social process.

In Barton's (1997) stylistic terms, thus, fluting became a form of group social marker, an aspect of active style. Folsom fluting was accomplished in order to display one's skills, as a key attribute of a successful hunter. In camp, while producing tools, fluting may have occurred in fairly public or even ritual contexts that allowed individuals to show their skills (e.g., the special activity areas at the sites discussed above). Other individuals—youths and young adults—likely participated in these gatherings to learn from their elders, akin to the cultural transmission model described above. Another benefit was that any individual entering a camp showing the indicator traits of success—such as fluted Folsom points—was given immediate status and, perhaps, acceptance. This immediate status acceptance would clearly have been important for hunter-gatherers looking for friends and mates in the low-population density Plains during the Late Pleistocene (MacDonald 2004).

The cultural behaviors (including fluted points) of good hunters became popular as youths and young adults copied the indirectly biased traits of influential elders. Such a conservative strategy of cultural learning was a means to minimize the risk of individual failure, as might occur if an individual opted to attempt trial-and-error learning (guided variation). Given the widespread nature of Folsom bison hunting, successful cultural traits were likely copied in order to improve and ensure future hunting success. As Ahler and Geib (2000, 2002) indicate, the techno-functionality of fluting was obviously important. Use of the fluted Folsom point would not have persisted for as long as it did across such a wide area if it was not highly functional. However, the flute is a perfect example of over-engineering for possible socio-

ideological purposes. Clovis and Goshen were successful without hyper-fluting, as were later Paleoindian points which lacked fluting altogether, including Agate Basin, Hell Gap, Cody, and a variety of other finely-manufactured projectile points. During the Folsom period, fluting was likely one of several indirectly biased traits which, as a whole, comprised the image of a successful hunter. Elders fluted their points, so youths copied them, and the practice persisted for hundreds of years.

The Demise of Folsom Fluting

The Risks of Folsom Fluting

The demise of Folsom fluting after approximately 10,200 B.P. can be explained by this model as well. Archaeological data support the contention that Folsom individuals were aware of the risks inherent in the fluting of projectile points. Namely, under certain circumstances, Folsom individuals chose to use unfluted Folsom points. Analysis of the circumstances of the flute-or-not-to-flute decision is suggestive of risk avoidance strategy that may have ultimately spelled defeat for the use of the point type.

Often referred to as Midland points (Judge 1970), these unfluted versions of Folsom points provide evidence that Folsom individuals chose to use unfluted points depending on certain environmental circumstances. For example, the Shifting Sands Site in west Texas yielded 81 projectile points in the Folsom component, including 61 unfluted (Midland) Folsom points and 20 fluted Folsom points (Hofman et al. 1990:237). This ratio stands in dramatic contrast to the Bobtail Wolf site in western North Dakota in which 31 fluted Folsom points were recovered compared to only two unfluted Folsom points (Root et al. 2000:259, 268-269) (Figure 5).

The most obvious distinction between the Shifting Sands Site in west Texas and the Bobtail Wolf Site in western North Dakota is the availability of high quality tool stone for projectile point manufacture. At Shifting Sands, the nearest source of preferred high quality stone (Edwards chert) is approximately 170 km to the east (Hofman et al. 1990:248; Hofman 1992:211). At Bobtail Wolf, the preferred stone (Knife River flint) was found on-site. Ingbar and Hofman (1999:102) and Hofman (1991:342; 1992:194) provide additional data regarding the percentages of unfluted and fluted Folsom points at the Lindenmeier, Lipscomb, Blackwater Draw, Hanson, and Elida Sites, while Bement (1999a:112-117; 1999b: 141-142), Bradley (1982:186-194) and Meltzer (2006) provide similar data for the Cooper, Agate Basin, and Folsom Sites, respectively (Table 1; Figure 5; see Figure 1 for site locations).

As reflected in Figure 5, Folsom individuals clearly preferred to use fluted Folsom points, with only the Shifting Sands Site showing an opposite trend toward unfluted points. When compared to the distance to most proximate preferred lithic raw material source (defined as the material with the highest percentage of fluted points and channel flakes in an assemblage) (Table 1), there is no significant correlation with the percentage of unfluted points (*multiple R*=.029; *F*=.005; *df*=7; p=.15). In other words, distance to the nearest preferred stone quarry seems to have played no factor in determining whether Folsom individuals used fluted or unfluted points. While this is contrary to what might be expected, it clearly shows that Folsom individuals far and away preferred fluted points and used them whenever they felt comfortable with the predictable availability of tool stone.

As Hofman (1992), Amick (1996), and others (Ahler and Geib 2000; Ingbar and Hofman 1999) have suggested, fluting of Folsom points occurred in areas where tool stone was predictably available or, alternatively, when Folsom hunter-gatherers felt comfortable with the

status of their hunting tool kits (Sellet 2004). In stone-scarce environments or otherwise high-risk situations, as at Shifting Sands, Folsom individuals occasionally chose to use unfluted projectile points. These decisions were controlled by the nature of the tool stone environment and the ensuing costs and benefits of lithic material procurement and mobility. In other words, Folsom individuals knew all too well the dangers and risks involved in fluting Folsom points and chose not to do so under certain extreme environmental conditions or in situations of unpredictable access to tool stone.

Fluting at, or within predictable striking distance to, lithic sources reduced risk due to the availability of stone for Folsom point replacement, as exemplified by data presented in Table 2. At the Hanson Site in Wyoming, 17 of 19 channel flakes are of a single non-local material (Phosphoria). At the Agate Basin Site in Wyoming, 87 percent of the channel flakes are of non-local materials, including 52 produced from Knife River flint from more than 400 km away (Ingbar and Hofman 1999:102; Sellet 2004:1557, 1562). At Agate Basin, 55 of the channel flakes were produced from quartzite and Mississippian chert found approximately 60 km from the site, while 12 channel flakes are of materials found near the site. At the Bobtail Wolf site, channel flakes of non-local materials (Moss Agate, porcellanite, Swan River chert, and Rainy Buttes silicified wood) indicate curation of Folsom preforms and subsequent fluting at the Knife River flint quarry area (Root et al. 2000:267).

While Sellet (2004:1562) states otherwise, at all three of these sites—Hanson, Agate Basin, and Bobtail Wolf—reliable replacement stone was locally available if the points were broken, as occurred so often during fluting. At the Rio Rancho site in New Mexico, of the channel flakes with identifiable lithic raw materials, all 129 were produced from materials with non-local sources (Huckell and Kilby 2002:26). While no reliable local sources of material were

available near Rio Rancho, several varieties of materials were available within a few days walk of the site. Thus, the semi-local availability of these stones likely assured Folsom individuals of replacement material if it was necessary. In other words, at these sites, individuals curated high quality Folsom point preforms for tens and hundreds of kilometers prior to fluting them. As Ingbar and Hofman (1999:103) state "It seems contrary to common sense, and to models of resource transport in general, to transport an item for a great distance, only to subject it to a relatively risky procedure (Folsom fluting)."

The Fall of Folsom Fluting

These fluting and non-fluting data indicate that the inherent risk in Folsom fluting was apparent to Folsom individuals, a fact that may have increased the importance of fluting as a status marker within Folsom culture. As Sellet (2004:1562) states, "the high failure rate associated with Folsom points was not without costs in raw material procurement and transport…one could presume that they would entail a higher degree of anticipation and overall deeper planning." This enhanced planning was costly and expensive in time and lithic raw material and, ultimately, was nonsensical given the fact that unfluted points were as successful as fluted points in hunting bison.

However, approximately 10,200 B.P., archaeological data indicate that individuals ceased to use Folsom points, in favor of a variety of other point types that required no fluting in their production (see Figure 2). At this time, it appears that Late Paleoindian hunters decided that the fluting of Folsom points was no longer worth the risk. Late Paleoindian projectile point forms, including Agate Basin, Hell Gap, and Cody/Scottsbluff among other varieties, proved to be techno-functionally useful, but did not carry the same production costs as Folsom points. While

these varieties of projectile points were technologically sophisticated, the marker trait of fluting was abandoned for other markers, including collateral parallel flaking.

As such, Native Americans may have realized that the high costs of fluting were an unnecessary risk. Fluting essentially jeopardized the status of one's tool kit, a dangerous endeavor in a cultural system based in bison hunting. While these risks seem to have been accepted during the Folsom period, the changing face of Late Paleoindian social and subsistence systems apparently instigated a switch away from fluting.

Hayden (1982, 1986:178) provides a complimentary framework regarding the transformation in projectile point styles between the Late Pleistocene and Holocene. Pleistocene hunter-gatherers, including those of the Folsom culture, relied extensively on large fauna as prey during subsistence. Late Pleistocene individuals (including Folsom) likely possessed increased social group cooperation (Hayden 1982,1986), as reflected by the widespread use of the Folsom point across the Great Plains. In this vein, the fluted Folsom point—as described here—reflected this cooperation, as it was symbolic of widespread cultural connections. Good hunters were likely accepted by members of other bands if they possessed the suite of traits used by good hunters, including the Folsom point.

However, during the early Holocene, increasing populations and territoriality likely instigated decreased inter-group socialization. The ultimate result was a more diverse suite of projectile points during the Late Paleoindian-Archaic periods compared to the preceding Folsom, Goshen, and Clovis periods (Frison 1991:57-137, 1998:145-147; Hayden 1982:116). Regional point types emerged as a reflection of increased resource diversity, increased regional territoriality and populations, and decreased social connectivity between widespread groups (Bamforth 2002). Projectile point types in the Northwestern Plains, thus, are distinct from those

in the Southern Plains during the Late Paleoindian and Archaic periods (Hayden 1982:116; Buchanan et al. 2007:293; Frison 1998: 159-162). As Hayden (1982:114) indicates "Stylistic diversity is much lower during the Paleoindian than in succeeding Archaic times."

Summary and Conclusion

The functionality of the Folsom point cannot be denied; it was a sophisticated technology useful in human survival in the Great Plains of North America during the Late Pleistocene (Ahler and Geib 2000, 2002). Between 10,900 and 10,200 years ago, the fluting of Folsom points was a marker of social inclusion and perhaps ritual tradition. The importance of the flute was in many ways symbolic for Folsom Native Americans; it was a signal of success, every bit as important as its functional advantages. In this way, its functionality—its contribution to success—lay not only in its sophisticated technology, but partly within its style as well. As such, the Folsom point contributed to individual success not only due to its technological attributes, but because of its symbolic meaning to Folsom identity. The fluted point marked individuals as part of the society, but even more as outstanding individuals within a society heavily dependent on hunting success. The Folsom point represents an excellent example of a projectile point which maintained a style that was functional on multiple levels.

However, after 10,200 B.P., by the end of the Folsom period, the fluted projectile point had lost its resonance among Plains Native Americans. The inherent risks of fluting became too costly in the face of changing social and subsistence circumstances. Fluting of Folsom points, thus, no longer was part of the "good hunter" model. However, despite its demise, its place in

prehistory is substantial, representing one of the most beautiful, if not eccentric, varieties of projectile points ever made by humans.

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Tables

Table 1. Comparison of Fluted and Unfluted Folsom Points in Plains Folsom Sites.

Site	Fluted (%)	Unfluted (%)	Preferred Stone	Source (km)	Reference
Shifting Sands, Tx	21	64	Edwards chert	170	Hofman et al. 1990:237
Bobtail Wolf, ND	94	6	Knife River flint	1	Root et al. 2000:259, 268-269
Blackwater Draw, NM	65	35	Edwards chert	360	Hofman 1991:392
Lindenmeier, Co	75	25	local chert	5	Wilmsen and Roberts 1978
Hanson, Wy	90	10	phosphoria	20	Ingbar1992:175-182
Elida, NM	86	14	Edwards chert	340	Hofman 1991:341-342
Cooper, OK	90	10	Alibates	160	Bement 1999a:112-115
Lipscomb, Tx	100	0	Edwards chert	360	Hofman 1992:217
Folsom, NM	100	0	Alibates	265	Meltzer 2006268-272
Agate Basin, Wy	75	25	Knife River flint	400	Frison 1982:58; Bradley 1982:194; Sellet 2004:1559

Table 2. Comparison of Channel Flake Data from Selected Plains Folsom Sites.

Site	Ch.Flakes local (n)	Ch. Flakes non-local (n)	Site Type	Reference
Hanson, Wy	2	17	Camp/workshop	Ingbar 1992:179
Shifting Sands, Tx	0	50	Camp/Kill	Hofman et al. 1990:226
Indian Creek, MT	5	1	Camp	Davis and Greiser 1992:262
Bobtail Wolf, ND	44	11	Camp/workshop	Root et al. 2000:268
Elida, NM	0	13	Camp	Hofman et al. 1990:26
Rio Rancho, NM	0	129	Camp/workshop	Huckell and Kilby 2002:26
Agate Basin, Wy	15	107	Camp/kill	Sellet 2004:1559

Figure Captions

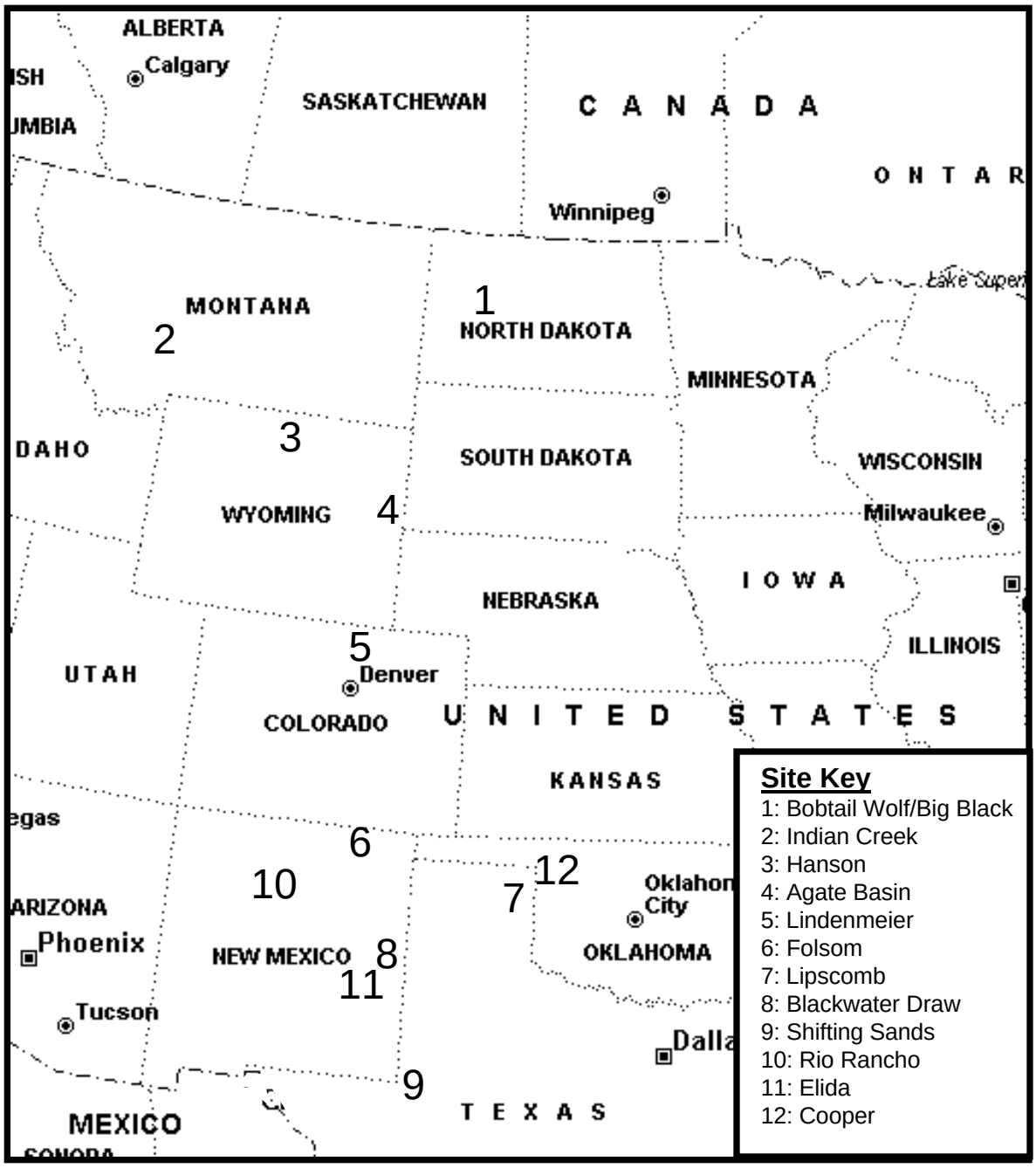
Figure 1. Map of Folsom Sites Discussed in Text.

Figure 2. Paleoindian Projectile Points (left-right): Clovis, Goshen, Folsom, Agate Basin, Hell Gap, Cody/Scottsbluff (Modified from illustrations in Frison 1991).

Figure 3. Comparison of Mean Bison MNI data for Select Paleoindian Sites in the Plains (data sources discussed in text).

Figure 4. A Model of Folsom Cultural Transmission (after Cavalli-Sforza and Feldman 1981).

Figure 5. Percentage of Fluted and Unfluted Folsom Points in Plains Sites.


ALBERTA
Calgary
SASKATCHEWAN
C A N A D A
Winnipeg
MONTANA
NORTH DAKOTA
MINNESOTA
SOUTH DAKOTA
WISCONSIN
Milwaukee
WYOMING
NEBRASKA
I O W A
ILLINOIS
UTAH
Denver
COLORADO
U N I T E D S T A T E S
KANSAS
Oklahoma City
OKLAHOMA
Phoenix
NEW MEXICO
Tucson
TEXAS
MEXICO
1
2
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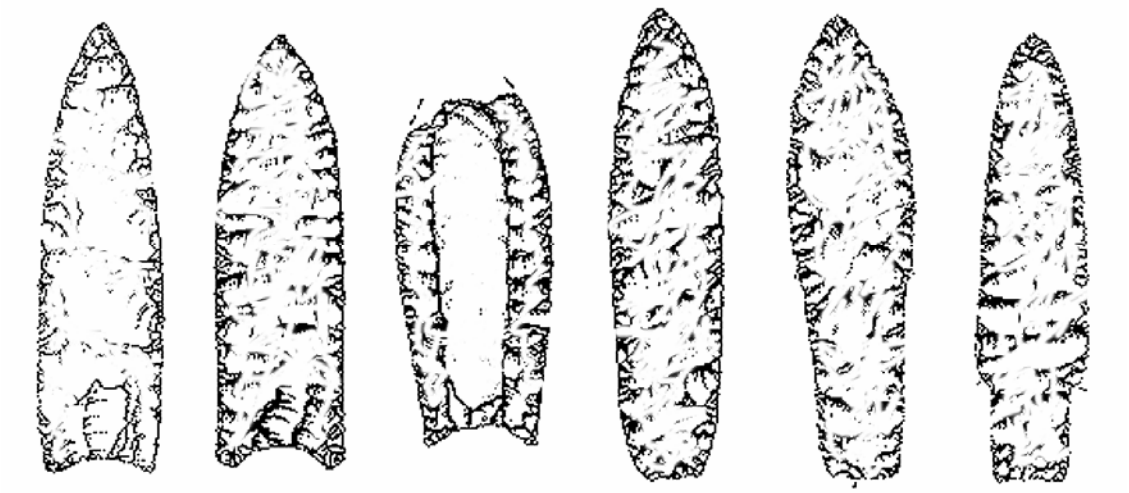
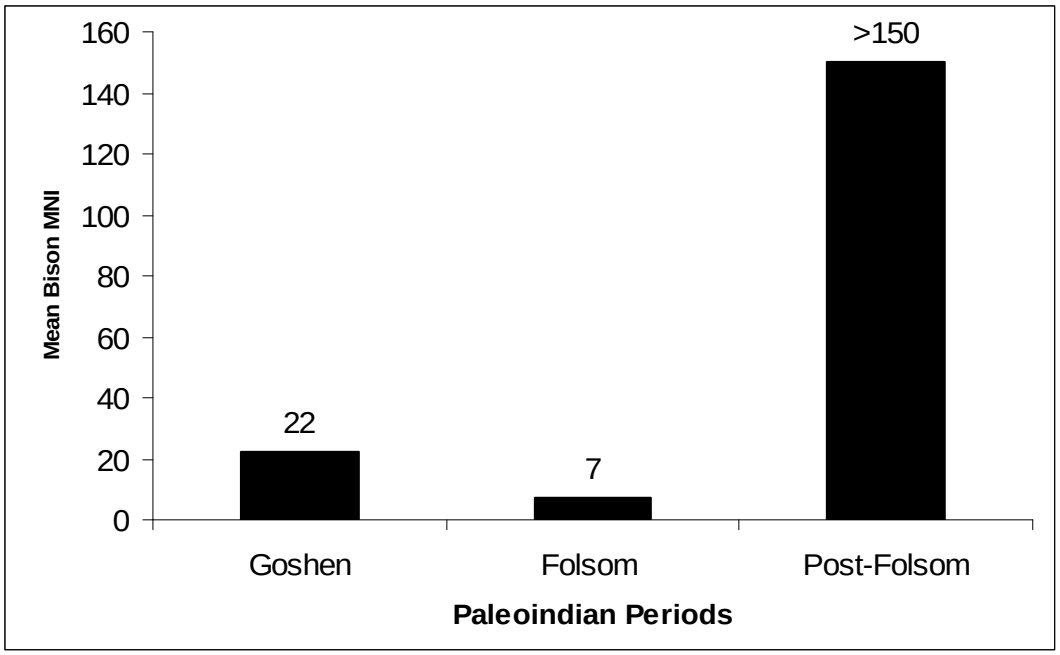
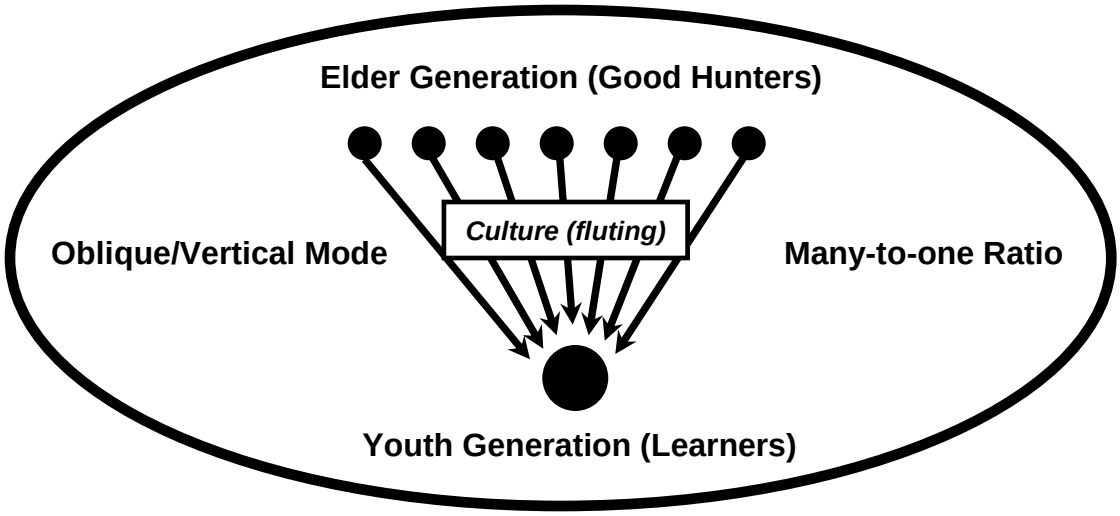
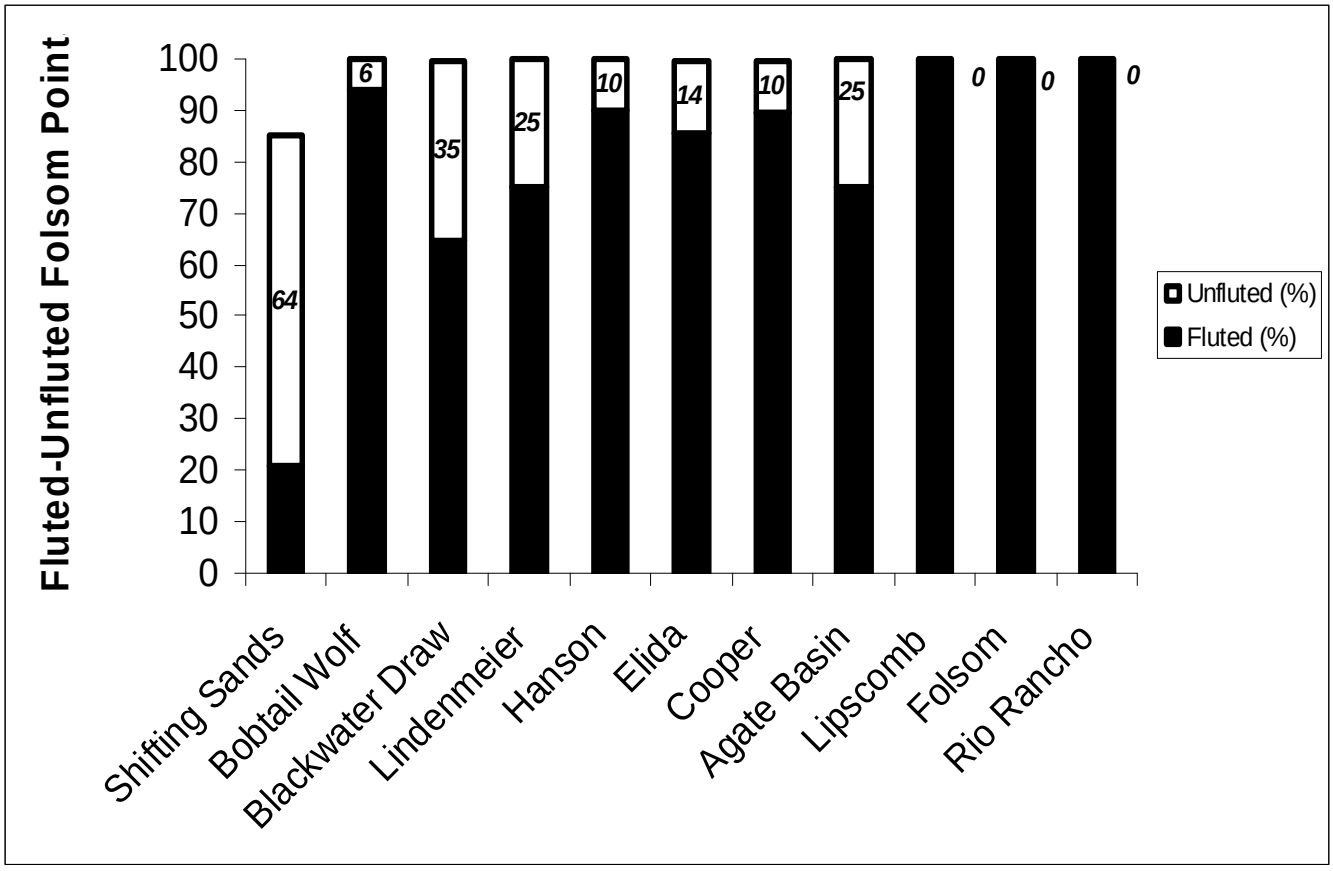
Site Key
1: Bobtail Wolf/Big Black
2: Indian Creek
3: Hanson
4: Agate Basin
5: Lindenmeier
6: Folsom
7: Lipscomb
8: Blackwater Draw
9: Shifting Sands
10: Rio Rancho
11: Elida
12: Cooper




160
140
120
100
80
60
40
20
0
Mean Bison MNI
22
7
>150
Goshen
Folsom
Post-Folsom
Paleoindian Periods


Elder Generation (Good Hunters)
Culture (fluting)
Oblique/Vertical Mode
Many-to-one Ratio
Youth Generation (Learners)


Fluted-Unfluted Folsom Point
100
90
80
70
60
50
40
30
20
10
0
64
6
35
25
10
14
10
25
0
0
0
Unfluted (%)
Fluted (%)
Shifting Sands
Bobtail Wolf
Blackwater Draw
Lindenmeier
Hanson
Elida
Cooper
Agate Basin
Lipscomb
Folsom
Rio Rancho