THE PROJECTILE POINT IN PERSPECTIVE

A review of classification systems, consistency, and context regarding the dart-arrow dichotomy in North American archaeology

Submitted by Danielle Davies, to the University of Exeter as a thesis for the degree of Doctor of Philosophy, October 2014.

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ABSTRACT

The sorting of artefacts into categories for study represents simultaneously one of the most important – and yet one of the most problematic – tasks in archaeology. In an ideal world, the archaeological record would comprise clearly-defined and easily-separable groups of material for consistent identification and interpretation; the reality, though, is somewhat different. Here, in a systematic review of associated classification systems, the long-standing dart-arrow dichotomy in North American archaeology provides valuable insight into the relationship between classificatory idealism and practical reality, and, in-so-doing, lends itself to a much-needed reassessment of technological change. As the results derived from different study areas using different classification analyses make clear, traditional assumptions of a consistent large dart, small arrow point divide are far too simplistic, overlook the importance of individual context, and obscure the deeper complexities of human technological adaptation. Although a necessary and inevitable part of the interpretive process, thus, artefact classification must be approached in a more reflexive manner if the results derived are to provide meaningful insight into past systems and behaviour; something that can only be achieved via regular systems of review.
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A BRIEF INTRODUCTION TO THE VOLUME

‘The action of flaking stone leaves a record of human thought and behaviour not unlike the combining of letters to form words, phrases, and sentences. Archaeologists recover fragments of evidence; now we just need to learn to decipher the languages’

(Stanford and Bradley 2012, 30)

Deciphering these languages has kept archaeologists occupied for over a century, not least in the study of flaked stone projectile points. The application of ever-changing theoretical perspectives and methodologies to the archaeological record continues to reinvigorate these studies, yet it is only as we move beyond the simple assignment of type fossils and into the behavioural realm that we begin to uncover the true technological diversity endured by people in the past. ‘The knowledge and practice of making, using, and discarding stone tools… involves the organisation of materials, tools, and people’ (Nelson 1997, 371). In other words, the actions of people, by design or coincidence, are permanently preserved in the remains of their tools. Collections of tools, in this case flaked stone points, provide a vast database of information regarding human behavioural patterns through time. Our ability to ‘identify particular types of projectile points and recognise methods of manufacture unique to them,’ via the classification process, puts us ‘in a position to organise the remains of many extinct cultures, follow the path of developments, and see significant changes over time’ (Justice 1987, 1). Reconnecting these models of change with past peoples and places is a necessary part of this process, placing material cultural changes in their wider socio-cultural and environmental contexts.

It is not uncommon for the archaeologist to become lost in detailed description and complex quantitative measures so that the very reason for studying a group of artefacts - to shed light on their makers - is almost forgotten. This is often the result of initial concerns with organising the data into neat and comprehensible categories for, or as a part of, the analytical process, and is a problem inherent in all classification practices. Here we explore these concepts with a reassessment of the change from spear-thrower technology to the use of the bow-and-arrow in prehistoric North America, a topic which has witnessed
much debate over the last fifty years or so. In this case, primary concern has been with dating the introduction of the new technology and the accuracy with which various projectile forms can be classified. However, as Justice (2002, 18) argues, ‘tools are a product of a technology but technology must also be looked upon as a way people solve problems.’ Situational human behaviour and measures of accuracy are uncomfortable bedfellows, for behaviour often transcends assumed cultural and ecological boundaries and does not fit neatly into type categories. A major part of this volume, therefore, will be to question why, if artefacts are so closely intertwined with their makers, their complexity should be given so much less attention? Do artefacts ever really fit into closed type categories? As Chang (1967, 13-14) proposes, ‘artefacts remain our operative data, to be sure, and classification remains our basic method, but the primary unit delineating consideration must be conceptualised at another level that is more meaningful in terms of “people”.’

Recent years have seen a resurgence of interest in this field of research, particularly with regards to the role of traditional classificatory schemes in both revealing and concealing technological diversity. As such, this volume was formed in response to an ever-growing need to combine and contrast previous works on the subject so that future scholars might be made better aware of the information available to them, and of the cause and effect relationship between people (past and present) and artefacts. Thus, the aim of this volume is twofold. Firstly, it explores some of the ways in which we, as archaeologists, have tried to decipher the languages expressed in stone tool remains with specific reference to the dart versus arrow point dichotomy in North American archaeology. In so doing, this study brings together the vast collection of information written on the subject, currently scattered across the pages of disparate journal articles and textbooks. Secondly, it provides a reassessment of the variations expressed in the ‘reading’ of these languages, and their relationship with a common end-goal: information about the people who made and used these tools. Approached in three parts, it begins with an overview of key definitions and debates associated with the dart-arrow dichotomy and classification practices more broadly, followed by a systematic review of the evidence using samples gathered from three different study areas, and, finally, ends with a discussion of insights gained.
PART ONE: DEFINITIONS AND DEBATES

1. A Brief History of the Projectile Point

1.1. Characterising Flaked Stone Points

Poor preservation of organic materials means that a large portion of artefactual material remains lost, and the archaeologist is faced with only a few preserved elements with which to interpret past behaviours and processes. With this borne in mind, the majority of recovered material from prehistoric contexts has been in the form of flaked stone, among which characteristic projectile points commonly feature. This focus on the preserved stone elements, combined with the rarity of associated organic material has important implications for understanding the use-contexts of originally composite tools and weapons. A dart point, for example, is part of a much bigger projectile system often including both a foreshaft and mainshaft, feather fletchings, hafting materials, and an atlatl or ‘spearthrower.’ Similarly, an arrow point is incomplete without its fletched mainshaft and bow counterparts. Without evidence of these other elements, it is easy to discount them from discussions of tool manufacture. Only a few archaeologists refer to the comparative ease of manufacture and time expenditure between points and their associated hafting materials (for example, Kirk and Daugherty 2007, 61; Whittaker 1994, 248), and only occasionally are we reminded that in some cases no stone points were used at all, ‘the foreshaft itself was simply sharpened on the end’ (Justice 2002, 28).

Furthermore, problems arise when, in the absence of supporting evidence, points are used to identify the mode of propulsion in use in a specific time and place. To avoid confusion, in cases where the use-context of a point remains unclear, the term projectile point is favoured over more specific descriptions which attribute an assumed function (Justice 2002, 1; Thomas 2000, 48). Indeed, while projectile points are generally regarded as those used with an associated projectile launch device, with information gleaned from various use-wear studies, experimental analyses and ethnographic accounts, most now recognise that ‘the actual function of these tools was not limited to use as tips for weapons’ (Justice 2002, 1). Thus, the true complexity of flaked stone point studies is demonstrated. However, when considered in broader
contexts and with appropriate sample sizes, groups (or types) of flaked stone points reflect patterns in technology which can then be broadly associated with human groups and behaviours.

Projectile point attributes (Figure 1), in their various combinations, form the basis upon which these ‘types’ or ‘classes’ are created. As Justice (1987, 6) suggests, ‘the form and flaking characteristics or attributes of projectile points reflect cultural patterns that maintained special guidelines for manufacture,’ and can be associated, thus, with the intentions of their makers. Explored in more detail in later chapters, ‘there is no single optimum design for projectile points’ (Knecht 1997, 200), rather, a range of optional variables available for selection and refinement into what a group or an individual deems appropriate for use in a given context (or series of contexts). Patterns in point types can be used to represent these makers within the context of time, culture complex or regionally-bound social groups (ibid, 6), though the range of conformity and variability

![Diagram of projectile point features](image)

**Figure 1:** A selection of terms used to describe projectile points (Justice 2002, 4). The variety of base types, notches and blade forms are evident even in these three examples.
among such type sets attests to the diversity among past artisans in relation to various socio-cultural and environmental influences (see Chapter 4). As Nelson (1997, 374-375) suggests, design concepts may range from single purpose to multi-purpose (versatile) or denote sequential changes in function (flexible), each of which can be inferred by detailed analyses of point form, manufacture, use, and reuse processes, and the broader use-context. Others look towards the division between expedient and formal flaked stone technologies (for example Railey 2010) and changes in reduction strategies (such as Nassaney and Pyle 1999) as a way of recognising differences in function among projectile point assemblages. Regardless of the route taken, a diverse array of tool forms persist, and while categorisation remains a vital part of the interpretive process, we must be mindful of the subjectivities of each analyst, the fact that different points may mean different things to different people, and of the interplay between human intention and execution, which may not always correlate.

1.2. Tool Types and Modes of Propulsion

‘Projectile technology refers to launched weapons used in both hunting and warfare.’

(Knecht 1997, 3)

Knecht’s broad definition encompasses a wide range of projectile forms across time and space, and covers a plethora of socio-economic use-contexts. Thus, it provides a useful starting point from which to consider various modes of propulsion. When the specific principles of each individual tool type or weapon are considered, however, the technicalities of definition become a little more complicated. As Whittaker (2010b, L7) notes, ‘although spearthrowers precede bows all over the world, their mechanical principles are quite different. The bow acts as a spring, storing human energy in the draw; the atlatl acts as a lever, enhancing human energy in the throw.’ In this sense, seemingly closely-related tool types can actually demonstrate a fair number of differences; differences which may not appear as obvious among the sparse remains of the archaeological record. In the absence of supporting evidence, experiential archaeology, experimentation, and interdisciplinary discussion can be of use. By attempting reconstructions of past systems in this way, it follows that we
might better understand the complex principles behind them. As Cotterell and Kamminga (1990, 160) point out, 'it is usually through experience that we learn about the behaviour of projectiles; a golfer does not consult ballistic tables before teeing off, but simply knows the right way to hit the ball. However, to understand fully the sophistication behind many seemingly simple projectiles one needs to understand their mechanics.'

Of particular import for this volume are the variables associated with each projectile system and their influence upon projectile point design. Accuracy, killing power, range, and in some instances, durability, are among the requirements considered most influential when designing a tool or weapon (Christenson 1986, 115), thus, compromises between these requirements will be reflected in the projectile points produced. 'While the choices may not be endless, the possible variables affecting the use of the spear-thrower or the bow are very numerous' (Cattelain 1997, 228), and each element of the design (size, weight, basal style etc.) can be placed on a sliding scale relative to adjustments of each other part of the system. In this instance, a spearthrower might compensate for a lighter tip with a heavy, balanced foreshaft, while a longer shaft might be used alongside a heavier point with the bow (ibid, 232), demonstrating nonconformity to the given size differentiation between darts and arrows. Despite this possibility, Hughes (1998, 365) suggests that while 'a bow may be able to cast a dart-sized projectile and a spearthrower may cast a throwing spear... the reduction in performance and possibility of breakage would prevent prehistoric hunters from manufacturing mismatched weaponry.' Thus, practicality ('common sense' theories) must also be considered, though sometimes at odds with the favoured stylistic traits for any given culture. The effective competition between style and functionality and the implications for point design will feature in discussions throughout this study.

Aside from the mechanics of each system, a large emphasis has been placed on transitions in technology and the replacement of one system for another, supposedly more efficient one; the change from spearthrower to bow being the most prominent of these. With sparse evidence of the organic material required for confirming the presence or absence of each mode of propulsion, dating the introduction of the bow and replacement of the atlatl in prehistoric North America remains controversial (Whittaker 2010a, 199). The timing and rate of transition can be seen to vary across the world, with some areas never
receiving the new technology and others using both forms in tandem (Yu 2006, 201). This variability reflects the problems inherent in treating technological change as a simple, rapid, and widespread phenomenon. Thus, the complexities involved in the implementation of a new technology among communities used to a certain tradition should be borne in mind throughout.

**The Throwing Spear**

The throwing (or thrusting) spear is the oldest of the three weapon systems detailed here, with the earliest evidence dating to around 380,000-400,000 years ago at Schöningen in Germany (Dennell 1997, 767). In this case, the recovered wooden shafts had been sharpened at the tip end, though points made of stone, bone, and antler are found in later contexts. Ethnographic accounts of the San hunters of the Kalahari demonstrate the versatility of this weapon, suggesting a multiplicity of uses including impalement devices on game trails, in fishing pools, and as clubs, as well as for throwing from hunting blinds and as thrusting weapons in close quarters (Hitchcock and Bleed 1997, 355-356). However, unlike darts and arrows, the simple throwing or thrusting spear was used without the aid of an associated launch device, thus limiting the accuracy, power and distance achieved with its use. This is not to say that its manufacture and use required any less than careful consideration. The spears from Schöningen, for example, were manufactured from the trunk of a spruce tree, each tip carved from the basal end where the wood is hardest, and each with the same proportion and centre of gravity (Dennell 1997, 767). As such, they reveal what appears to have been a complex decision-making process with ‘considerable depth of planning, sophistication of design, and patience in carving the wood, all of which have [previously] been attributed only to modern humans’ (ibid, 768), thus attesting to the value of such finds when, on rare occasions, conditions allow for their preservation.

**The Spearthrower**

A natural development in the history (or prehistory) of projectile technology, ‘the invention of the spearthrower considerably lessened the amount of strength and skill needed to cast a spear’ (Cotterell and Kamminga 1990, 166). Widely used throughout the Palaeolithic, ‘it reached its most developed form in Australia, where it is called a *woomera*’ (ibid, 166), with studies demonstrating a 60 per
cent increased thrust when compared to the simple hand-thrown spear (Justice 2002, 34). Known as the ‘atlatl’ in North America, the device consists of a stick or rod, usually made of wood, with a hook or gutter for engaging the end of a spear (Figure 2). Held by a handle or finger grip, ‘the atlatl imparts a great deal of added thrust to a thrown spear because of the added length of the arm’ (ibid, 33), acting as ‘a lever or, rather, a complex series of levers’ (Whittaker 2010, 203). Unlike the hand-thrown spear, the use of a spearthrower allows for a more effective compromise between the combinations of accuracy and velocity required for a successful shot. While ‘accuracy is best achieved with low trajectories, which in turn puts a limit on the weight of a spear, heavier spears have a higher kinetic energy potential and thus better penetration power,’ therefore, ‘the spearthrower is a good compromise, making it possible to cast a lighter spear at higher velocity’ (Sassaman 1996, 58; see also Cotterell and Kamminga 1990, 168).

The tuning of projectile devices to suit each individual person and pursuit is vital for achieving the desired outcome, a point often overlooked in studies of spearthrower efficiency. As Hutchings and Lorenz (1997, 895) propose, ‘the spearthrower is not the awkward, inefficient or inaccurate weapon often described in the historic and academic literature. Like the bow and arrow, however, it benefits from properly constructed and properly matched equipment;

Figure 2: The dart and atlatl (Whittaker 1994, 46).
dart lengths, weights and flexibility must be tuned to the spearthrower and to the
user for maximum efficiency. Context, too, is important. Still in use in Oceania,
the Arctic, and in a large part of the Americas (Cattelain 1997; 215), a diverse
set of socio-cultural and economic environments give rise to different
interpretations of design and function. Typical representations of the
spearthrower in use are in terrestrial environments with a standing posture,
though they also feature commonly in aquatic and marine environments, such
as the Arctic types which are used exclusively from a seated position in kayaks
(ibid, 215). Contrasting strategies involving varying distances, as well as the
requirements of each individual hunter are also known to correlate with the
design of the projectile being launched (ibid, 215-219). Also worthy of mention
are atlatl weights or ‘bannerstones’, slipped over the spearthrower and believed
by some to have been by design, a feature of the working device, though others
remain sceptical of their function, whether mechanical or decorative (for
example, Cotterell and Kamminga 1990, 168-9; Raymond 1986). Nonetheless,
it is these little details, seemingly minor, that demonstrate the complexities
involved in tool manufacture, and though often overlooked, represent important
features within their design and utility.

The Bow and Arrow
Similar to the dart and atlatl, the development of the bow and arrow, also found
in a range of hunting and warfare use-contexts, was based on the principle of
weapon propulsion. However, the associated mechanics of each are varied
enough that any direct evolutionary relationship appears unlikely (Whittaker
2010a, 199). As Cattelain (1997, 219) proposes, ‘the bow is essentially a spring
made up of two flexible, elastic limbs held under tension by a string.’ Unlike
earlier weapons, these limbs store the energy of the human muscles so that,
upon release, ‘the energy of the bow is quickly transferred to a comparatively
light arrow which is projected at a much higher speed than can be achieved by
hand-throwing’ (Cotterell and Kamminga 1990, 180). The amount of energy
stored (and subsequently released) varies depending on the physical strength
and arm length of each individual, yet the flatter trajectory produced compared
to those of spears is a universal property increasing its accuracy, and in many
cases, its popularity, particularly at longer distances (ibid, 180-181).
Over time, the development of the bow and arrow (the antiquity of which will be addressed in later discussions) saw the specialisation of various bow types into several categories ranging from ‘self or simple bows which are made of only one material, usually wood; “reinforced” bows of which the wood core is reinforced, in every sense of the term (for breakage resistance and strength), by a laminate of, for example, sinew; and composite bows, the most sophisticated type, which are formed of several associated elements, either of the same material (wood laminate) or of different materials (for example, wood, horn or antler laminated with sinew)’ (Cattelain 1997, 219-220). With the exception of those areas where the bow was not adopted, notably Australia, people developed a range of bow styles ‘throughout the world and in all types of habitats, ranging from the glacial landscapes of the Arctic, to the deserts of the Sahara and the Kalahari, the densest forests of the Amazon, the Eurasian steppe, and the North American prairies’ (ibid, 220). Depending on the associated environment and use-context, the mass of each arrow could be adjusted to account for use at different ranges (Cotterell and Kamminga 1990, 181), making it a flexible weapon for use in a number of different hunting situations.

Arrows, too, occur in a number of different forms. Their tips, whether fashioned from wood, stone, bone or antler, demonstrate a vast range of diversity, and it is the diversity of flaked stone points which forms the basis of this work. Associated arrowshafts, bindings and fletching styles, only a handful of which are known from rarely preserved archaeological finds, supplemented by ethnographic examples, are further testament to the varieties and expressions of preference among past peoples. Archaeologically, composite arrows, comprising a mainshaft, typically made of cane, and detachable foreshaft, ‘are the first types of arrows, and for all practical purposes apply many of the same materials and look like miniature atlatl darts with smaller tips, smaller diameter shafts, etc.’ (Justice 2002, 39). While these continue throughout most of the archaeological record, self-arrows fashioned from solid wooden shafts become increasingly popular by the Late Prehistoric and Protohistoric periods (ibid, 39), though the reason for this change is unclear.

Regardless of type, arrows tended to be made in sets, each according to the criteria of the maker. As is the practice today, a basic measurement of appropriate arrow length is the distance from the chest to the tip of the
outstretched hand at full draw. While this may not have been the practice used by all, it is likely that some form of individual tailoring of arrows would have existed to ensure that they performed to an acceptable level, thus introducing another design variable within the projectile system as a whole.

**Debates over Superiority**

The comparative advantages of the bow and arrow versus the dart and atlatl have a long history of debate in North American archaeology. The bow and arrow replaced the dart and atlatl as the dominant weapon of choice across the continent, and while the timing and speed at which this change occurred remains open to debate, it represents a clear adaptation in which the new technology offered resident populations a competitive advantage. The basic mechanics of each weapon system provide the basis for theoretical arguments within this framework, drawing on notions of efficiency, the relevance of which are subject to archaeological experimentation. As always, use-context remains an important determining factor, and the more ‘efficient’ weapon is not always the one chosen.

Broadly speaking, the mechanical properties of the bow point toward an advantage of increased range and accuracy over the atlatl (Blitz 1988, 133), the result of a lighter projectile shot with a flatter trajectory. Indeed, experiments testing the same reed arrow with different launch devices (spear-thrower, simple wooden bow and composite bow) indicate ‘a clear linear trend in improved performance’ (Miller et al. 1986, 179). Perhaps, in part, this trend is linked to the skill acquisition relative to each weapon. The ‘relative ease with which a hunter can learn to become skilful and accurate with a bow,’ for example, is quite different to the use of an atlatl, which ‘is subject to much more human error and much more difficult to make consistent’ (Whittaker 2012, 13). The space requirements associated with launching each weapon (*Figure 3*), the bow requiring significantly less, was likely another important factor contributing to its success (Yu 2006, 210), even if its use required both hands. As Whittaker (2012, 13) maintains, that casting the atlatl requires only one hand is of limited advantage anyway, for the other is still needed to carry the darts and load them into the device with each new shot. Thus, the practicalities of space, accuracy and range, directly or indirectly linked to the accessibility of resources from a variety of environments, provide evidence for the comparative versatility of the
bow and arrow, offering ‘a flexibility of use contexts that cannot be matched by the atlatl’ (Yu 2006, 209).

It must be borne in mind, however, that flexibility is not necessarily a determining factor in the selection of a weapon. Sure enough, evidence supports the notion that the bow and arrow was used in a diverse array of environments, ‘open and closed, terrestrial and aquatic, and on practically all types of game,’ with hunting strategies including ‘stalking, individually or in a small group; individual tracking for approach hunting with or without a screen, with or without a decoy system; and game drives with beaters, generally in small groups, but in certain cases with much larger groups, such as in peccary hunting in the Amazonian forests’ (Cattelain 1997, 228). The bow was a significant innovation accessible to a vast number of people around the globe – of this there is no doubt. However, the value of other tools and weapons, used either independently or complementarily to the bow and arrow, is also attested to in the archaeological and ethnographic records and should not be overlooked.

For the most part, the dart and atlatl is primarily suited to use in open terrain as opposed to more densely-covered environments such as tropical woodlands (Cattelain 1997, 228). Close range ambush hunting, therefore, offers a context in which the atlatl might be considered just as efficient as the bow (Blitz 1988, 134). However, as vegetative density and distance from prey increases, so too does the comparative advantage of the bow and arrow. In many respects, the bow and arrow transcended the restrictions of earlier tool types, resulting in accessibility to a broader range of resources. The benefits it
may have offered in warfare, for example the ability to carry a larger supply of projectiles and more quickly re-arm when engaging with the enemy (Hutchings and Lorenz 1997, 895; Yu 2006, 215), also attest to its versatility.

Flexibility and versatility are paramount to understanding why the bow and arrow was so quickly adopted among many groups, though practical advantages such as these are not necessarily the determining factors in weapon selection. As evidence for the use of different tool kits among neighbouring groups attests to, social traditions often play an important role. Just because a tool or weapon can be used in a range of different environments and hunting situations, does not necessarily mean it will be. Some groups simply would not have required such a versatile tool, and even where adaptation to mixed environments was important, it was not unlikely they included more than one type in their tool kit. In this sense, the merits of several tool types might be combined and considered complimentary rather than competing.

The spearthrower’s ability to immobilise prey upon impact, for example, is especially useful in contexts where ‘large, fast animals or animals that can escape into environments beyond the hunter’s reach, such as air and water’ (Yu 2006, 210) are being targeted. By weakening an animal relatively quickly the tracking time is also heavily reduced, an important consideration when competing with other predators. Ethnographic accounts of the Tyua and other groups of the Kalahari San in areas such as the Nata River region attests to this, where large numbers of spotted hyenas threatened the chances of successfully recovering prey targeted with poisoned arrows, typically associated with longer tracking times than those targeted with spears (Hitchcock and Bleed 1997, 355). Seasonal access to poison supplies was another important factor in the selection (or lack thereof) of different tools, and mode of dispatch by no means fixed. For example, bow hunters of the Kalahari ‘nearly always make use of spears to finish their kills’ (ibid, 358), and it is not uncommon for larger point specimens to co-exist with smaller types archaeologically (as at Mummy Cave in northwestern Wyoming), perhaps as thrusting spear components used in conjunction with projectile devices (Hughes 1998, 393).

The supposedly evolutionary changes in tool type and selection are not as simple as they might at first seem. Hunting strategies, often deep-rooted in tradition, can form in response to a number of social or environmental pressures
that fluctuate through time and may have practicalities beyond what seems obvious to the archaeologist. Stereotypes of the simple spear and the superior bow, collective spearthrower hunting and individual stalking with the bow and arrow, do not always have basis in reality. Clearly, human adaptations, in both the distant and more recent past, are much more complicated than that. Among the many variables introduced by each context are ‘local ecological conditions (including distribution of water sources, foraging patterns of desired prey species, availability of natural cover for hunters etc.), individual group preference for particular prey species and hunting strategies, and seemingly ad hoc weapon selection at the time of encounter with prey on the basis of factors such as firing distance, quantity and condition of weapons and ammunition (e.g. spears, arrows, or bullets) on hand, and size and agility of the target animal’ (Knecht 1997, 18), as well as differences in skill and ability relative to tool type.

A consideration of these combinations is difficult enough in ethnographic cases, let alone with limited archaeological evidence. This is not to say that studies of prehistoric tool selection are impossible. It simply serves as a cautionary tale for considering some of the generalisations applied to group adaptations across time and space. ‘The extreme variation in both prehistoric and ethno-historic equipment evident in the ethnographic literature suggests that detailed discussion of a projectile delivery system must be specific to a particular time and place’ (Hutchings and Lorenz 1997, 891), so that the diversity or non-diversity of groups in various socio-environmental conditions can be contextualised before studying trends of a much larger scale. Broadly speaking, this is the aim of the case studies presented in Part Two.

1.3. Old World Origins

General consensus places projectile technology, the earliest of which appears to have been the spearthrower, in the Old World by at least the Upper Palaeolithic. This consensus deteriorates, however, as its development is traced back in time. Shea (2006) applied TSCA (tip cross-sectional area) values (originally derived from New World specimens by Hughes 1998) to specimens from Africa, the Levant, and Europe in an attempt to identify any major patterns of change that might correlate with the development of projectiles in these earlier periods. Despite the ambiguities of ‘backed’ pieces from Middle Stone
Age and Later Stone Age contexts, the results failed to indicate the presence of anything other than points suited for use with thrusting or hand-cast spears before 40-50,000 years ago (ibid). Further to this, the typological variability of points from these contexts suggest ‘it is vastly more likely that projectile point technology was developed convergently among African, Levantine and European hominin populations’ rather than by way of migration or diffusion processes (ibid, 839). Correlations between the development and big game hunting strategies are also questioned in the absence of points in these contexts, and factors such as increased competition (ibid, 842) or ecological niche broadening strategies (Shea and Sisk 2010) are proposed as viable alternatives.

Similarly, the emergence of the bow and arrow lacks absolute clarity. Wooden arrowshafts from the North German Plain attest to its presence by c. 9000BC, supported by depictions in African petroglyphs from around this time onwards (Clark 1970, 157; Thomas 2000, 48). Some of the later Aterian small barbed and tanged points from North Africa may have been used to tip arrows even earlier than this, as may some of the microlithic assemblages from sub-Saharan Africa (Clark 1970, 157), though this too remains uncertain. The recovery of a bowstave fragment dating to the mid-third millennium provides an interesting insight into associated perishable materials, recovered from the edge of the Kafue Flats in Zambia, where evidence also points towards ‘the probable use of poison… in the form of numerous pods of the shrub Swartzia, commonly used for arrow poison by the Kalahari Bushmen’ (ibid, 157). Regardless of its precise origin in time and space, evidence suggests that the bow and arrow spread eastward, although ‘the chronology of the bow in northeast Asia, the presumed source for diffusion into the New World, is presently uncertain’ (Blitz 1988, 126).

1.4. New World Origins

Whether by independent invention or the transfer of ideas among early migrating populations, evidence now points to the presence of projectile technology in the New World at some of its earliest sites. It has long been accepted that the atlatl was in use at least as early as the Archaic, with evidence along the Columbia River of the Northwest dating to c. 8,000-9,000
years ago (Kirk and Daugherty 2007, 60), and between 5,000-7,000 years ago in the Far West around the Great Basin (Aikens 1983, 177). The introduction of inorganic components – atlatl weights – during the mid-Holocene improved the archaeological visibility of the technology (Sassaman 1996, 58), though the perishable nature of earlier spear throwing systems has typically made identification at earlier sites incredibly difficult. Nonetheless, the recent discovery of ivory atlatl hooks at a site along the Santa Fe River (see Figure 4), Florida, provides rare and valuable insight into projectile technologies associated with the Paleoindian period (Stanford and Bradley 2012, 175).

While the general consensus has been that this early technology likely entered the continent alongside early migrants from the Old World (for example, Kirk and Daugherty 2007, 60; Morse and Morse 1983, 120), debate now rests on the route these early peoples took, whether across the Bering Strait or the Atlantic ice edge. Key proponents of the early Atlantic route, Dennis Stanford and Bruce Bradley, compare the similar stylistic traits of some of these early specimens with those attributed to the Solutrean in Western Europe (Figure 4), a material cultural connection lacking among Siberian Palaeolithic people (2012, 174-175). Regardless of origin, spear throwing devices were known by at least some of the earliest occupants, forming a foundation upon which the technology would later develop and flourish, becoming the universal weapon of choice throughout much of the prehistory of the New World (Justice 1987, 10; 2002, 28).

The origins of the bow and arrow in the New World, whether an independent invention or introduced from elsewhere, is subject to much debate. Evans (1957, 84) uses a child playing with a piece of string as a crude analogy for invention, suggesting that ‘contrary to the belief of some archaeologists, the principle of the bow was not hard to discover.’ As such, the adoption of the bow and arrow at different times and in different localities seems entirely possible, and rather than the invention itself, ‘it was the development into an efficient
weapon that was difficult’ (ibid, 84). Blitz (1988, 132), on the other hand, suggests that ‘even though the initial occurrence of the bow in most regions must be expressed in relatively large units of time, there is a clear chronological trend from north to south,’ and that this trend ‘implies diffusion rather than multiple episodes of independent invention.’ In this sense, it is a secondary diffusion process, the transfer of ideas and innovations among neighbouring groups, rather than movements of people, which is considered most likely (ibid, 132). Again, suggested migration routes into the New World have important implications for considering external stimuli and the introduction of a new technology. As it stands, the most likely stimulus appears to have been from Asia in the Arctic Small Tool Tradition (Justice 2002, 45; see also Blitz 1988, 127; Fagan 1991, 151), with some of the earliest ‘recognisable’ arrow points found at Cape Krusenstern, Alaska, dating c. 2,250BC (Thomas 2000, 48).

Experiments demonstrating the possibility that shouldered points from later Solutrean sites – the earlier periods a potential source of early populations in the Americas – were used to tip arrows should, nonetheless, be borne in mind (see Stanford and Bradley 2012, 131).

Traditionally, the bow and arrow was considered so superior a tool that, once discovered, it would have been quickly adopted and, for the most part, preceding tools such as the dart and atlatl, quickly discarded. Recent investigations, however, have shed new light on the topic and, in the chapters that follow, the complexity of mapping changes in projectile systems will be addressed. As new evidence and new methods of investigation are unveiled, interpretations regarding the presence of the bow and arrow continue to develop. At present, these various analyses can be divided into two main groups. The first and most commonly cited interpretation is of a fairly late introduction sometime during the late Middle or Late Woodland periods, with a north to south diffusion characterised by the presence of small triangular or stemmed forms; the second is of an earlier introduction, usually attributed to the Archaic, where it would have been used alongside the dart and atlatl for some time until refined and standardised in later periods (see Bradbury 1997, 207-208).

Proponents of the later introduction tend to support the diffusion hypothesis, whereby knowledge of the new technology spread south from the Arctic and Subarctic regions and into the Northern Plains by c. A.D. 200,
reaching other areas such as the Eastern Woodlands and the Southwest by c. A.D. 500, becoming widespread no later than A.D. 800 (Aikens 1983; Baker and Kidder 1937; Blitz 1988; Cordell 1984; Fagan 1991; Griffin 1983; Justice 1987 and 2002; McNutt 1996; Morse and Morse 1983; Pauketat 2004; Thomas 2000). Some, such as Blitz (1988, 133), recognise a certain amount of variability between regions, with a more gradual transition in the Great Basin and Intermontane West than in the Plains, Midwest, and Southeast. The general impression, however, seems to be one of a fairly rapid transition from one technology to another, derived from observations of point size. Alternatively, proponents of an earlier introduction, whether by diffusion or independent invention, use case studies of contemporary dart and arrow points (Webster 1980), revised classification functions (Ames et al. 2010; Bradbury 1997), and use-wear studies of morphologically atypical arrow points (Odell 1988) to support claims of an earlier Woodland or Archaic origin, and question the validity of ‘a simple unidirectional model’ (Nassaney and Pyle 1999, 258).

One of the biggest problems clouding this debate is that of definition. The introduction of a new technology and its widespread use and standardisation are competing criteria which must be clarified in the context of each argument. For example, the co-occurrence of dart and arrow points in stratigraphically sound contexts is a useful piece of evidence for inferring the early use of the bow alongside the atlatl, but a single case study does not attest to its widespread adoption across the continent. Here, the interpretation derived depends entirely on the question being asked, be this ‘when was the bow and arrow first in use?’ or ‘when was the bow and arrow in widespread use?’ A strong dependence on point size as an indicator of changes in technology is another weak point in the debate. The innovation and experimentation that would have accompanied the manufacture of points for a new projectile system would likely blur the divisions between traditional dart and developing arrow point forms (Lyman et al. 2008), so that various types of cultural transmission, whether copied (indirect bias) or by experimentation (guided variation), are also worthy of consideration (Bettinger and Eerkens 1999). As Kirk and Daugherty (2007, 60) attest to, innovation and replacement do not necessarily go hand in hand, and just as with modern inventions, ‘people kept older technologies while simultaneously diversifying.’ This is a concept to be borne in mind in the discussions of identification that follow.
2. Dart Point or Arrow Point?

2.1. Perceived Differences

Assumptions provide the foundations upon which we base our interpretations of the past. In the case of differentiating between dart points used with the atlatl and arrow points used with the bow, the main assumption rests on size. Here, suppositions regarding the change from one projectile system to another ‘are based on the apparent total absence from all respectably ancient deposits of small, light points suitable for the tipping of arrows; and, conversely, by the presence in such deposits of larger points, of sizes and weights appropriate for service with the heavier, longer darts propelled by the spear-thrower’ (Baker and Kidder 1937, 51). As Thomas (2000, 48) attests to, ‘most of what we believe about the spread of bows and arrows through the Americas relies on this inference.’ This large dart, small arrow point dichotomy has been debated for the better part of a century, as size continues to be used as the main criterion for judging change. Comparisons of cultural sequences from North America (the Great Basin) and elsewhere (central Japan, Hokkaido, and Cantabrian Spain), confirm that ‘the decrease in sites containing only large points is a defining characteristic of the projectile transition, regardless of time or place’ (Yu 2006, 202), providing at least some justification of size as a useful marker. However, as is clear from the discussion of origins, above, judgements regarding size can be highly subjective and lead to the formation of rather different interpretations.

For the most part, arguments for the presence or absence of each weapon system ‘use more sophisticated arguments than point size alone, but the basic difficulty of recognition remains’ (Whittaker 2010a, 201). Recognising the introduction of a new technology is especially difficult, and a certain amount of functional overlap between dart and arrow categories should be expected ‘as the makers of atlatl darts carried on their traditions of knapping as they shifted to smaller points for a different weapon’ (Whittaker 2012, 10). The presence of this overlap is further attested to in archaeological experimentation. Couch et al. (1999, 32), for example, found little correlation between the length and weight of points and the distance they travelled, so that size in general might be related to other factors such as cutting edge, maintainability and availability of raw
material, rather than tool type alone. Various methods of manufacture are also of import, such as the potential shift from formal to expedient flaking technologies (Railey 2010), and the nature of the product being produced. A comparison of microblades and bladelets provides an interesting insight here. The first refers to the intended primary products of an Old World blade technology, and the second to small Clovis blades which, intentional or otherwise, were the secondary products of a large-blade technology (Stanford and Bradley 2012, 54-55). Both describe small blades, but each represents a different technology. Similarly, some projectile points will have been made smaller intentionally, perhaps for use with arrows, while others might be small as a result of external factors, such as the material available to work with or the effects of reworking. Thus, the correlation between point size and function must be viewed with some caution.

The variation introduced by past people further clouds this field of study. People made choices, some random some patterned, and their abilities with each weapon type would have differed. In this respect, projectile efficiency relies upon much more than the design – large or small – of the stone tip, but because this is usually the only part that survives, it continues to provide the main focus for study. If we hope to move beyond basic interpretations of technological change and associated human behaviour, however, we must seek to explore other important factors as well. As Whittaker (2012, 11) cautions, it is unwise to rely on point size as an indicator of weapon systems, except in the grossest of terms, at the further ends of the size ranges,’ for ‘the ambiguity of point size cuts both ways, whether you want to find early bows, or late atlatls.’ Below, an assessment of various methods of projectile point identification, including attribute analyses and experimentation, addresses the issue of ambiguity in greater detail.

2.2. Methods of Identification

**Attribute analyses**

Attribute analyses are centred around the determination of an artefact’s most distinctive features (see Collins 1970, 19). In the case of the dart-arrow dichotomy, size has traditionally been considered the most important trait for differentiation, though it is, in itself, a product of several competing variables.
Early studies saw the selection of single variables for measuring bimodality among collections, as in Fenenga’s (1953) study of point weight. Two decades later, Thomas (1978) attempted to contextualise single attributes through the use of multivariate analyses, combining measures of length, width, thickness, and neck width, in a more holistic approach. In this case, hafted ethnographic and archaeological specimens were used to provide ‘a set of known parameters… for comparison with unknown archaeological specimens’ (ibid, 468). Shott (1997) later extended this study by increasing the dart sample size, and replacing potentially problematic attributes from the classification function (such as length, often altered through breakage or reworking, and non-universal neck width, often restricted by the presence of unnotched specimens) with shoulder width (likely related to hafting type), a reflection of Thomas’ initial observation that arrow foreshafts tend to be more gracile. Hughes’ (1998) study of the 9000-year sequence from Mummy Cave in northwestern Wyoming, on the other hand, used tip cross-sectional area (TCSA), perimeter, and neck width (later applied to Old World collections by Shea 2006) to determine patterns of change, while Ames et al. (2010) used a combination of both (classification functions based on Shott’s revisions of Thomas, and threshold values adapted from Hughes) to determine changes among samples from the Columbia Plateau.

These are only a handful of some of the more widely documented analyses applied to the archaeological record, but they provide good examples of the selection and reselection of seemingly important attributes within and between classification schemes, often influenced by the successes and failings of those that preceded them. Even where similar techniques have been applied to dart and arrow point samples, it is interesting that readings of bimodality are not always in agreement and that some level of misclassification persists. Inevitably, this has had an impact on the interpretations drawn from them. Thomas (1978), for example, used the 86 per cent success rate of his classification function to validate the assumption that dart points tended to be larger than arrow points, the main premise upon which the introduction of the bow and arrow is considered. Similarly, Fenenga (1953, 313-314) recognised ‘two distinct fashions or traditions of chipped stone point technology… regardless of what interpretation is made of the differences in function of the two separate classes.’ Cattelain (1997, 229), however, highlights overlap
between points weighing 5-15g, while Shott’s (1993) application of Thomas’ function to specimens from the Upper Ohio Valley, and the uncertainty surrounding the Chesser Notched biface, called into question the validity of clear lines of division. On the one hand, indeterminate specimens might have been early arrow points, similar in design to dart points but altered (made smaller) to suit the new technology; on the other, misclassification and the potential for reuse and reworking might see them better placed in the dart category (ibid). Even after a number of adjustments were made (Shott 1997), imperfections in the classification function remained, leaving some to question its utility beyond ‘the tentative classification of isolated finds’ Corliss (1980, 352). To question the utility of this technique, and of attribute analyses in general, is not to discount its value, but it is important to account for indeterminate specimens (14 per cent is not an insignificant value), all too often explained away as unimportant anomalies.

In some cases, qualitative data can provide a useful source of supporting evidence. Nassaney and Pyle (1999), for example, combined quantitative analyses of point form and qualitative reconstructions of reduction trajectories from Plum Bayou cultures in central Arkansas to distinguish between the two technologies. In this case, evidence of a change in reduction strategy, from core-based dart points to flake-based arrow points, was used to justify a more abrupt introduction of the bow, despite the continued use of the dart, so that ‘the bow and arrow may have been merely an addition to the hunting-warfare toolkit’ (ibid, 257). Others, including Lyman et al. (2008), compare and contrast evidence from a range of different geographic areas to contextualise their conclusions. Here, results derived from a corrected coefficient support the notion of a rise in diversity of point forms (quantitative overlap) during periods of innovation, before settling down into more standardised forms (ibid). Similarly, Bradbury (1997) and Ames et al. (2010) discuss the possibility of an earlier introduction of the bow, including a long period of experimentation, culminating in the replacement of local arrow point traditions by the small triangular type more broadly used to represent the change from spearthrower to bow. Hughes (1998) also defines a sub-group representative of innovation, this time within the spear/dart point category. A change from heavier, thicker lanceolate forms to lighter, thinner triangular forms could, in this case, reflect the introduction of
fletching methods around 7600BP, as the need for balancing with forward weight was eliminated (ibid, 370).

Naturally, different regions will reflect more or less subtle differences within this broader period of technological change. These differences, and acknowledgement of the full range of point forms, typical or otherwise, represent the true diversity of the archaeological record and the human behaviours reflected within it. Ethnographic collections provide a useful context in which to consider this diversity, helping form some of the interpretations discussed above. For archaeologists dealing with the behaviours of people in a very distant past, this provides an insight that is otherwise inaccessible. However, there are limitations. As Hildebrandt and King (2012, 790) make clear, a morphological shift to larger arrow points following historic contact, perhaps a reflection of the ‘desire to produce larger more interesting pieces for exchange,’ may have undermined the accuracy of studies incorporating this data ‘by incorrectly increasing threshold size of arrows, and thus blurring differences between the two technologies as they were used in the prehistoric past.’

Following this, they proposed the dart-arrow index (derived from the work of Delacorte 1997), based upon a threshold value calculated by combining neck width and maximum thickness, attributes less likely to be affected by reworking, fracture, or stylistic features such as ‘differential notching, basal configuration, or creative treatment of the margin (e.g. elaborate serrations)’ (Hildebrandt and King 2012, 794). Recent work (Erlandson et al. 2014; Walde 2014) however, points toward the contextual limitations of this approach, the index performing poorly for coastal regions and the Canadian Plains. Again, the successes and limitations of each approach will vary according to time and place, and some ethnographic collections may be more representative than others. Regardless, the point here is not to nullify practices within attribute analyses or classification schemes, but to demonstrate the value of these limitations for highlighting areas requiring further investigation.

**Experimental and use-wear analyses**

Archaeological experimentation and macro/micro use-wear analyses provide another set of tools for approaching artefact identification and interpretation. As Knecht (1997, 1) confirms, by ‘using hands-on or replicative approaches, experimentation with projectile technology has led to the demonstration of
limitations and expanded possibilities that are not always thought of by archaeologists on the basis of form and/or ethnographic analogy.’ In this sense, rather than in competition with each other, traditional attribute analyses and experimentation should be regarded as complementary methods of investigation. It is the initial classification process, based upon the selection of favoured attributes, which provides the assumptions then tested by experimental and use-wear analyses. Among those tested are comparative performance and notions of efficiency, the identification of functional wear patterns that might have archaeological visibility, and the parameters associated with point use (refer to Knecht 1997, 12). Each of these is especially relevant to the dart-arrow dichotomy in North American archaeology, as attested to in the examples below.

Both the design of experiments and the experience of the researcher have an effect on the results produced, and thus the reliability of subsequent interpretation. Hutchings and Lorenz (1997, 894) expect researchers to have ‘both a thorough knowledge of the equipment, and the necessary motor skills to explore the capabilities of ancient tools and weapons,’ while Whittaker (2010a, 214) accounts for the difficulty of controlling variables in even the simplest of experiments:

‘… The element of human error, skill, knowledge, and experience in using any technology is often a major complicating factor. We cannot live as our prehistoric subjects did, and we cannot think their thoughts; to experiment realistically with their technology, therefore, we must become fairly proficient with it, and to compensate for the obscuring effects of random errors and variation in each act, we must create large samples of experimental trials.’

Experience, then, is a vital tool for interpretation, and while the availability of time and resources may limit the scale of some projects, appropriate experimental design and honest evaluations should place results in their appropriate context. When conducted appropriately, these studies contribute a great deal to our understanding of early technologies, shedding light on the limitations of previously proposed notions regarding artefact function.

An early example is Browne’s (1938) paper documenting the use of points deemed too large or too heavy to tip arrows by other researchers, a
response to the assumptions surrounding point size in Baker and Kidder (1937). Browne’s work (1938 and 1940) was among the first to highlight the problem of using size as the sole method for interpreting point function. The failure of stone points to conform to strict lines of division (when used in the field) provided impetus for debate surrounding the viability of distinguishing between dart and arrow points in the archaeological record. A series of experiments by Odell and Cowan (1986) later produced a valuable dataset pertaining to the use-wear traces found on retouched and unretouched projectile points of various sizes. Interestingly, the length-width ratio of the points (closely related to target penetration and the probability of hitting bone) appeared to have a greater effect upon point longevity than either size or mode of propulsion, though, naturally, arrow points – being typically smaller – were often more difficult to recover (ibid). In this case, point form was regarded both as a primary response to the requirements of a successful hunting tool, and as the secondary product of recovery, reworking and reuse. The complexity of point form within a broader consideration of use-life is thus attested to.

Just as with attribute analyses, archaeological experimentation can produce a range of results, each associated with a different interpretation. Observations of overlapping dart and arrow point forms provide a good example of this. While most researchers are willing to accept that some points could have been used with either weapon, debate now rests on the likelihood that they were. On the one hand, Evans (1957, 83) suggests ‘it is quite likely that if they could be used they were; for primitive man, with his limited equipment, was likely to use any tool or weapon that would work.’ On the other, Hughes (1998, 365) proposes that while ‘a bow may be able to cast a dart-sized projectile and a speerthrower may cast a throwing spear… the reduction in performance and possibility of breakage would prevent prehistoric hunters from manufacturing mismatched weaponry,’ so that each projectile system and their associated stone points would have been at least partially guided by design. Both are viable arguments, but mean little in the absence of contextual information, such as the availability of raw material or evidence of reworking. In this case, experiential, experimental, and indeed attribute analyses, benefit from studies of use-wear.

A comparison of the data compiled from Odell and Cowan’s (1986) study with specimens from Archaic, Woodland, and Mississippian components of the
Illinois Valley reveal just how valuable use-wear studies can be (Odell 1988). In this case, a number of non-projectile uses (cutting, scraping etc.) were associated with traditional morphologically-typed points, while non-typical pieces usually placed in the ‘retouched piece’ or debitage categories showed signs of impact damage (ibid); an observation also noted in his earlier assessment of traditionally-conceived projectile armatures from Mesolithic site, Bergumermeer, in the northern Netherlands (Odell 1981a). Similarly, Aoyama’s (2005) study of Aguateca pointed stone artefacts demonstrated the problems inherent in assigning function without detailed microwear analysis, while the presence of impact damage on non-typical projectile tips could, in both cases, be used as evidence for an earlier introduction of the bow and arrow. In another study, retouch location and density were used to provide a better picture of the manufacture and use contexts of hafted bifaces (typically described as dart points, either curated or replicated) recovered from the Coalition and Classic periods of the Pajarito Plateau, New Mexico (Harper and Andrefsky, 2008). In this case, the authors ‘contend that, rather than signalling the use of dart technology during the Ancestral Pueblo period, some large hafted bifaces recycled from Archaic sites served as cutting or sawing tools, fulfilling a need for Ancestral Pueblo people not filled by expedient flake tools’ (ibid, 176). Thus, despite appearances, the atlatl may not have been in use at this time.

As is clear from each of these examples, the traditional divide between points used to tip darts and those used to tip arrows is far from simply managed, and while the initial sorting of finds into seemingly distinct categories is a vital part of the initial organisation process, the verification (or not) of these categories (and their associated functions) requires further practical investigation. In addition to those listed, residue analysis (blood, protein, etc.), where viable, can provide useful information regarding tool function (Justice 2002, 1), as can evidence of tool prehension and hafting, the formation of which are ‘sufficiently systematic and patterned to allow valid and reliable interpretations’ (Rots et al. 2006, 935).

Context, too, is crucial. Secure stratigraphic data provide the most convincing arguments, but there are some peculiarities that the archaeologist will struggle to account for. As Miller et al. (1986, 189-190) caution:
‘A wide range of head sizes and designs can develop among contemporary groups of archers in the same region and the tendency of archers to trade and exchange arrows or recover fallen arrows during battles would further complicate attempts to define arrowheads as uniformly small projectile points and ignore the historical and ethnographic evidence for wide ranges of acceptable point size.’

In this sense, the meanings attributed to an artefact might be redefined in response to ever-changing contexts of use (Warburton and Duke 1995, 227). Projectile points are just one part of a much broader system, itself constrained by various socio-cultural and/or environmental influences. A more detailed discussion of these is provided in later chapters, but a brief mention here simply serves as a reminder of the interplay between environment, human behaviour, and material culture production, and the multiplicity of analytical techniques required in order to access even a fraction of this information.

2.3. Various Schools of Thought

Rarely do archaeologists agree on cases as complex as the development of the bow and arrow. Naturally, different researchers favour different theoretical and methodological models, each valuable in their own right, but strongest when used in conjunction. Most scholars now recognise the merits of a multi-faceted approach, resulting in rigorous debate based upon a number of research goals and interpretations. Whether complimentary or competing, each viewpoint provides impetus for further archaeological analysis and the expansion of subject-specific knowledge.

Traditionally, deterministic views of linear development have dominated accounts of the bow and arrow in North America. In many respects a superior weapon, it seemed natural to suppose a rapid introduction across the continent, broadly characterised by a change in projectile point size. Scepticism of this simplistic and generalised narrative, however, soon formed in response to a growing number of studies which revealed a more complex history. Even as early as the late 1800s, scholars documented the problems inherent in the identification process:
‘The arrow-heads, spear-heads, and knives of the prehistoric races have such a likeness of form, style, and size that a line of division between the three is practically impossible… A classification of infinitesimal divisions, with slight differences, difficult to distinguish and still more difficult to remember, will never be satisfactory or acceptable.’

(Mason et al. 1891, 58)

A rough division between leaf-shaped, triangular, stemmed, and peculiar (serrated, polished etc.) forms was proposed, though the authors acknowledged that ‘methods vary with different peoples and differences in the material lead to variations in treatment by the same people’ (ibid). In a time before use-wear and other scientific analyses, one can appreciate their dilemma. As attested to in the discussions above, researchers still struggle with some of these problems today, and while the ability to distinguish different forms may have improved, the science is far from precise. As Fenenga (1953, 309) concedes, ‘it is true that “intermediate” points exist which might have served with either weapon.’ Over time, a number of more inclusive views have been borne out of this admission, helping to diversify the field of study, itself more diverse than previously thought.

Increased dialogue between attribute analysts, experimenters, and those conducting use-wear studies (different methodologies, though not mutually exclusive) have combined to form both more focussed and comprehensive investigations into topics surrounding the identification debate. While the overarching theme remains division, an increasing acceptance of some of the key limitations, including issues of technological continuity, complementarity and functional variability, have made vital progress in uncovering the true diversity of the archaeological record. In this sense, the relationship between the dart and atlatl and the bow and arrow is one of complex technological development rather than a single event in a linear sequence of change. Increasingly, people are seen as innovators, experimenters, and important agents whose behaviour, both directly and indirectly, affected alterations and fluctuations in tool form and hunting strategy throughout time. People were capable of improvement, but equally they relied in some part on their traditions. As Kirk and Daugherty (2007, 60) suggest, the bow was ‘an innovation, an addition to weaponry but not a replacement of old by new,’ and ‘people kept older technologies while simultaneously diversifying.’ As attested to in
ethnographic accounts, similarities between tool types can be just as important as their differences. For example, as with the San Hunters of the Kalahari, ‘both spears and arrows… were tools which, while they might look slightly different from one another, served the same basic purpose: getting food’ (Hitchcock and Bleed 1997, 350). The archaeologist must, therefore, attempt an equal analysis of both the similarities and the differences between tool types, and reflect on occasions where modern perspectives might come into conflict with the interpretation of ancient artefacts.

The persistence of tradition, namely the endurance of the dart and atlatl in later contexts, provides an interesting case for consideration, witnessing resurgence in interest over the last two decades. Justice (2002, 45) briefly referred to the painted depictions of atlatls and bows from rock art in the Great Basin and kiva walls at sites in the Southwest, ‘adding to the evidence that the new technology did not entirely replace the spear.’ Six years prior to that, Sassaman (1996, 64) cited an earlier work by Hall (1977) regarding the survival of the atlatl as a ‘ceremonial emblem,’ recreated in other material forms such as the atlatl-pipe, following the introduction of the bow and arrow. Bradley’s (2010, 293-294) report of Stix and Leaves Pueblo, Colorado, also raised the possibility of a later dart point form attributed to the Pueblo I period, ‘curious because dart points, and evidently the atlatl, are not found in the preceding Basketmaker III times.’ Whether reintroduced after being abandoned as a weapon or the product of another group who retained its use and moved into the area, the meaning of this form remains open to debate. The most comprehensive report in favour of the continued use of the atlatl in the Southwest, however, was by VanPool (2006), who used comparisons of point attributes and evidence of potential bannerstones to support the claim that the atlatl was used alongside agricultural practices during later periods in the region, even if at a much reduced and specialised scale.

Whittaker (2012, 1), however, remains doubtful of the late survival of atlatls, raising concerns over ‘the ambiguity of the supposed evidence, uncertainty about atlatl functions and efficiency, and the lack of late examples among the few dated specimens and in late contexts generally.’ He questions the legitimacy of using point size as a stand-alone marker of function, as supported by his experiences in the field, and reports that even where larger points are recovered in later contexts, they tend to be associated with special
deposits such as foundations and medicine bundles (ibid, 12). The use-context of an artefact, thus, is far from constant. Rather, associated meaning and function are in a perpetual state of change as they interact with people over time. Some points demonstrate physical signs of reuse, but as Harper and Andrefsky (2008) attest to, this too may vary from the tool's original function. In this case, larger (dart) points from earlier contexts were collected and reused as hafted bifacial cutting tools rather than as projectile armatures (ibid). Even where dart points are recovered, their association with a wider projectile system (the atlatl) is far from clear. Whittaker (2012, 14) uses the morphological similarity of atlatls in the region to suggest their collective association with a given (early) time frame, and argues that 'if atlatls were at all common in late times, as they were in Mexico, we should have better evidence of them from sites with well-preserved organic artefacts.' Without this evidence, debate concerning the endurance of the dart and atlatl seems set to continue. Its resurgence as a topic of interest does, however, stand as testimony to the importance placed upon this period of technological change, and the trend towards a more inclusive, reflexive view of material culture and associated human behaviour.
3. Using Classification Systems

3.1. Organisation and the Archaeologist

‘Classification is of necessity the foundation of data analysis in archaeology.’

(Read 1974, 216)

The sorting of artefacts into classes or types is simultaneously the most basic and the most arduous of tasks the archaeologist is faced with. Systems of categorisation, whether simple or complex, form the backbone of archaeological study and provide a vital interpretive framework with which to test archaeological theory. Arranging and rearranging artefacts into groups is what allows the archaeologist to ‘make sense’ of objects within their broader temporal, spatial, and cultural contexts. Without this process, excavations would simply produce a series of disassociated objects with little connection to each other or the people that produced them.

**The value of creating order**

Broadly speaking, artefact categories are based upon the selection of ‘diagnostic’ attributes, such as projectile point size in the dart-arrow point dichotomy. Combinations of attributes, including blade length and shoulder width, might be used to subdivide this category, itself further divisible by raw material type or the presence or absence of notches. Separating items into classes or types like this allows the analyst to become increasingly familiar with the material and to recognise key trends in and between collections. Projectile points, for example, ‘usually highly standardised in terms of size and shape in any given region at any particular time,’ but with ‘extremely variable morphologies both temporally and spatially’ (Knecht 1997, 6), were, for a long time, a vital tool for dating sites and collections within a broader geographical context. Pottery types too, were significant temporal and spatial markers in this sense. The emergence of radiocarbon dating methods, however, ‘liberated an enormous part of archaeologists’ time, resources, and efforts,’ putting them ‘in a position to ask systematically more substantial questions of their data than the chronological queries prevalent until then,’ such as ‘the reasons for cultural
evolution, the functions of artefacts, and the precise nature of social and political systems of past cultures’ (Hayden 1984, 82).

In light of this development, archaeological classification witnessed a broadening of its horizons far beyond morphological differentiation and chronological placement and into the realms of artefact function and associated cultural ideals (see Steward 1954, 54-57). Each attribute was soon considered ‘a fundamental element, a logically irreducible lowest common denominator of artefacts,’ not just a way to distinguish one from another, but ‘the result of a piece of predetermined and deliberate hominid behaviour’ (Clarke 1968, 138). The extent to which the outcome of this behaviour reflects the intended or ‘predetermined’ goal remains open to debate. However, in terms of projectile points, a case can certainly be made between form, flaking characteristics, and the ‘cultural patterns that maintained special guidelines for manufacture’ (Justice 1987, 6). Gifford (1960, 343), on discussing pottery types, maintains that whether consciously or unconsciously, the coalescence of certain attributes reflects an interaction between people and a wider system of ideas and values, and that ‘these ceramic ideas occurred in the brains of the potters… they are not by any means creations of an analyst’ (Gifford 1960, 343).

Some artefact types are more rigidly defined than others (Watson et al. 1984, 201), a result of the question (or series of questions) being asked. Different questions may require different approaches, and as Chapter 2 attests to, a combination of several provide the most comprehensive set of results with which to work. Computer-based statistical analyses are commonly used today, both assisting with the formation of categories and with measuring their accuracy. The analyst is still responsible for the raw data (the selected attributes) entered into the system, but the results produced and any degree of uncertainty put into objective form (Spaulding 1953, 313; see also Collins 1970, 20). Both quantitative and qualitative judgements play an important role, and ‘whether the resulting clusters are regarded primarily as an arbitrary summary of data, or as a direct reflection of significant patterns of human behaviour it is clear that no interpretation of archaeological finds can be attempted until this initial stage of organisation has been completed’ (Hodson 1970, 299). It must be borne in mind, however, that the sorting of artefacts refers not to a single event in time but to a fluid process, ever-changing as different variables are selected for study and more evidence becomes available (refer to Read 1974, 224).
Naturally, successful categorisation must strike the balance between the norm and the range of acceptable variation. As Krieger (1944, 272) makes clear:

‘Any group which may be labelled a “type” must embrace material which can be shown to consist of individual variations in the execution of a definite constructional idea; likewise, the dividing lines between a series of types must be based upon demonstrable historical factors, not, as is often the case, upon the inclinations of the analyst or the niceties of descriptive orderliness’

This is a topic at the centre of the dart-arrow dichotomy, drawing attention to the issues surrounding overlapping artefact forms, observer bias, and consistency in application, to be discussed in more detail below. Daniels (1972, 219) proposes that ‘ideally… categories must be so defined that two observers sorting the same material would assign the same artefact to the same categories, and that the same observer will always assign the same artefact to that same category.’ In reality though, to expect this level of objective consistency is impractical, for ‘however closely the criteria for assigning objects to categories are defined, the real criteria used by any one observer at a particular time will be only an approximation to the definition,’ and these will, ‘particularly with unfamiliar material and during long analyses, tend to change, either continuously in one direction, or by drifting back and forth’ (ibid, 222). People are, by their very nature, subjective beings. Just as people in the past subjectively shaped their material culture, the archaeologist subjectively interprets it. The appropriation of cultural types is, in fact, ‘abstracted on different levels of apparent complexity by the observer’ (Ford 1954b, 47). In this way, each level is ‘no more “real” than another… what the classifier must do is to select a level which will serve the purposes in view’ (ibid). This purpose is subject to change, as are the categories produced, and ‘as long as they can be shown to work for that purpose they require no more abstract justification than a crowbar. Their validity lies ultimately in their value’ (Adams and Adams 1991, 8).

The value of creating order (and reorder) via artefact classification, despite its various limitations, are clear. It provides the very foundations of archaeological study. The implementation of systems of review are therefore imperative. Cycles of review and refinement, such as those detailed in the dart-
arrow dichotomy, are vital for preventing an investigative stalemate, a concern expressed by Hayden (1984, 81):

‘Unfortunately, at some point in the elaboration of the world cultural-historical framework, it seems that archaeologists largely forgot why typologies were created. Instead of typologies being taught as tools for solving specific problems, they often became deified classifications… Typologies had no rhyme or reason; they just existed and had to be learned.’

The scientific rigor of the processualists and the increased reflexivity of the post-processualist era have, for the most part, combined to eliminate this problem. Each researcher has their own opinion of which categories are most useful, but most now accept that there is usually more than one option. Archaeological categories can, have, and will continue to change through time. This is an inevitable part of knowledge expansion. Awareness of this change, and an acceptance that classifications are ideas not facts, that they are fluid and changing, and that each is designed for a given purpose, is the key to understanding the objects we seek to learn more about. Justice (1987, 12-13), in his volume Stone Age Spear and Arrow Points of the Midcontinental and Eastern United States makes a valuable observation:

‘Virtually every typologist has faced the problem of classifying specimens that have attributes that overlap more than one defined type. Either the material remains unclassified or classification is made using one of the existing type definitions.

Krieger (1994, 276-277) too, refers to the ‘hair-splitting decisions on individual specimens’ which often force artefacts into inappropriate or artificial categories. Justice (1987, 12-13), in response to this problem, proposes the use of morphological correlates, the clustering of similar point types on individual and group levels to account for intra-type diversity and inter-type similarity:

In cases such as these, the option to use the cluster level designation, which incorporates the range of variation of a number of types, allows materials to be classified on technological considerations without the need to force specimens
into type categories. Consequently, a higher level category (e.g. morphological correlates in a cluster) is available for specimens that would otherwise be unclassified or potentially misidentified. This classification system allows more flexibility, but it also invites the user to become increasingly familiar with the various traits which combine to form the unique types that are critical to understanding prehistory.

Far from ‘deified classifications,’ this system is modelled around the diversity (and the subjectivity) of the archaeological record, accepting that morphological traits are not strictly constant and providing a good example of how to account for it. When approached in this way, the ordering of artefacts, at varying degrees of complexity, is a successful and invaluable tool for interpretation.

3.2. Issues for Further Consideration

Regardless of its merits, the process of artefact categorisation inevitably suffers some criticisms. Categories, by nature, are highly variable, ‘being defined partly intuitively and partly rationally, partly essential and partly instrumental’ (Hermon and Niccolucci 2002, 217), and although this variability does not prevent the process of interpretation, an appreciation of its existence is imperative. Each ‘process that leads from artefacts to theories does not rely on numbers and computations, but has to cope with decisions’ (ibid, 222), and despite the best efforts of each analyst, ‘choices must be made with regard to which attributes are to be emphasised’ (Hill and Evans 1972, 251). It is the interplay between people, process and interpretation which directs the discussion below, including reference to competing categories, observer bias, attribution of meaning, and the role of the individual craftsperson. Ideally, each category should be clearly-defined for consistent application. However, in reality, ‘clear types are rare and do not exhaust all archaeological material which in the majority of cases is in reality made without any moulds’ (Gorodzov 1933, 100-101). Thus, each process of classification relies on two dimensions of accuracy: ‘one is the correct placement of an artefact into a given category and the second is the definition of the categories themselves’ (Read 1974, 217).
Competing typologies

Inevitably, different archaeologists favour different methods of classification, the variety of which helps foster healthy scientific debate. An understanding and appreciation of other works in the field is what defines future research goals. Dialogue between analysts, too, is a necessary part of the interpretive process, both within and between disciplines, helping expand and refine knowledge of a given subject area. The sharing, comparing and reviewing of datasets among researchers plays an important role within the assessment of various classification schemes. On occasion, ‘serious problems are encountered in the integration of classifications that have been developed by groups of archaeologists working independently of each other in the same region’ (Trigger 1989, 383), a product of different approaches. Bettinger and Eerkens (1999), for example, highlighted clear discrepancies between the Monitor and Berkley projectile point typologies, which use weight and basal width discriminators respectively. Both have been used to distinguish between Elko corner-notched points, thought to have been used with darts, and Rosegate points used to tip arrows. In this case, the typologies disagreed over narrow-based dart points and heavier arrow points, specimens which blurred the distinction between forms. In so doing, the inaccuracies of each typology were exposed, calling into question their reliability as tools for interpretation. At the same time, however, it provided useful insight into each of the types under scrutiny and their potential function.

In another case, Justice (2002, 136) draws attention to the similarities between the San José point type attributed to the Southwest and resharpened examples of Dalton from the eastern Plains. The distance between the geographic distributions of each, combined with the ‘well-established Early Archaic temporal parameter of Dalton’ make any direct relationship between the two unsupportable, though they do serve as a useful ‘lesson in potential for any shape [with or without a similar associated technology] to reappear at any time in the archaeological record without connections between remote geographic regions’ (ibid). This provides a useful backdrop from which to consider the role of the analyst in the creation, application and explanation of artefact types. As Whittaker et al. (1998, 134) attest to:
'Attributes are always selected by the analyst, and therefore attributes – and the types they define – are always affected by the problems and the biases of the investigator.'

**Observer bias**

Naturally, the categories each archaeologist creates reflect, in some way, their research interests, whether temporal, spatial, functional or stylistic. As Trigger (1989, 382-383) maintains, ‘even efforts to classify “objectively” by searching for “natural” clusterings of attributes within large data matrices are subjective to the extent that the listing of attributes is based on the archaeologists’ knowledge and sense of the significance of the material they are analysing.’ Personal judgement, therefore, is intrinsically linked to the creation and application of a series of artefact categories. Thus, ‘it is impossible to talk about types and typologies except in subjective terms. We cannot speak of the concepts; we can only speak of our concepts’ (Adams and Adams 1991, 5). Classification is not about finding the ‘right’ groupings, but developing a system tailored to the research task in hand. In this sense, it is ‘intersubjective agreement’ or consistency in application which is more important, for ‘we will never know, in many cases, how closely our type concepts correspond to some external reality, but we can discover and measure how closely the concepts of one person correspond to those of another’ (Adams and Adams 1991, 4).

Several studies have attempted to measure observer consistency, producing a number of insightful conclusions. The analyst-induced variability derived from a lithic assemblage by Beck and Jones (1989), for example, highlighted the importance of explicitly defined artefact classes. In this case, consistency could be improved by eliminating as many arbitrary decisions as possible from the selection process. The problem remains, however, that someone is still responsible for creating the ‘explicitly defined’ classes in the first place, and by eliminating the potential for dialogue and discussion between analysts based on their different perceptions, the archaeologist is at risk of overlooking important features within the assemblage. As Adams and Adams (1991, 188) maintain, ‘attempts to rid classification of… subjectivity have ended by robbing them also of their utility. The utility of type concepts is enhanced, not diminished, by the very complexity that makes them so difficult to define rigorously, and that makes decision-making an unavoidable necessity.' Thus,
measures of difference are much more realistic (and helpful) than their impossible elimination.

Another study, by Fish (1978), identified clear discrepancies in the classification of Kayenta ceramics by four trained analysts, ranging from 22 to 30 per cent, with no one analyst or type consistently lacking consensus. Gnaden and Holdaway (2000), too, observed patterns in observer error regarding a lithic assemblage from the Stud Creek site. In this case, it was interesting to note that multiple observers were often more consistent than the experts, perhaps a product of recognising finer detail than the less-trained eye. Regardless, ‘archaeologists should not assume or act as if their classificatory schemes produce fully replicable sets of data’ (Fish 1978, 88). Different people project different perceptions, neither of which is constant. Whittaker et al. (1998) propose the ‘learning genealogy’, defining the relationship between the individual and their solutions to, among other things, exposure to the opinions of other researchers. In this sense, artefact categories are modelled around both intra and inter group perceptions and are open to modification (or ‘legitimisation’) as consensus changes through time. Gnaden and Holdaway (2000, 745) propose the implementation of an observer variation program to account for these fluctuations, integrated into the artefact recording process so that ‘the results from the previous season may be used to reduce the level of observer variation in the current season by targeting variables that have proved difficult to measure consistently.’

Likewise, beyond the field, ‘statistical manipulations of archaeological data and the conclusions drawn from them should include considerations of pre-existing observer discrepancy in the original data’ (Fish 1978, 88), particularly ‘as we look to artefact classification for finer resolution... bias becomes more critical, and failure to recognise its existence will cause serious problems in interpretation’ (Beck and Jones 1989, 259). Observer bias is an inevitable part of the analytical process, but at least by recognising its presence we can factor its impact into our conclusions. As Gnaden and Holdaway (2000, 746) make clear:

‘Assessing the significance of observer variation helps to establish the scientific validity of archaeological interpretations and helps ensure that the variation studied is a product of the past, rather than present, behaviour.’
Lumpers and splitters
Closely related to observer bias is the process of sub-categorisation. Based on the variation expressed between researchers, ‘both in their perceptions and in their value orientations… given the same body of material to classify in the same way and for the same purposes,’ it is only natural that ‘some… will always come up with more types than will others’ (Adams and Adams 1991, 280). A ‘lumper’ will tend to group artefacts into large and inclusive classes, whereas ‘splitters’ tend to use many more classes, each with a higher number of diagnostic features and less internal variation (see Rouse 1960, 316-317). The same basic categories will remain, but the presence or absence of further sub-categories can dramatically affect the interpretations drawn, whether associated with functional, temporal, or cultural differences. Thus, the complexity of the questions being asked and the availability of supporting evidence should be borne in mind when considering the validity of seemingly infinite artefact divisions. As Whittaker et al. (1998, 159) suggest, in an effort to maintain consistency, ‘difficult distinctions should be dispensed with in favour of more obvious ones,’ and that ‘in the absence of clear interpretive reasons for differentiating types, lumping will yield more comparable results from observers than splitting.’ Thus, unless the research agenda requires it, extensive sub-categorisation is unwarranted:

‘It is important that the student of classification not get so confused by all of the terms that he or she is unable to see the forest for the trees.’

(Bailey 1994, 4-5)

Group dynamic and the individual maker
Another issue for consideration is that of the interplay between the individual artisan and the wider community. Gifford (1960, 341-2), in his discussion of pottery types, describes a combination of culturally-accepted mental templates and individual motor skills in association with the stylistic values or requirements of a given culture. In this sense:

‘Types are summations of individual or small social group variation consistent with boundaries imposed by the interaction of individuals on a societal level and determined by the operative value system present in any society.’
For the most part, artisans comply with the socio-cultural expectations in place, for reasons of ‘economic necessity’ and ‘psychological comfort’ (ibid, 343), thus producing broadly consistent type categories. It must be borne in mind, however, that the design of a successful tool requires more than adherence to stylistic codes. As attested to in ethnographic accounts, attributes such as size and weight, both of a single element (such as an arrow point) and of a complete system (the bow and arrow), are often tailored to the needs of the individual. Among the Pumé hunters of Venezuela, for example, boys’ arrows are smaller versions of the men’s arrows (Greaves 1997, 298), while the length of spearthrowers among the Inuit of Unalit, Alaska, appears to be calculated according to ‘the build of the hunter, as well as the type of game being hunted’ (Cattelain 1997, 215). Studies of the Agta of Northeastern Luzon indicate a correlation between bow pull weight and the strength of the hunter; ‘mature, strong men may carry a sixty or seventy pound bow; women and youths use lighter pulls’ (Griffin 1997, 272). Inevitably, these seemingly minor differences have the potential to introduce significant variation among point types, and while we may think of bows and spearthrowers as fairly standardised projectile systems, ‘this association can exist essentially within the mindset of the weapon’s owner [or of the archaeologist] and can be contradicted by the realities of use’ (Cattelain 1997, 230). Particularly when combined with the issue of intra- and inter-tribal trade and exchange (Miller et al. 1986, 189-190), we must be mindful of the limitations regarding assignments of arbitrary type criteria.

**Emic or etic?**

With the subjectivities of the individual analyst and the ancient craftsperson borne in mind, we must also consider the relationship between present perceptions of artefact groups, varied as they may be, and those of people in the past. This raises a number of interesting questions regarding the validity of classification schemes, for ‘it is important to be clear whether an order is being imposed or unearthed’ (Herbertson 2002, 58). The interplay between the intentions of the ancient craftsperson and those of the modern archaeologist (and their associated research agenda) provides an interesting topic for debate, characterised by *emic* and *etic* type categories. Emic categorisation, on the one hand, ‘refers to the way indigenous groups classify their objects or behaviour,’
whereas etic types refer ‘to the way “scientists” (in this case, archaeologists) classify objects or behaviour to resolve specific problems, or find out specific types of information’ (Hayden 1984, 80). In a sense, emic descriptions ‘require one to enter the world of purpose, meaning and attitudes’ (Harris 1968, 571), notoriously difficult concepts to access archaeologically. ‘The argument that it is necessary to look at “their” view of “their” world is,’ however, ‘one that is central to “cognitive” and “postprocessual” views of archaeology’ (Johnson 1999, 79). Thus, investigation into the value of emic types has received a fair amount of attention in more recent years, fuelling debate between processual and postprocessual researchers.

Chang (1967, 78) for example, argues that ‘the “right” categories are those that reflect or approximate the natives’ own thinking about how their physical world is to be classified, consciously or unconsciously, explicitly or implicitly, within which framework they accordingly act.’ As such, ethnographic accounts of emic categories provide useful insights into native perspectives, which may themselves be organised on a number of different socio-economic levels. As Hayden (1984, 85) points out:

‘…emic categories… may vary within communities according to specific roles of individuals… Generalised users of these same objects may be only interested in their overall functional classification, while specialised users may have elaborate distinctions for the same objects.’

Access to accounts of this type of culturally-appropriate categorisation and sub-categorisation is clearly a valuable resource, though its value for assessing more ancient artefact collections is debatable; ‘at least in prehistoric archaeology emic classification represents more an ideal than a realistic possibility’ (Adams and Adams 1991, 223). From the processualist (or positivist) perspective, archaeology deals with the mute remains of action, not thoughts, the latter being difficult, if not impossible, to access. Brew (1946, 46) goes as far as to suggest that ‘objects do not “belong” or “fall into” types, they are placed in types by the student,’ so that ‘no typological system is actually inherent in the material.’ Rather, each system is a construct of the modern archaeologist and ‘it is difficult, if not impossible, to know how well they correspond to “native” classifications’ (Debénath and Dibble 1994, 4). Thus, the analyst is constricted
by the gulf between the past and the present (Figure 5). As Adams and Adams (1991, 284) suggest:

‘Presumably any consistent difference between artefact groups which can be recognised by archaeologists could also have been recognised by the makers and users of the artefacts, but there is nothing to indicate how important those differences would have been considered. Probably some of them would have been regarded as vital, and others as trivial.’

The variety of seemingly subtle and distinct characteristics among Medieval Nubian pottery types, for example, may reflect the division of conscious and unconscious intentions on behalf of the makers (ibid, 269) though these divisions will always be clouded by our own modern perceptions of what constitutes ‘subtle’ and ‘distinct’. In many cases, etic and emic concerns are in stark contrast:

Figure 5: The gulf between the present and past, interpretation and ‘truth’ (Johnson 1999, 14).
‘In fact, archaeologists are often interested in problems which ethnic groups find minimally interesting and for which one should not expect to find any special terms. For instance, from the emic point of view, it could be said that archaeologists have been absolutely obsessed with small stylistic changes over time and from region to region. Most traditional people do not view such changes as important to their lives, if indeed they are aware of them at all.’

(Hayden 1984, 86)

In many cases, the features to which we attribute importance may be the product of a number of unconscious actions. Individual motor habits, idiosyncrasies, and mechanical contingency strategies (such as availability of raw material in a given region) are just a few examples of behaviour that might result in artefact clusters irrelevant of conscious human goals or preferences (Hill and Evans 1972, 266; Watson et al. 1984, 209). Thus, as Binford (1968, 424-425) argues, we should not ‘handicap our analytical abilities for studying cultural processes by restricting our classifications to emic categories cognitively meaningful to past peoples,’ particularly when dealing with the distant past. In this case, ethno-archaeological information should be supplemented by other useful approaches, such as experimental and replicative analyses, in order to both aid and balance interpretation (Hayden 1984, 90). As such, while emic categories, where appropriate, can provide a useful point for comparison with archaeological classifications, they should in no way monopolise the research agenda; ‘one may well be interested in what people actually do, rather than what they think (the latter being difficult at best)’ (Hill and Evans 1972, 266). Thus, rather than two competing types, emic and etic types form two sides of an ‘interpretive coin.’ On the one hand are the etic distinctions based on modern perceptions, which is usually the only perception we have access to. These may or may not correlate with emic descriptions, but they are vital for helping us ‘make sense’ of large assemblages of material culture. On the other are the emic distinctions which, though rarely accessed, shed valuable light onto our own perceptions, creating a more holistic account of what people in the past both thought (intention) and did (execution).
**Multi-functional tools**

Assumptions of artefact function are inherent in the classification process, the result of conscious or unconscious impositions of modern interpretation. Sometimes these functional assignments seem ‘obvious,’ especially among ‘typical’ artefact forms, but as studies of use-wear have demonstrated, tool use (and reuse) can be much more complex, cross-cutting morphologically-derived distinctions and their functional connotations. As in the case of the dart-arrow point dichotomy, the design of each point must be considered within its broader context of use, ‘relative to the power of the bow, the athletic prowess and strength of an atlatl user, the use of feather fletching, and the intended function at close or long range,’ so that both ‘large and small examples should be expected within the range of variation’ (Justice 2002, 16). Human responses to the implementation of a new technology, raw material availability, individual and group preferences, and the practicalities surrounding various hunting strategies, to name a few, each play a role in the design and function (or multi-function) of a tool. Thus, distinctions are not as simple as they may seem, and what may look like a projectile point may well have been used for a more varied set of tasks than typically assumed.

Though we might not like to admit it, archaeologists tend to deal with ‘fuzzy’ sets of data (see Adams and Adams 1991, 73), a product of the varied and situational nature of human behaviour. Versatility and flexibility, therefore, likely featured in the design and manufacture of a given tool or tool set, the former a response to the demands of simultaneous different tasks (multi-functional requirements), the latter to sequential changes in use (Nelson 1997, 374-375). A versatile tool can be used in more than one context and for more than one task at a given time. In projectile studies, this effects both the projectile (and its individual components) and the associated launch device. A number of Australian points associated with the spearthrower, for example, lie within the range of variability suitable for use in hunting *and* warfare, while the seemingly task-specific seal spearthrowers of the Inuit were used with more than one projectile type to avoid overloading the deck of the kayak with other spearthrower forms while hunting (Cattelain 1997, 216-218). In this sense, tool function is a result of both scheduled and unscheduled demands, often predetermined but not always predictable. As Justice (2002, 2) suggests, ‘the hunting scenario of prey being dispatched and then rendered with the same
stone projectile point is logical and economical,’ and whether designed with interchangeable functions in mind or not, versatility is a vital ‘common sense’ feature of the prehistoric tool kit.

Flexibility, too, is a natural response to the effects of tool use (see reworking and reuse discussions below), with changes in form often associated with a systematic change in function. ‘A hafted scraper with a bevelled end for scraping the flesh from animal hide,’ for example, ‘might be recycled into a spear point or knife by flaking away the bevel to make a new tip, or two recycled spear points could be fashioned from a large one accidentally broken’ (Justice 1987, 5). Naturally, some tool types will be more flexible than others, closely-related to external factors such as raw material availability. Some will have had but a single purpose. Either way, considerations of tool use, whether single or multiple, simultaneous or progressive, provide useful insight into the relationship between form and function and the potential for greater functional diversity in the archaeological record. ‘The reductive character of lithic technology and the fact that lithic artefact functions may change as the artefact form is changed’ (Andrefsky 2005, 30) is critical to the discussion of tool reworking and reuse, below, and has important implications for the way in which seemingly distinct artefact forms are categorised.

**The effects of rejuvenation, reworking, and reuse**

In a perfect world, artefacts would fit into clearly-defined categories. Each type would be fixed in time and space, have a specific function, and cluster tightly with others of its kind. In reality, many ancient objects were no more fixed in form and function than those of today. Prehistoric peoples recycled and reused various materials just as we do now, and while each product recovered represents an activity, this tends to be ‘the last activity concerning that specific tool’ (Flenniken 1984, 199). As ethnographic analogy and personal experience have shown us, rejuvenation, reworking, and reuse are common occurrences within the use-lives of stone tools. Thus:

‘For all types there must be a series of distinguishable core traits and also a range of variation which includes patterns of morphological attributes in all combinations from pristine tools to those in heavily resharpened and reworked states.’ (Justice 2002, 3)
Naturally, modification sequences will vary according to time and place, each defined by a series of socio-economic constraints, including techniques of manufacture, stylistic preferences, and access to appropriate raw material. Bone and antler points, for example, might be reworked into progressively shorter tips following use, breakage, and rejuvenation (Stanford and Bradley 2012, 63), though ‘possibilities for morphological variation across and along the longitudinal axis’ are far more limited than those made of stone, ‘as is placement of morphological features of hafting technology’ (Knecht 1997, 205). Some types, then, are more heavily affected than others, though each has the ability to shape interpretation. As Cordell (1984, 104-105) cautions, ‘in some cases, two projectile point styles may be the same tool in different stages of reduction’, such as Frison et al’s (1976, 45) hypothetical sequence of point breakage and reworking at the Hawkin site (Figure 6).

An experiment conducted by Flenniken and Raymond (1986) provides another good example of the interaction between use and reuse, as a number of hafted Elko corner-notched projectile points were tested to provide insights into tool modification. In this case, processes of rejuvenation altered point morphology to the extent that what started out as Elko corner-notched could then be reworked into an Elko, Gatecliff or Rosegate temporal type (Figure 7). Thus, the implications for assigning morphologically-derived types are clear, particularly among collections with limited stratigraphic control; the archaeologist ‘cannot assume that patterns of morphological attributes have clear-cut chronological significance when simple alteration of shape during use-life may change the temporal assignment of that point by thousands of years’ (ibid, 609). Hence, considerations of intensity of use should always feature in
discussion. Dibble (1991), proposed a similar concept with regards to the Mousterian typology of the Middle Palaeolithic. Rather than the stylistic (Bordes 1961; Bordes and Sonneville-Bordes 1970) or functional (Binford and Binford 1966; Binford 1973) concepts proposed by others, he suggested that assemblage variability was a reflection of degree of intensity of utilisation. In his view:

‘… types represent neither modal categories nor intentional endproducts, but more or less arbitrary categorisations of pieces that were reworked and rejuvenated until they were no longer useful or desired and then discarded. So, while flakes were undoubtedly deliberately retouched to achieve a suitable working edge, the overall morphology of the final piece is not… intentional or necessarily desirable.’

(Debénath and Dibble 1994, 6)
In all likelihood, each viewpoint (of function, style and utility) is in some way correct, combining to form a more holistic account of potential scenarios. Each forces us to consider the relationship between intentions and possibilities, theory and practice, design and manufacture:

‘… as the piece being worked gets smaller, the flintknapper will opt for a design solution that can be met by the needs of a secure hafting mechanism. In other words, positioning, dimensions, and morphology of hafting characteristics such as notches will be influenced by culturally dictated morphological norms (i.e. mental templates) operating in concert with the shape and size of the piece with which the artisan is faced.’

(Knecht 1997, 204-205)

The interplay between people, process, and practicality produces an inevitably complex sequence of actions. In areas with limited raw material availability for example, tool design (and re-design) may require greater flexibility than those with plenty. However, ‘as hunting and gathering strategies were organised and planned for success, the occurrence of unique or unusual rejuvenation and retooling behaviours is to be expected, but not in such frequency as to totally overshadow a traditional manufacturing technology’ (Justice 2002, 17). Irrespective of external constraints, selected strategies should, therefore, still be visible in the archaeological record, signalling the extent to which artefacts were ‘allowed’ to be manipulated (Warburton and Duke 1995, 227), whether conservative or radical. Just ‘like the process of manufacture, resharpening and reworking techniques were accomplished following culturally prescribed methods and techniques in vogue in particular time periods and prehistoric traditions’ (Justice 2002, 23). Where possible, detailed debitage analyses inform us of this learned behaviour (Flenniken 1984, 200), helping create a more complete account of prehistoric tools within their broader use-life context. There will surely be much we cannot know, but a simple awareness of the effects of reworking and reuse are vital when sorting through the products of a reductive technology:
‘… it is important to realise and understand that lithic tools physically change shape and that archaeologists collect lithic tools at static points in what may have been in a process of change. The dynamic process associated with lithic tools has important implications for artefact typology and the assessment of artefact functions.’

(Andrefsky 2005, 30)
4. Shaping Technologies

The dart and atlatl and the bow and arrow share a number of traits characteristic of the term ‘projectile technology’, though each category (and sub-category within) are subject to the particulars of a given time and place. Differences expressed via economic necessity, environmental factors, and socio-cultural concerns attest to the subjective nature of the design and function of tools recovered from the archaeological record. Christenson’s (1986, 118-119) simplified model of projectile effectiveness (Figure 8), for example, demonstrates the not-so-simple relationship between a handful of the design goals involved in producing an ‘effective’ weapon. Factor in the subjectivities of individual environmental context, hunting/warfare strategy, and cultural preference and the situation becomes even more complicated. As in Muller’s (1983, 392) discussion of Mesoamerican influences upon the Southwest, “the mere introduction of a technology or an “idea” does not explain or cause developments. The local society, whether innovating or accepting, still can

Figure 8: Simplified model of projectile effectiveness (Christenson 1986, 118).
develop only so far as the local social and environmental conditions permit.’ The discussion that follows provides a number of examples (based largely on ethnographic data) regarding this interaction between people, place, and the plethora of economic and socio-cultural constraints they are faced with. Naturally, this brings into question the relationship between functional and stylistic characteristics, and the complex set of decision-making processes inherent in the design process.

4.1. Economic Efficiency and the Environment

Throughout time and space, human development, whether technologically, politically, or socially, has been influenced in some way, large or small, by the local environment. Naturally, we must be cautious as to how much importance we place on its role for fear of becoming environmentally deterministic and overlooking other important socio-cultural factors. However, the specifics of each ecological niche, cool or temperate, wet or dry, desiccated desert or heavily vegetated forest, and the opportunities for resource exploitation they provide, are key to understanding the ways in which people were capable not just of surviving, but of developing increasingly complex systems of technology. Notions of economic ‘efficiency’ feature commonly in discussion regarding chosen modes of adaptation (tool type, hunting tactics, etc.), though what it actually means to be ‘efficient’ remains open for debate. As we explore the effects of location upon adaptation, including resource availability and suitable hunting strategies, the complex relationship between technological solutions (such as the spearthrower and the bow and arrow) and the environment becomes abundantly clear.

**Adapting to the landscape**

When interpreting technological trends in and between regions, and more broadly across the continent, variations in landscape are an important consideration. As Justice’s (1987, 2002) type cluster maps show us, certain technologies appear to be environmentally conditioned, and thus tightly focussed in certain areas. Others, such as Clovis, transcend these divisions and delineate broader spheres of influence. By establishing such boundaries (or lack thereof), the archaeologist is better equipped to judge the impact of
different landscapes upon the adoption of a given point type and associated mode of propulsion. Moreover, ‘since projectile point types represent prehistoric technological and cultural traditions, the tracing of their distributions allows the delineation of the area of influence or trade as well as the range of ecological zones to which they became adapted during their existence’ (Justice 1987, 11). Again, people, points, and place are reunited as the merits of mapping point location stretches beyond the simple what? and where? questions and into the realms of how? and why?

Naturally, different technologies are better suited to different environments, each offering a different grade of flexibility. While most consider the bow and arrow a more flexible tool than the dart and atlatl (for example, Yu 2006, 209), associated ‘cover structure’ remains an important concern. Described by Bartram (1997, 340) during a comparison of Kua (Botswana) and Hadza (Tanzania) bow and arrow hunting, the term cover structure refers to ‘the relevant topographic and vegetative characteristics of an area that determine how a hunter must approach prey to remain undetected.’ The nature of the surrounding landscape, whether open or closed, even or uneven, heavily vegetated or sparse, exerts a clear design constraint on the favoured tool type. In this sense, ‘selective advantage is conferred on designs that are as accurate and powerful as can be (generally larger equipment) while allowing the archer to get close enough to shoot without being detected by the prey (generally smaller equipment)’ (ibid). When the open habitat of the Kua is set against the densely-covered hilly terrain of the Hadza, it is easy to understand how selective advantages may differ, with the Kua opting for smaller hunting gear capable of being carried long stalking distances and the Hadza for larger, more powerful equipment capable of concealment in thicker cover (ibid).

Of course, these advantages must also be considered in relation to the spatial requirements of a given piece of equipment (see Chapter 1.2), and while the example above compares two bow types, the relationship between cover structure and different modes of propulsion provides further insight into the effect of landscape upon tool selection. Yu’s (2006) study of the atlatl to bow transition within three geographically distinct study areas (central Japan, coastal Spain, and the North American Great Basin), for example, provides an interesting correlation between more densely vegetated areas and earlier transition rates. In this case, the ‘earliest transitions occur in Spanish and
southern Japanese sites... characterised by high annual rainfall, high net above-ground productivity, and high effective temperatures,’ whereas ‘the Great Basin sites, with lowest annual rainfall, low net above-ground productivity, and moderate effective temperatures, consistently show the latest transition’ (ibid, 212). It seems the bow and arrow offered greater opportunities to exploit a landscape typically considered less profitable via previous hunting methods. In effect, the expansion of this new ‘hunting niche’ would have extended the available resource base and associated diet breadth of those in that area- a competitive advantage later adopted in areas with fewer restrictions on access to resources.

Based on the above premise, it seems sensible to assume that ‘high pressure’ environments are more open to change than ‘low pressure’ ones. A pressurised environment may be an environment that is considered inaccessible with traditional tools (as above), or one that involves the taking of dangerous game or the use of high-risk hunting strategies (see Justice 2002, 46), forcing people to search for newer, safer and more ‘efficient’ solutions. By the same merits, ‘specialised adaptations as well as occupations in remote regions where knowledge of new solutions were either limited or unwarranted would conceivably have slowed the spread of the technology’ (ibid, 45), attesting to the role of mobility, population pressure across the landscape, and the effects of proximity to (or isolation from) other groups. As Yu (2006, 214) suggests, ‘in arid environments where territories are large and mobility high, packing thresholds are not expected to be reached very quickly. But changing population distributions in highly productive environments may have fuelled early projectile transitions.’ When considering the reasons for the implementation of a new technology such as the bow and arrow, then, we must be mindful of the landscape itself (size, resource availability, accessibility, and suitable equipment selection) as well as the knock-on effects of landscape packing upon broader survival strategies (shrinking territories, closer contact with other hunters- and innovators, general decrease in mobility, and other implications such as trade and conflict).

Furthermore, it must be borne in mind that landscapes are far from static entities; they are fluid and changing. Climatic fluctuations, for example, whether local, regional, or continent-wide, likely had an effect on surrounding populations in different areas and at different times, providing another important
consideration when interpreting cultural and technological adaptive changes more broadly (for a rigorous framework for assessing climate-induced culture change see Eren 2012).

Managing available resources
Access to resources, for both making the tool and making the kill, inevitably influence the selected mode of adaptation.

Tools
Naturally, the availability of raw materials in any given time or place will affect the composition of a hunting toolkit, including the form it takes throughout its various use-life stages. As attested to in Chapter 3.2, the same point at different stages in the reduction sequence might be interpreted as an altogether different type or subtype. Efficient managing of the local resources, particularly in areas with fewer supplies, however, could mean that ‘the relative frequency of one or the other in a particular subregion may have more to do with distance to sources of raw materials than to changes in artefact style over time’ (Cordell 1984, 104-5). The typological variation expressed among Middle and Late Archaic stemmed points, for example, may be a product of resharpening and rehafting processes, as well as strengthening techniques (e.g. basal grinding) intended to prolong use-life, rather than definitive differences in style (Amick and Carr 1996, 47), thus attesting to the role of resource management. In this case, prolonged use-life is prioritised above point form, though in other cases there appears to have been tighter controls placed on the latter. Buchanan’s (2006) study of Folsom sites in and around the Edwards Plateau, for example, demonstrates little correlation between linear distance to raw material and the various length characters of point form, limiting the effects of reworking and hinting at careful management of resources and a seemingly more scheduled exploitation strategy.

The prioritisation of one parameter over another, regardless of the outcome, provides clear evidence for a complex decision-making process linking the craftsperson to their environment. In reaching the end goal (i.e. the tool considered most efficient and effective in a given situation), materials for the production of the whole tool must be considered, not just the stone points preserved in the archaeological record today but the entire weapon, including
any strategic extras such as the use of poison. Historically, stone points were avoided altogether in New Guinea and lowland South America, despite stone being used for other tools, demonstrating a conscious decision to use another (perhaps considered superior) material such as bamboo. Among the reasons for this choice might be its sharp edge (perhaps less breakable), ease of manufacture for a long, broad tip (perhaps for deeper penetration), or easier material procurement (Ellis 1997, 34-5). On the other hand, it could be that stone points simply were not necessary within the broader hunting strategy. For example, where poison is used and ‘the goal of the projectile is to simply deliver the poison to the prey or enemy... it does not matter how much damage the actual weapon tip can induce, or at least, the tip’s importance as a damage-inducing device is lessened’ (ibid, 55). Thus, while we tend to prioritise the value of the stone tips preserved for us to study, it is important to remember that they are only a single element within a bigger system comprising the complete tool and associated exploitation strategy for a given location.

When reflecting on the broader manufacturing strategies of prehistoric people, time remains one of the most important considerations. Deliberation over the cost of the chosen manufacturing and hunting strategies, and the predicted economic return, centre on the expenditure of time and energy. As Ellis (1997, 57) suggests, the time taken to make a stone tip may be countered by the time later spent reworking, rehafting, and producing replacements. Inevitably, this will have a ‘knock-on’ effect on the quality of the end-product and decisions as to the most ‘efficient’ tool to both produce and utilise. These concerns extend beyond the points themselves, as each component of the broader system provides a demand on the manufacturer’s time (for example, see Kirk and Daugherty 2007, 61; Whittaker 1994, 248 for discussions on wooden shafts). With this in mind, while personal preference may feature in the decision-making process, logical notions of multi-functionality, flexibility, reliability and maintainability are vital for understanding how people adapted their toolkits to suit their economic needs.

Generally speaking, ‘economic efficiency’ requires the ability to weigh up task losses against task gains. The selection of stone to tip a weapon, for example, may offer an advantage in terms of impact-induced target damage, but this might be outweighed by a number of liabilities, among them ‘a shorter use-life, excessive investment to produce or maintain the weapons that would
detract from the time available for hunting and other critical activities, and the need for a continuously functional (i.e. reliable) weapon—i.e., one not likely to break in transport’ (Ellis 1997, 59). The size, shape, and material selected are a direct reflection of the ‘weighing up’ of these liabilities (see also Knecht 1997, 206-207). In this sense, context is crucial, as inferred by Bleed’s (1986) models of reliable and maintainable systems (Figure 9). An environment stocked with predictable game, for example, would suit a scheduled hunt with a well-crafted weapon: a reliable system. One with diverse and scattered game with continual demands, on the other hand, would suit a more portable, repairable toolkit: a maintainable system. Regardless of the system selected, each demonstrates close ties with the environment and associated resources.

As the seasonal constraints of a given environment change, so too might the system selected. Binford’s (1979, 262-263, in Ellis 1997, 58) study of the Nunamuit Eskimo, for example, describes the difference between ‘deer’ and ‘bear’ arrows:

‘The difference… was not so much that each was exclusively used for the two types of game but that the antler points were used more commonly during the months of freezing weather, and stone when it was warm. Stone points were very easy to break and were unreliable to carry, because they “cracked sometimes from just being rubbed together in the quiver” when it was very cold.’

In this case, durability was a major concern. For others, such as the Pumé of Venezuela, multi-functionality took precedence. For example, it was noted that during a number of hunting trips arrows often substituted for knives, and ‘both the number of tools used and the number of tool uses were strongly correlated with travel distances’ (Greaves 1997, 311). As both of these examples make clear, ‘hunting tools are used in accordance with… behavioural strategies, not the individual design capabilities of each particular tool’ (ibid, 314), and these behavioural strategies are intrinsically linked to the particulars of a given time and place.
Figure 9: Reliable and maintainable weapons systems for comparison (Bleed 1986, 744-745).
Targets

Just as the landscape determines what raw materials are available for conversion into useful tools, so too does it determine the availability of different plant and animal resources for consumption. With this in mind, it seems natural to suppose that different animals (i.e. targets) in different locations may warrant the use of different tool types. In some situations, the target may even be human (i.e. inter-group conflict), and while tempting to suggest a simple correlation between point form and target type, other contributing factors such as material preference and availability should also be considered. In a number of ethnographic cases, stone points were typically reserved for use in warfare and dispatching larger animals, while smaller game tended to correlate with the use of organic weapon tips or blunt foreshafts (Ellis 1997, 40-44; Justice 2002, 40).

These distinctions are more difficult to come by archaeologically, though as Ellis (1997, 53) proposes, in societies where large land mammal hunting was not critical to survival, we might assume a higher percentage of non-stone weapon tips compared to those where it was. However, the correlation between point size and target size, though practical, is not without its limitations. A comparative study of Paleoindian points by Buchanan et al. (2011), for example, demonstrated that while the larger point-larger target trend persisted in general terms, there were few distinguishing factors between specific types (i.e. Clovis-mammoth and Clovis-bison points). Perhaps this represents a cultural difference between Clovis types and others such as Folsom; perhaps it describes an adaptive stage between mammoth and bison hunting with few distinguishable differences. Either way, ‘there is no simple relationship between point size and prey size’ (ibid, 863), and other factors such as the impact of target agility and the accessibility of the landscape likely contributed to the design and selection of a given tool.

If we accept that different species in different landscapes move in different ways and pose different challenges, it seems sensible to surmise that each combines to produce a different hunting device and associated tactic. Spears, for example, are commonly favoured above bows and arrows for targeting larger animals among the San hunters of the Kalahari, a product of their ability to impart a ‘knock-down’ force in areas where tracking the target is unviable due to the prevalence of other predators (Hitchcock and Bleed 1997,
This advantage must, however, be weighed against the risks of increased proximity to a dangerous target. On the other hand, long distance harassment in warfare would be better suited to the use of lighter arrows with a greater effective range (see Miller et al. 1986). Clearly, then, distance to the target and the dangers posed, whether of retaliation or of escape, have the ability to shape hunting practices in some way, from the tool selected to the design of each component. In this sense, tool and target selections, both environmentally-conditioned in some way, combine to form a context-appropriate strategy.

**Developing a suitable strategy**

Economically ‘efficient’ systems tend to be context specific. As the discussions above attest to, ‘the extent to which any design variable is emphasised depends on hunting strategy, prey characteristics, environmental conditions, and the scale of mobility,’ so that ‘the ballistic properties of points may vary by season or as hunters move through different landscapes or approach different prey’ (Nelson 1997, 380). Weapon selection among the Agta of Northeastern Luzon (refer to Figure 10) provides a good example of this interconnection (Griffin 1997, 282):

‘The rainy season brings sodden forest floors and quiet stalking possibilities. Men and women can stalk without noisy steps, creep even within touching distance of unwary pigs, and cast very heavy, wide projectile points. Compared to a light point, the heavy, broad points have greater shocking power and cause more damage to the prey. While a light arrow travels far and fast, it may not have the destructive power of the heavier arrows and is relatively useless for a close-in shot against a large animal… Conversely, in the dry season, the forest is noisy, the game lean and wary, and stalking is an unprofitable strategy. Instead, drives with dogs are best, followed by night hunting with flashlights or by ambushing from fruiting trees. Often, shots must be taken at some distance or at fleeing animals. Multiple-component arrows are used only in sure situations; otherwise, arrows with light, slim points are shot.’

The point (and associated system) selected is a product of several factors, each contributing to the success of the hunt, and ‘although equipment plays a role in successful hunting,’ it should be clear that ‘environmental factors, hunting
strategies, and most importantly, the hunter’s knowledge of the animals and their habitat are crucial’ (Bartram 1997, 340); all elements of a much broader survival strategy. Practical adaptations weigh up the cost of time and energy against the predicted return for various solutions to a given situation, and while we may assume that the most ‘efficient’ of these solutions is the one selected, this may not always hold true. For example, we may assume that darts tend to be confined to fewer but larger resource species located in more open environments, and arrows for more diverse, day-to-day forays among a broader range of environments (Shott 1993; also Cattelain 1997, 219-220), but ethnographic evidence attests to ‘the simultaneous use of multiple kinds of hunting weapons, as well as the use of different hunting technologies by neighbouring groups of people operating in similar environmental conditions’ (Knecht 1997, 18). In this sense, ‘efficiency’ is a relative term, and may mean something entirely different from one group to another.

Some contexts may suit a simple either/or tool option. Ethnographic studies of the African savannah and plains hunters, for example, demonstrate a clear preference for longer, more powerful bows than those in dense forest conditions (Cattelain 1997, 222). Here, the relationship between tools and terrain is well-explained. By contrast, South American groups deliver a mixed trend (ibid, 224) that warrants another explanation. Variability in tool design may result from modifications owing to personal preference, for example, or stem from the need to develop a more flexible, maintainable toolkit in one area of the landscape compared to another. The availability of other hunting aids can also effect the design and utilisation of a given tool type. The San of the Kalahari, for example, conduct most of their hunting today from horseback using spears or with the aid of dogs, and place comparably little emphasis on long stalks with

Figure 10: The light, slim Agta points favoured in the dry season (top), compared to the heavier, wider points favoured in the rainy season (bottom) (Griffin 1997, 283).
the bow and arrow (Hitchcock and Bleed 1997, 356). In the absence of these aids the selected strategy could change completely. Thus, traditional assumptions of an evolutionary trend from simple to complex modes of propulsion (i.e. from the spearthrower to the bow and arrow) should always be placed in their broader strategic context.

Generally speaking, people choose what appears (to them) to be ‘efficient’, or at the very least, ‘effective’ solutions to the tasks encountered. However, this decision-making process (*Figure 11*) is inevitably skewed by subjective perceptions of what being ‘efficient’ means within the broader socio-cultural context of a given time and place, and by a tendency towards cultural tradition. The role of other subsistence strategies too, has a significant impact upon the time and energy expended on tool manufacture and use. As Plog’s (1997, 70) discussion of developments in the American Southwest attests to, an increased emphasis on plant-gathering activities and a focus on increasingly sedentary ways of living may call for modifications to traditional hunting techniques. Thus, a well-balanced view of tool use and changes through time should be sure to consider the broader adaptive context of each area of study, as well as the social dynamics of each associated cultural tradition.

4.2. Socio-cultural Influences

While the attribution of ‘meaning’ continues to receive mixed reviews, the archaeologist cannot deny that artefacts represent in some way, simple or complex, fossilised human behaviour. Manifest in this behaviour are ideas- mental templates- which reflect an appropriate mode of manufacture, style, and artefact function. As Chapter 4.1 suggests, this template is often guided, at least in part, by the local environment and effective economy. The cultural heritage and social peculiarities of a given context, however, are also important contributors. Tools may have more than one function, and functions may extend beyond the practical and into the symbolic realm. They represent skill and
learning, knowledge and communication, and the powerful relationship between tradition and innovation. There is no limit to attributed meaning; it can be both functional and emotional, which leads us to consider the multivocality of material culture and the interplay between tools, individual agents, and broader changes in hunting technology through time.

_Fossilised behaviours and the mental template_

‘Artefacts are man-made objects; they are also fossilised ideas. In every clay pot, stone axe, wooden doll, or bone needle, we see preserved what someone once thought pots, axes, dolls, or needles should look like. In every culture there are conventions which dictate the form of artefacts.’

(Deetz 1967, 45)

In this sense, cultural (including technological) traditions are shaped by social convention- our perceptions of what something should be like. The relationship between material culture (such as stone tools) and conventions (both functional and stylistic) is a reciprocal one. Traditional conventions (or templates) dictate how a tool is made, its appearance, and how it functions. Each tool produced via this convention perpetuates the tradition. On occasion, a group or individual may experiment with the design process, or test out a new function. Such innovations, where successful, then have the ability to alter convention, signalling the dawn of a new tradition. Innovations can range from simple modifications to an old system to the more complicated development of an entirely new one, each a valuable source of information regarding human adaptation. The interrelationship between tradition and innovation is an important one, as it signals the adherence (or lack thereof) to a new set of cultural guidelines.

The transition from old to new rarely runs smoothly. The value placed upon a culture’s traditions can be difficult to challenge, and while in many cases celebrated, innovation can often be viewed as something to fear. Reluctance to change is an on-going phenomenon and transcends notions of ‘efficiency’ and the potential for improved performance. Even where the practicalities associated with a new system are accepted, some groups or individuals may continue to opt for the traditional, less efficient one because it is familiar- it
represents their cultural heritage and heritage is socially very important to us. A case study of the Middle Palaeolithic Levallois tradition along the Middle Nile River (Stanford and Bradley 2012, 151), provides a good example of this persistence with tradition:

‘The only flakable stone there was small pebbles, less than 10 centimetres long… It is extremely difficult to flake these pebbles within the Levallois tradition. To archaeologists and modern knappers, who expect the form and size of stone to influence technology, this would have been an ideal situation for a change in technique. Nevertheless, the Levallois tradition was so strong that the Middle Palaeolithic knappers found a way to stick to it… In my experience this is a real challenge, and there is no indication that the bladelets [created during the process] were used. This is an absolutely amazing example of imposing a traditional technology on a difficult stone form. Once a Levallois knapper, always and only a Levallois knapper.’

Just as some of us shy away from fast-changing digital technologies today, so too must prehistoric people have shied away from unfamiliar new technologies in the past. Even where innovations were embraced, it was not uncommon for an element of the traditional to be maintained or incorporated into the new type. Justice (2002, 167), for example, describes the similarities between early Ventana and later prehistoric point types in the American Southwest, adding that ‘Apache and Navajo groups are known to have purposefully collected old projectile points for a variety of reasons including for arming their arrows’ so that ‘examples of many ancient projectile point types were actively brought into service during the Historic period.’ It seems this form was considered successful enough to be re-adopted again for a similar function to before. In other cases, traditional forms may be readopted for a new function, perhaps ritual in nature. The presence of a type similar to the Archaic Majamar in a later (12th-13th century) context at Canyon Creek Ruin, for example, seemed so out of place as to consider it a ceremonial piece, perhaps collected and retained for use in that specific context (ibid, 185). Bradley’s (2010, 292) report of Stix and Leaves Pueblo, too, describes the presence of dart points characteristic of periods before the site was established. On this occasion, the ‘earlier points are mostly broken and none seem to have been resharpened for reuse as points. But, one
and possibly two have been renotched for use as pendants’ (ibid) (*Figure 12*). Ritual or not, this knowledge and appreciation of earlier technologies represents an important connection between the past and present, tradition and innovation, function and meaning.

The survival of material in the archaeological record, in particular the preponderance of flaked stone, likely acted as an important mode of communication across the generations. As Warburton and Duke (1995, 226) aptly put it:

‘… material culture, in any situation or context, has the potential to influence and manipulate contemporary and future human behaviour. Earlier point styles were not unknown to Indians, whether they were revealed in episodes of earlier use at some of the multicomponent kill sites or by other mechanisms that would keep earlier points and their “styles” visible to the Indian. To deny this possibility is to argue that Indians had no knowledge of their own past; clearly this proposition is unacceptable.’

Thus, when we consider the implementation of a new technology, we must be mindful of the fact that this represents just a single phase within a much broader cycle of technological traditions and innovations. Within this cycle there will be occasions when tradition holds strong, and others when innovation takes precedence. In some instances a balance may be struck between the two. The use-life of a tool such as a stone point may span several generations and incorporate many more functions (practical or symbolic) than is typically credited. Thus, while the numbers of a traditional type may diminish through time, the knowledge and value of that type may not.

When a tool (or any piece of material culture in general) features attributes that extend beyond the requirements of mere function, a deeper, social explanation may be warranted. The variability expressed among flaked stone points provides an especially good example of this. The application of different patterns of flaking, the placement of notches, the size, shape, and

*Figure 12*: Middle Archaic (‘pendant’) point recovered from Stix and Leaves Pueblo, with evidence of renotching near the tip (Bradley 2010, 292).
angle of the blade, the type of base, and the material used, each represent a
decision (or set of decisions) reached by the maker. Clearly, some of these will
be based on the economically-founded functional requirements of the tool.
Others, however, seem to lack a practical explanation. In this case,

‘One must… ponder the role of such artefacts in their prehistoric cultural
contexts. With what power was the projectile point imbued to allow the
investment of so much time, skill, and artistry by its fabricators? One can only
deduce that these points played a social role beyond the killing of animals.’

(Warburton and Duke 1995, 213)

As Justice (1987, 6) confirms, ‘aesthetics must also be considered,’ for
‘prehistoric tools and especially projectile points are products of ancient art as
well as technology.’ We know that reuse and retouch practices signify the extent
to which artefacts were ‘allowed’ to be changed and manipulated, and therefore
must not underestimate the aesthetic value awarded to this artefact category. A
rainy season activity among the Agta of Northeastern Luzon, smithing arrow
points, ‘allows men to sit about together, discuss point styles to make, comment
on each other’s efforts, and learn unknown styles’ (Griffin 1997, 282). Thus, the
manufacturing process is a social one, combining the basic practical
requirements of the tool and the anticipation of future needs with individual and
group choices, preferences and discoveries. Also woven into this process and,
in effect, the end product, are processes of learning and chains of cultural
transmission (see Bettinger and Eerkens 1999 for more detailed discussion on
cultural transmission). The transmission of aesthetic ideals, whether copied or
modified, for example, yields valuable information about the social conformity of
various cultural groups exposed to similar technologies.

**Intra- and inter- community interactions**

The composition of a community (and neighbouring communities) will often be
reflected in the composition of their toolkits (i.e. the availability and utility of
different technologies), and should always be borne in mind when considering
the adoption or integration of seemingly ‘new’ designs or the succession of
similar designs through time. Within each community are different agents
(children, adults; males, females; married individuals, unmarried individuals; the
poor, the wealthy), each with a mixed response and variable access to different forms of material culture. Among the Pumé of Venezuela, for example, ‘boys’ arrows are smaller versions of the men’s arrows... made from thinner and shorter mainshafts, foreshafts, and iron raw material... Most boys’ arrows had point and spur arrow points’ (Greaves 1997, 298). Ethnographically, this difference is well-explained. Archaeologically, however, the poor preservation of organic components would limit our ability to confidently interpret the social divisions between these different point types. In another case, Warburton and Duke (1995, 215) describe the evolution of arrow use among the Blackfoot of the American Plains, from wagers in children’s games to ‘more serious or life-endangering pursuits, including both hunting and warfare’ by the age of 12 or 13. Here, similar arrows used by individuals of a fairly similar age may have very different social (and economic) functions. Again, these functions may not be apparent from an archaeological perspective.

Intra-community responses to the production and utilisation of flaked stone tools among ethnographic societies, then, provides useful insight into potential social contexts of typical tool types and may account for some of the variability expressed among site collections from the more distant past. Evidence of contact between historic groups (inter-community interaction) also provides a useful perspective on the likely transfer of technical skills, knowledge and tool types between archaeological cultures, ranging from peaceful trading and gift-giving to inter-group conflict and large scale warfare. As Cordell (1984, 118) explains, ‘the situations to which human societies adapt include the contexts created by other societies as well as those of the natural environment.’ Territorial boundaries, comparative survival strategies (whether hunter-gatherer, agricultural, or a mixture of both), and the movements of neighbouring people, each contribute to the technological responses of a given group. Using Griffin’s (1997) example of the Agta, it is those most commonly involved in hunting, such as the Ihaya Agta, ‘and those with the best game resources [who] have the greatest variety of projectile point types and the best knowledge of arrow technology and style,’ while those such as the Palanan Agta, who have given up most of their hunting in favour of farming, entertain a much narrower range.

Just as the Blackfoot passed bows and arrows (and thus point styles) through the generations in the act of gift-giving (Warburton and Duke 1995, 215), so too did different groups exchange or recover items from each other. In
peaceful times, these exchanges may have celebrated the sharing of new knowledge and perpetuated the use of successful new technologies. In times of conflict, technologies may have afforded greater secrecy and protection, while at the same time generating an atmosphere of competition. As Blitz (1988, 135) maintains, competition is an important factor in the pursuit of new and ‘improved’ technologies such as the bow and arrow; a trend of dissemination so powerful it ‘almost certainly overrides local ecological conditions.’ In this sense, there is a combined socio-economic pressure to adopt new forms, in times of both collaboration and contention. For this reason, socio-cultural contexts can be considered just as influential as the local economy and environment.

The multivocality of material culture

An object can mean different things to different people, or draw a variety of responses from the same person. Just as a stone tool can serve more than one ‘economic’ purpose throughout its use life (projectile point, knife, piercer, scraper), so too can it fill numerous other socio-cultural and even political purposes. In this sense, material culture is multi-vocal. The physical and non-physical, action and meaning, combine to form the broader life ‘stories’ behind each object, in this case, the projectile point. Physically, points may be used to hunt or in warfare, each technical response a product of the intention to wound, kill, or demoralise the target. In this context, points represent actions typically associated with power, prowess and prestige. Reports of the Blackfoot (Warburton and Duke 216-218), for example, attest to their heraldic function in warfare and other dangerous life or death encounters, provoking tales of power and daring around the campfire. Beyond the obvious, however, are a number of other social connotations that link to broader, more abstract concepts such as life cycles, marriage, fertility, contemporary order, and future behaviour. It is an arrow, rather than a knife, for example, which the Blackfoot use to cut the umbilicus:

‘… the arrow in this case was used to sever the new life from the old. This association of the renewal of life and recurrence of generations with the arrowhead is one that is repeated time and again in both the Blackfoot natural world and supernatural world.’

(Warburton and Duke 1995, 214-15)
In another example, this time of the Tyua of the Kalahari, spears feature in the quest to obtain a wife:

‘… spear hunts are undertaken not only for purposes of obtaining meat, skins, and other materials, but they are carried out for social purposes as well. Young Tyua men who wish to get married must first prove to their prospective fathers-in-law that they are good hunters. Bride price… is provided in the form of several large animals, preferably eland or gemsbok.’

(Hitchcock and Bleed 1997, 355)

Thus, points in prehistory likely aided survival in the social and spiritual realms just as much as the economic one. ‘Just as the arrow could wound or kill the bison, so it could wound or kill a young man socially; alternatively, it could bring him social prestige and a better life’ (Warburton and Duke 1995, 216). We may never know the extent to which these analogies hold true in the prehistoric world, but to underestimate the socio-cultural value of the projectile point, and the impact this may have had upon its design, execution, and (multi) function, would be to ignore a vast source of information regarding patterns in ancient technology.

4.3. Style and function

As evidenced above, each design solution (tool type) represents a compromise between the practicalities of effective function and culturally-determined stylistic preferences or ‘templates.’ Typically, the practical function of an artefact is associated with the economic requirements of a given environment, while stylistic traits, often seemingly impractical, are assumed to represent deeper socio-cultural influences within society. Both, however, have hidden connotations, as functional requirements crossover into the social and spiritual realms, and stylistic markers are used for practical (i.e. identification) purposes, thus revealing a complex decision-making process within the design and utilisation of each artefact.

The primary concern of the archaeologist tends to be the assignment of functional artefact categories, featuring (conscious or unconscious) assumptions that each solution was designed and adopted with optimum
economic efficiency in mind. Only later is the cultural significance of each category given more detailed consideration, yet, as we know, cultural preferences (as reflected in the stylistic character of an object), provide a strong competitor in the design stakes. To use a modern analogy, we may know that a certain laptop is more energy efficient than another, and more economically viable in a given context, yet we often overlook these facts in preference for one that we find more aesthetically pleasing, perhaps in a different colour, size, or a more popular model. It is not unreasonable to suggest a similar confrontation between function and style in the selection of ancient objects. The duality, or rather the multi-vocality of material culture can be difficult to deconstruct, especially when dealing with prehistoric artefacts where supporting evidence is scarce. The intricacy of some tools may lead us to overestimate their socio-cultural value, while the crudeness of others may tempt us to overlook important non-economic design features. ‘The less a particular tool attribute can be shown to be necessary to its physical use, the more likely this attribute was culturally rather than functionally determined’ (Stanford and Bradley 2012, 155), though inevitably there will be many we simply have not resolved yet.

As explored in earlier chapters, the functional or stylistic importance appropriated to given artefact type is intrinsically linked to the biases of the observer and the research question (or set of questions) being asked of the data. Any features consistently recognised by the modern observer would have been visible to both the maker and user also, yet the value apportioned to them is only ever an approximation. As use-wear analysis has shown us, the functional labels we assign artefacts (such as knife, spear point, piercer) are heavily influenced by modern preconceptions and do not always hold true among prehistoric specimens. In fact, the reductive character of lithic technology, forever fluid and changing, has important implications for the interpretation of both functional and stylistic artefact traits. The use-life of a tool can witness several functional changes (linear or alternating), which may or may not alter the stylistic character of the artefact. Where social pressures to maintain a distinctive style are strong, it is likely every effort will be made to preserve the most valued attributes. In other cases, the functional requirements of an artefact may require significant alterations via tool reworking and reuse, completely transforming it from the original. Taken together, these examples provide sound evidence for the constant interplay between the functional and
stylistic, economic and socio-cultural, practical and impractical features competing in the design process, an important consideration when interpreting the development, adoption, and acceptance of a new technology.
PART TWO: REVIEWING THE EVIDENCE

5. Developing a Suitable Methodology

5.1. Addressing the Void

The intention of Chapters 1-4 was to provide a suitable backdrop for exploring the categorisation of North American flaked stone points, namely dart and arrow points, in an attempt to reassess the validity (or lack thereof) of traditional approaches to artefact identification. Abstracted on different levels (local, regional, and continental), a comparison of previous works reveals enough interpretive variation to warrant this reassessment, incorporating the newly-gathered data presented in Part Two. As initial discussions regarding the physical properties and mechanics of each projectile device—spearthrower and bow—demonstrate, while the design of each tool must fulfil at least some basic physical requirements, there is scope for significant variation among each component. This represents an important concern for stone tool analysts attempting to differentiate between the use of darts and arrows in the archaeological record, reliant on the premise of a consistent size difference between the two. Increasingly complex statistical analyses may have improved the reliability of such classification schemes, but as experimental and use-wear studies attest to, this is far from a precise science. Instead of overlooking the persistence of mis-classified or indeterminate specimens, attempts should be made to explain this patterning within its local and broader contexts, as is the intention here.

Clearly, classification processes help us make sense of the objects we recover, providing a necessary foundation upon which to base archaeological interpretation. However, a distinct lack of consensus among many schemes, in this case the dart and arrow point dichotomy, testifies to the need for the periodic reassessment of approaches in light of newly available evidence and equipment, and continued communication and collaboration between researchers. In this way, issues regarding competing typologies, consistency in application, observer biases, and the problems surrounding use-life histories and multi-functional tools can be exposed and addressed, helping set the classificatory ‘ideal’ in a more realistic context.
The recovery and interpretation of archaeological data is an on-going process and, in this sense, there is a perpetual ‘void’ in the subject. Each classification scheme reflects, consciously or unconsciously, the interests of the researcher, and is typically designed with a research question (or set of questions) in mind. The question could be temporal, spatial, functional or stylistic, but almost always the focus is upon lines of division. This is only natural, for artefact categorisation is itself a way of sorting the data into more manageable groups for further analysis. The big questions posed in this volume, however, are concerned with artefact diversity rather than strict lines of division. Similarities and differences between points will continue to be the main measure used (via both quantitative and qualitative methods), but the measure itself is not of absolute timing or statistical accuracy, but of broader trends relative to each context. The interplay between the local environment and cultural ideals, the practicalities of function against stylistic requirements, and tradition versus innovation, each combine to shape the technological solutions selected or rejected by past people, and will be considered alongside the patterns expressed for each site (or dataset) described below. In so doing, we should achieve a more inclusive view of how humans responded to the proposition of a new technology, reconnecting the artefacts and their makers (or users) by allowing for the variability considered so problematic among traditional approaches to the subject.

5.2. Collecting the Data

As with any research project, data collection processes are shaped in response to the question (or set of questions) being asked. This starts with an overarching theme or main question(s), and leads onto various sub-themes and increasingly complex inquiry, usually subject to change as the project progresses and new goals and challenges put forward. Tying down key themes provides the direction necessary for determining desired dataset composition and, in effect, the required sourcing and collection methods to be appropriately scheduled within the project. Listed below (Figure 13) are the primary research questions stated for this project, followed by a brief discussion regarding their impact upon the collection and composition of the associated dataset.
Are there distinct quantitative and qualitative differences between stone points used with the dart and atlatl and those used with the bow and arrow?

This question features three main concerns. To begin, differences between stone points required a sample of pointed stone artefacts assumed to have been intended or employed as part of a projectile device. More specifically, with the focus upon differences between dart and arrow points, the assemblages studied had to (assumedly) represent the use of one or both of these technological solutions. The word ‘assume’ is used here to reflect the concerns expressed in Part One; there are no absolutes when it comes to this topic—debate regarding timing, introduction and tool functionality continue to cloud judgements with respect to the distinctiveness of artefact categories. A vital element within this research project, however, this complexity provides useful and necessary insight rather than a major stumbling block. Lastly, the identification of distinct quantitative and qualitative differences required a decision as to the appropriate artefact attributes to be selected for study (including measures such as length, width, thickness, blade type, base type, and so on); a process intertwined with the questions that follow.

Do traditional assumptions of a clear difference in size hold true?

Intrinsically linked to the quantitative differences covered above, a study of differences in size between points required a decision as to which attributes best represent this composite characteristic, while being simple and effective to both measure and record in the field and under limited time conditions.
Is artefact classification, in this case distinguishing between different projectile points, an objective process, or subject to contextual differences?

Split into two parts, this final question adds finer resolution to the dataset. Approaching the objectivity of the classification process required forethought and planning regarding potential classification schemes for testing, including any required attributes (quantitative or otherwise) to be added to the data record sheet, while the question of contextual differences required that the samples studied were environmentally and culturally diverse enough to warrant useful internal and external comparisons.

In response to these questions, a basic plan of action for achieving a suitable dataset was formed. The dataset needed to comprise a set of samples assumed to represent either or both dart and arrow point technologies and incorporate a range of different environmental and cultural contexts for comparative purposes. Information gathered from this dataset then had to include appropriate quantitative and qualitative measures required for subsequent attribute analyses and the application (and interpretation) of a set of predetermined classification schemes. Geographic context provided the main starting point for approaching this task, namely, the selection of environmentally-distinct study areas, combined with a consideration of venues likely to have appropriate assemblages available for study. Three main study areas were selected (The Southwest; The Northern Plains; The Eastern Woodlands), a product of the environmental and cultural diversity they represent relative to the research agenda, and of the logistics of supervisory fieldwork obligations and accessibility at each of the associated research venues (The Anasazi Heritage Centre, Colorado; Mitchell Prehistoric Indian Village, South Dakota; The Smithsonian’s Museum Support Centre, Washington DC/Maryland).

**Collection methods**

Largely determined by the time, location (mobility and accessibility issues) and resources available for the project, equipment was kept relatively simple, with quantitative measures taken using standard digital callipers and micro-scales, and photography equipment limited to the author’s own standard digital camera.
(macro-function). Microsoft Excel spreadsheets provided a more than sufficient platform for recording and storing the data for conversion into suitable charts and tables, as well as for future analyses, including the application of simple classification functions and basic statistics. The spreadsheet format was kept as simple as possible too; each site assigned its own file, separate site areas (where sites had these sub-divisions) their own tab within the file, each with an ordered list of required attributes (Figure 14; refer to the Appendix for a full list). The order of information to be recorded was kept the same throughout, allowing consistency in navigation within and between sites and study areas across the dataset.

The questions being asked of the data, set in the context of the time available for study, required the selection of suitable quantitative and qualitative attributes for recording. Generally speaking, quantitative attributes such as point weight, maximum length, width and thickness combine to describe, on a basic level at least, the size of a point, while neck width and basal width commonly feature in the classification approaches described in earlier chapters. After reviewing a number of approaches to the classification of dart and arrow points, Thomas’ (1978) single and multiple variable functions (using length, width, thickness, and neck width), Hughes’ (1998) threshold values associated with point weight, tip-sectional area and perimeter (including width and thickness values), and Hildebrandt and King’s (2012) dart-arrow index (using neck width and thickness), were selected as a diverse and (potentially) insightful set of techniques to reassess. This borne in mind, the six quantitative measures listed above were deemed more than enough for the task at hand. In hindsight, Shott’s (1997) update of Thomas’ work seemed more appropriate to test than the original, the implication being that, as Shott did for Thomas’ work, and other scholars have done with Shott’s (e.g. Ames et al. 2010, 299), point width (or maximum width) is thereby assumed to equate with what Shott terms shoulder width.
Figure 14: A snapshot of a sample data record sheet in Microsoft Excel.
The selection of qualitative attributes, typically more subjective in nature and difficult to ‘measure’ were less simple to decide upon beforehand. However, based on the time available in the field, it seemed sensible to restrict the records to material type (where known), blade type and basal type (simple and efficient to record). Space for interpretation (i.e. point type/function) and ‘any other notes’ (e.g. features of special interest such as characteristic impact damage, flaking style etc.) were also included as useful references (alongside photographic records) for future analytical phases, but required little detailed note-taking. With these elements decided upon, the collections sourced, and the fieldwork scheduled, the dataset was successfully acquired by the end of the first year of the project (Figure 15).

<table>
<thead>
<tr>
<th>Study Area</th>
<th>Site/Assemblage</th>
<th>Collection Venue</th>
<th>Sample Size (N)</th>
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<tbody>
<tr>
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<td>AHC</td>
<td>13</td>
</tr>
<tr>
<td>Southwest</td>
<td>Payne</td>
<td>AHC</td>
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</tr>
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<td>Periman Hamlet</td>
<td>AHC</td>
<td>56</td>
</tr>
<tr>
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<td>AHC</td>
<td>16</td>
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<tr>
<td>Southwest</td>
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<td>22</td>
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<tr>
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<td>161</td>
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<td>Woodlands</td>
<td>Winslow</td>
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<td>99</td>
</tr>
</tbody>
</table>

AHC = Anasazi Heritage Centre  
MPIV = Mitchell Prehistoric Indian Village  
MSC = Smithsonian’s Museum Support Centre

Figure 15: A summary of the project dataset.
5.3. Analysing the Data

The analytical process here refers to the various ways in which the data was used to address the main project questions. The questions, multi-layered themselves, were well-suited to a multi-faceted approach, from site-level attribute summaries and simple single variable or combination analyses (providing a foundation for initial observations of point morphology), to the application of more complex solutions associated with various classification schemes (allowing for the development of higher-level interpretation regarding differences in technology, form and function relative to a given context). Before any analyses could begin, however, was the vital task of ‘cleaning’ or ‘filtering’ the data collected in the field.

Limited access to collections meant there was little time to be spent debating the inclusion (or exclusion) of individual, often fragmented, specimens and their associated values in the field, thus, the completeness of each was noted, and measurements for later review marked accordingly (see starred values in Figure 14). A necessary process upon returning from the field, therefore, was to sift through this data (with the aid of a corresponding photo-log) and separate the ‘useful’ information (complete or near complete values) from the ‘unhelpful’ information. Naturally, this process required a vast amount of decision-making with regards to how complete or damaged an artefact was, the likelihood it still represented a working tool and was therefore worthy of inclusion at various analytical levels, and of just how realistic expectations of consistent type categories for making these inferences really were. This is an important point for reflection, as it demonstrates how the researcher, consciously or unconsciously, comes to form the assumption that some values are near enough to their ‘originals’ to warrant inclusion – an all-too-common judgement call that has the power to skew the results of classification and interpretation if conducted carelessly, but necessary if the sample is to be kept as large as possible. Subjective though it may seem, this sort of decision-making is an inherent part of data handling and, as demonstrated in the chapters that follow, where recognised, has the ability to provide useful insight into issues surrounding sample coverage, the visibility of specific attributes for interpretation, and the applicability of contrasting classification schemes.
Attribute summaries, single variable and combination analyses

Simple statistical functions, readily available in standard Microsoft Excel spreadsheets, were applied to the data to derive basic information regarding the individual attributes selected for study. For the quantitative measures – weight, length, width, basal width, neck width, and thickness – this included the calculation of averages, ranges and outlier values. At the site level, these values were summarised in simple tables, providing an effective overview of the range of variation and relative presence (or absence) of unusual specimens (i.e. outliers) within the sample (Figure 16). Scatter charts, measuring the relationship between simple two-dimensional (length and width) and three-dimensional (width and thickness; weight and thickness) descriptors of point size and shape, were then used to contextualise this information by identifying key intra-site (morphological) trends and type clusters (Figure 17).

At the broader study area level, this data was presented in box and whisker diagrams. Useful visual and interpretive aids, they provide a useful indication of the relative spread of data from one site to another and, thus, the extent of morphological comparability (Figure 18). The median – the sample’s middle value – represents a measure of centrality around which the rest of the sample is placed, demarcated by a dividing line within the box, which comprises the characteristic middle 50 percent of the sample or the inter-quartile range. The location of the median within this range gives an impression of skewedness

Figure 16: A snapshot of some of the Excel functions applied to the data (top) and an example attribute summary table (below).
within the core dataset (i.e. a tendency towards higher or lower values), while the lines or ‘whiskers’ extending from the box represent the extreme upper and lower values of the sample and set the central values within their broader context. In this case, the inclusion or exclusion of outlier values (those which stray far enough from the ‘norm’ to be considered anomalies) has the potential to significantly alter the form the diagram takes. Generally, anomalies appear to distort the image presented and therefore tend to be removed, normalising the remaining dataset. For this project, which seeks to take a more inclusive view of the potential for artefact diversity, removing outliers seemed rather contradictory. Not to do so, however, would be running the risk of dramatically misinterpreting key trends in the data. Thus, for the basic single variable analyses at least, both modified and unmodified datasets have been considered, and comparisons drawn in hope of better understanding the role of morphological ‘deviations’ within the broader theme of technological change. Further to this, simple t-tests using Excel were applied to the data to provide a simple measure of difference regarding quantitative characteristics between sites and study areas.

While quantitative attributes tend to be the ones more typically associated with stone tool classification schemes, the interpretive value of qualitative features should also be borne in mind, particularly considering the fragmentary nature of many assemblages, and the detrimental effect this can have on the relative proportion of samples being represented. Simple counts of base and blade types – elements typically well indicated, even on fragmented...
specimens – for example, were conducted here to help contextualise any similarities or differences expressed in the results derived from quantitative attribute analyses, combining to form a stronger picture of preference in tool design. Taken together, these seemingly simplistic attribute analyses provide a vital source of information regarding key morphological trends (subtle or distinct) and type clusters, set in context by the results of various classification schemes and the traditional temporal, cultural, and technological assignments associated with each site and study area.

**Single and multiple variable classification analyses**

Designed specifically with the purpose of targeting differences within and between assemblages in mind – in this case, distinguishing between dart and arrow points – classification schemes offer excellent insight into the archaeological implications of assigning artefacts strict temporal, functional, technological, or stylistic categories. Different schemes tend to be designed for/derived from different samples, and therefore provide the perfect opportunity to assess the importance of context – a key facet of this research project. Detailed below are three fairly different approaches, developed at different times and making use of a variety of different measures. Interestingly, they all tend towards samples from the West, perhaps a reflection of preservation issues, but each has its own history and is rooted within its own interpretive context.

The first to be described are Michael Shott’s (1997) single and multiple variable solutions (*Figure 19*). Derived from Thomas’ earlier (1978) study, these solutions were produced in an effort to contextualise individual attributes through the application of multivariate discriminant analyses. Where previous works had typically focussed on single elements such as point weight (e.g. Fenenga 1953), and were relatively simplistic in nature, Thomas (1978) sought a more holistic approach, combining measures of point length, width, thickness, and neck width (derivatives of point size), taken from a sample of ‘known’ (i.e. hafted) archaeological and ethnographic specimens, to compute an unstandardised discriminant function from which classification solutions could be derived. The result allowed him to distinguish between unknown specimens with a given degree of accuracy (in this case, 86 per cent). Seeking to improve the accuracy and applicability of Thomas’ original solution, especially in light of
SHOTT’S (1997) SINGLE AND MULTIPLE VARIABLE SOLUTIONS

*Four variable solution*

Dart = 0.18 (length) + 0.87 (shoulder width) + 0.72 (thickness) + 0.21 (neck width) 
– 18.79

Arrow = 0.07 (length) + 0.49 (shoulder width) + 1.28 (thickness) + 0.14 (neck width) 
– 8.60

*Three variable solution*

Dart = 1.24 (shoulder width) + 1.94 (thickness) + 0.38 (neck width) – 22.70

Arrow = 0.69 (shoulder width) + 2.05 (thickness) + 0.19 (neck width) – 10.70

*Two variable solution*

Dart = 1.42 (shoulder width) + 2.16 (thickness) - 22.50

Arrow = 0.79 (shoulder width) + 2.17 (thickness) – 10.60

*One variable solution*

Dart = 1.40 (shoulder width) – 16.85

Arrow = 0.89 (shoulder width) – 7.22

*Figure 19:* An overview of Shott’s (1997) single and multiple variable solutions, as applied to the project dataset.

The results of his study regarding the Upper Ohio Valley (Shott 1993), which called into question the validity of divisions between various point types and, in effect, the introduction of the bow and arrow to the region, Shott (1997) expanded the dart sample from which it was derived, and conducted a reassessment of the order of importance of various attributes by further testing a series of single and multiple variable solutions.

Based on Thomas’ observations of point hafting and shaft size (arrowshafts tending to be more gracile), Shott substituted *width* for *shoulder width*, however, these two measures correlate closely and have been assumed equivalent elsewhere and for the purposes of this paper. Based on concerns with the reliability of other attributes, such as length (considered most susceptible to fluctuations based on breakage and reworking), and neck width.
(a non-universal attribute restricted by the presence of unnotched specimens), he systematically removed these from the original four variable solution (producing the three and two variable solutions, respectively), resulting in an improved degree of accuracy for point classification (to as much as 89.4 percent). Regarded as the most important indicator by standardised coefficients in the two-variable solution, shoulder width was taken alone to produce the one variable solution which, remarkably, produced a similar degree of accuracy to that of the multiple variable solutions, while applicable to a much wider range of specimens (as attributes required for identification decrease, the usability of a given sample increases). With the merits (and limitations) of single and multiple variable solutions borne in mind, each of Shott’s four solutions was applied to the dataset (Figure 20), contextualised by a simple calculation of percentage of total specimens available for use as a comparative measure of applicability (a measure also calculated for the other classification schemes).

![Excel screenshot showing calculations and charts](image)

**Figure 20:** An example of the application of Shott’s (1997) single and multiple variable solutions using Excel to produce bar charts for simple and effective presentation of dart and arrow point frequencies at site level.
The second approach to projectile point classification to be detailed here is that of Susan Hughes (1998). Hughes developed her measures as part of a re-examination of broader models of technological change. Taken from an evolutionary perspective, she sought to better understand projectile points as parts of complete weapon systems, using principles derived from physics and engineering to help pinpoint key variables thought to enhance their overall function and success as a composite tool. In this case, point mass, tip sectional area (or TSA), and tip perimeter (TP) were identified as key components in point design (displayed in Figure 21), with threshold values associated with various weapon systems (including the spearthrower and the bow) derived from archaeological and ethnographic specimens (in large part, from Thomas’ 1978 sample). Upon measuring these values against a 9000-year-old sequence from Mummy Cave, northwestern Wyoming, Hughes recognised an element of crossover between small darts and large arrows, as well as potential sub-groups among the dart samples (perhaps an indicator of fletching methods c.7600BP), but, generally speaking, her results reaffirmed traditional interpretations regarding the introduction of the bow and arrow c. 2000-1300 years ago. Utilising similar variables to Shott’s (1997) one and two variable solutions, but tested in different ways and derived from different perspectives,

<table>
<thead>
<tr>
<th></th>
<th>Bow and Arrow</th>
<th>Fletched Dart</th>
<th>Unfletched Dart</th>
<th>Flight Spear</th>
<th>Thrusting Spear</th>
</tr>
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<tbody>
<tr>
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<td>0.67</td>
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<td>3.10</td>
</tr>
<tr>
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<td>4.80</td>
<td>8.20</td>
<td>10.48</td>
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<tr>
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<td>3-8</td>
<td>9-70</td>
<td>0-156</td>
<td>227</td>
</tr>
</tbody>
</table>

_HUGHES’ (1998) TSA, TP, AND MASS THRESHOLD VALUES_

TSA (tip sectional area) = \( \frac{1}{2} \) width \times thickness

TP (tip perimeter) = \( 4s \), where \( s = (\frac{1}{2} \) width\(^2 \) + (\frac{1}{2} \) thickness\(^2 \)

With estimated threshold values:

*Figure 21: An overview of Hughes’ (1998) tip sectional area and perimeter calculations, and associated threshold values, as applied to the project dataset.*
Hughes’ calculations were also applied to the dataset (Figure 22), in the hope they might provide a useful reference of both similarity and difference between schemes.

![Excel sheet showing Hughes' TSA calculation](image)

**Figure 22:** An example of the application of Hughes’ (1998) TSA calculation using Excel to produce a box and whisker diagram for simple and effective presentation of the data at site level.

Last to be detailed is Hildebrandt and King’s (2012) dart-arrow index (Figure 23). The use of this index was borne out of growing concerns with the use of ethnographic samples in the development of a number of classification schemes, including those referred to above, and of the applicability issues associated with applying complex multiple variable solutions to assemblages.
HILDEBRANDT AND KING’S (2012) DART-ARROW INDEX

Dart-arrow index = neck width + max thickness

With an estimated threshold value of 11.8mm

*Figure 23:* Hildebrandt and King’s (2012) dart-arrow index and associated threshold value, as applied to the project dataset.

comprising heavily fragmented specimens. The dart-arrow index, they argued, comprising only two attributes (neck width and thickness), is considerably less prone to the vagaries of tool damage and reworking than alternative schemes, providing ‘a good proxy for the original size and weight of fragmentary projectile points’ (790), set in the context of a threshold value (11.8mm) supported by other chronological indicators, including obsidian hydration measurements and associations with radiocarbon-dated contexts. Having applied the index to archaeological collections from the northwestern Great Basin (where two technologies were successfully distinguished) and the ethnographic samples used by Thomas (1978), Shott (1997), and subsequent researchers thereafter, Hildebrandt and King proposed that, by contrast, points from archaeological contexts are more internally consistent and easily distinguishable than those derived from ethnographic contexts, which tend to demonstrate a broader range of sizes for arrows than archaeological samples would indicate. Based on this premise, they rejected the need for any major reassessment of the bow and arrow in western North America, a provocative statement with regards to the potential for technological diversity and inclusivity referred to in this project. Interestingly, recent studies published in *American Antiquity* (Erlandson et al. 2014; Walde 2014) evidence the context-specific limitations of their given threshold value, a problem especially pertinent to the theme of this work. As such, the dart-arrow index was applied to the dataset (*Figure 24*) in the hope it would provide an interesting comparison with the other two approaches to projectile point classification (both of which feature their own contextual biases) and deeper insight into the role of context.

Based on these brief summaries it should be clear to the reader that each and every classification scheme represents a (more or less) different
viewpoint, and thus represent important aids for both viewing and reviewing similarities and differences within and between assemblages and analytical approaches. Each scheme or ‘viewpoint’ shares ‘a dependence on the establishment of an accurate and reliable means of distinguishing archaeologically recovered arrow and dart points’ (Walde 2014, 156-157), thus:

‘Our higher order interpretations of the interrelationships amongst social organisation, culture change, and technological evolution and innovation… depend on the sound development of strong methodology.’

A strong methodology welcomes continual re-evaluations, is open to scholarly debate, and recognises the significance of context. Increasingly, researchers
are engaging (or, perhaps, re-engaging) in this process with regards to the dart-arrow dichotomy, re-assessing divisions based exclusively on size, and the problems associated with universally applying schemes derived from different samples, so that ‘archaeologists should continue to critically assess the antiquity of the bow and arrow and the function of projectile points worldwide’ (Erlandson et al. 2014, 162). As subsequent chapters attest, comparisons of the results derived from this review will help address some of the controversial questions surrounding this process, the objectivity, applicability, and accuracy of attempts at artefact classification – questions central to this research project – providing sound evidence for the reassessment of traditional assumptions regarding the dart-arrow dichotomy.

5.4. Deconstructing and Reconstructing: Reading the Data

Developing a suitable interpretive framework for presenting the results of data analysis is a crucial part of the research project. Just as different analytical methods were applied to target different elements within the research agenda, so too must the results be abstracted on different levels if they are to successfully address the multiplicity of questions raised. As such, the results chapters that follow have been structured according to an incremental assessment of trends, progressing from intra-site to intra- and inter-study area levels. A brief introduction to each study area (The Southwest, The Plains, and The Woodlands) is followed by a systematic review of each of its sites. Each review seeks to place the various attribute analyses and classification results within the site’s individual context (its respective environment, economy, socio-cultural influences etc.), combining to produce an interpretive platform for subsequent inter-site/intra-study area comparisons. In turn, these findings provide impetus for an assessment of trends between study areas (inter-study area comparisons), thus setting the scene for the discussion topics outlined in Part Three: a reassessment of traditional interpretations regarding periods of technological change, a re-evaluation of classification practices, and a reflection on the significance of individual context and meaning.
Figures 25 and 26 describe the location of the sites in the sample, set within the context of their broader study areas. The seven sites in the Southwest (Cougar Springs Cave, Payne, Duckfoot, Rio Vista Village, Periman Hamlet, House Creek Village, and Marshview Hamlet) are grouped together towards the northern boundaries of the area in the Mesa Verde region of the Colorado Plateau, located within modern-day Montezuma County, Colorado. By contrast, the Woodlands sites are less tightly-clustered. The most north-easterly of the five, Winslow, is situated in Montgomery County, Maryland, close to the border with Virginia, the location of the remaining four. Hidden Valley Rockshelter, John East Mound, and Linville Mound lie to the north, in Bath, Augusta, and Rockingham counties respectively, and Clarksville to the south in Mecklenburg County, on the border with North Carolina. Lastly, the Plains sites, found towards the north of the area in South Dakota, represent traditions of the Middle Missouri. Three of the four sites, Cattle Oiler, Bower’s La Roche, and Over’s La Roche, are located in the central Big Bend region within modern-day Stanley County, while the fourth, Mitchell, is seated along the northeastern periphery in Davison County.

An appreciation of the location of each site and study area relative to another, as here, is vital for assessing technological trends according to context. In this case, those selected provide the opportunity to assess the various relationships (or lack thereof) between closely clustered and more widely dispersed sites, including cultural ‘centres’ and their periphery. Furthermore, each area—far from a discrete element (attested to by the interpretive variability presented among maps detailed in textbooks and on the web), can be seen to overlap and interact with those around it, thus, both cultural and environmental boundaries are subject to change across time. Differentiation between the northern and southern environments of the Eastern Woodlands and their associated socio-cultural ‘identities’ presents a particularly good example of such vagaries, and provides another interesting topic for consideration when assessing the sites in this study area, typically located on the north-south border. This sort of diversity, variability, and comparability within and between contexts should be borne in mind throughout the examination of each study area that follows.
**Figure 25:** The location of each of the sites in the sample (base map taken from Nations Online 2014).

**Figure 26:** Site location within their broader study areas (base map taken from Nations Online 2014).
6.1. Study Area One: The Southwest

*Climate, landscape and the local economy*

*The North American Southwest is a land of contrasts and diversity that is united by an arid climate. The physical landscape includes extensive mesas (tablelands), rugged mountains, and low-lying deserts.*

(Cordell 1984, 1)

From the high elevations of the Colorado Plateau in north-central areas, west of the Rocky Mountains and east of the Great Basin, to the great southern deserts, such as the Chihuahuan and Sonoran, west of the Great Plains, brief geographic survey attests to the environmental diversity expressed across the prehistoric Southwest (*Figure 27*). The Mesa Verde archaeological region (*Figure 28*), the focal point of sites discussed here, characterises these
contrasts on a smaller, more manageable scale, encompassing ‘an area of just under 10,000 square miles bounded by the Colorado, Piedra, and San Juan rivers... located within the... Colorado Plateau, an immense area of geologic uplift encompassing much of western Colorado, eastern Utah, northern Arizona, and northwestern New Mexico,’ where ‘deep sandstone canyons dissect sage-covered plains’ (Crow Canyon 2011). Broadly speaking, the climate here is arid to semi-arid (accounting for instances of exceptional organic material preservation), and while upland areas tend to receive higher average rainfall than the desert (Fagan 1991, 252), rainfall itself is erratic, affecting the
predictability of harvests and thus people’s relationship with the land. According to Cordell (1984, 3):

‘Everywhere, water is the critical resource for life. Yet despite the harsh climate, the temperature extremes, and the aridity, the indigenous peoples of the Southwest developed a way of life dependent on farming Native American crops.’

Arguably, it is this early move towards agricultural adaptation - the cultivation of corn, beans, and squash - 'that most clearly defines the Southwest as a culture area,' and 'sets this region apart from the gathering-and-hunting peoples of California and the Great Basin and the bison-hunters of the western Great Plains' (ibid). Hunting and gathering (more or less, depending on local conditions) remained an important contributor throughout prehistory, including the taking of mule deer, big-horn sheep and pronghorn antelope, as well as smaller animals such as jackrabbits, voles, birds and waterfowl, yet 'the staple for most Southwest peoples of the past 2000 years was maize agriculture' (Fagan 1991, 252). In this sense, many have come to view the area as unique, a notion that has serious implications for how we view the expression of new technologies, such as the bow and arrow, in the archaeological record. It must be borne in mind, however, that unique does not necessarily equal isolated, for the peoples of the Southwest were far from disconnected from their neighbours. As Justice (2002, 2) points out, shell from the Pacific Coast and turquoise from central Nevada, as well as 'obsidian, various cherts, coral, pigments, exotic birds and feathers, as well as many other raw materials for tools and ornaments were traded into the Southwest from all directions that also included the Great Plains, California, and central Mexico' (Justice 2002, 2). Thus, while unique in many ways, we can be sure that communication networks, whether economically or socially founded, existed between the Southwest and its periphery.

**Lifeways though time**

‘Throughout their histories, the people moved between periods of sedentism and mobility. At times they depended more on hunting and gathering and were
therefore relatively mobile. At other times, periods of regional integration occurred, when very large areas of the Southwest seem to have been incorporated into one social, economic, or belief system, but these always had a tenuous hold.’
(Cordell 1984, 6)

The varied and changeable landscape of the Southwest meant that ‘the secret to survival was flexibility,’ thus, ‘Southwestern societies were in a constant state of cultural change’ (Fagan 1991, 247). Arguably the most notable change took hold in the latter centuries of the Archaic as the climate warmed, subsistence strategies diversified, and people began to deliberately cultivate domesticated plants. Known as the Intermediate Period or Basketmaker II (c. 500B.C. to A.D.500), it marked the shift towards a more settled way of life (Justice 2002, 11), and was accompanied by the emergence of new stone tool technologies. Culminating in the transition to Basketmaker III, this period is traditionally associated with the introduction of the bow and arrow and the decline and eventual replacement of the dart and atlatl, as characterised by an apparent change in size from large to small projectile points (e.g. Baker and Kidder 1937; Blitz 1988, 130; Justice 2002, 44; Thomas 2000, 48) (Figure 29). Glasgow (1972, in Cordell 1984, 225) associates this change with ‘the increasing importance of agriculture and… associated restructuring of other subsistence activities,’ with people

Figure 29: Projectile points from the Mesa Verde region, the shift to smaller forms around Basketmaker II-III marked accordingly (Crow Canyon 2011).
investing more time in and improving the efficiency of agriculture hunting, ‘which would still be necessary to supply high-quality protein.’ Similarly, Judge (1982, in Plog 1997, 70) suggests that ‘the bow and arrow is better when individuals are hunting, as might occur when more effort is being devoted to agriculture,’ and ‘may also have been more effective when hunting the types of small animals that are often the focus of groups that give priority to the collection of plant foods.’ Regardless of cause and effect, chronological debate continues and the time-frame for its introduction widened as the possibility for an earlier adoption of the bow and arrow (e.g. Browne 1938) and the persistence of the dart and atlatl into later periods (e.g. VanPool 2006) is pursued. Thus, a broad time-scale, from the Archaic through the Late Prehistoric periods in this region will be covered in the brief examination of lifeways below.

The Early to Middle Archaic economies in this region were centred on the hunting of small- and medium-sized game animals and the gathering of some wild plant foods (Cordell 1984, 101), but by the Late Archaic corn and squash had appeared on the Colorado Plateau and as the population increased, the territories of individual bands became smaller and more defined, and local traditions began to develop (Crow Canyon 2011). A proliferation of point styles beginning in the Middle Archaic serves as evidence of these growing traditions, perhaps as a mode of conveying social information, such as group membership and territorial boundaries (physical or perceived), a trend towards regional stylistic distribution that continued into later periods, though with seemingly more emphasis upon features relating to technological efficiency (Fagan 1991, 267; Plog 1997, 51).

Though present during the Archaic, it was during the transition to Basketmaker II that the cultivation of domesticated plants began to have a major impact, giving rise to a more settled way of life, reflected in the building of more permanent structures on farmsteads close to good agricultural land (Crow Canyon 2011). The ‘atlatl, with compound darts that had hardwood foreshafts tipped with large side or corner-notched points’ (Lipe 1983, 463) is considered the dominant weapon at this time, and with sites located in areas that had access to several environmental zones for hunting and gathering, we can attest to its continued importance in the early Basketmaker lifeway. Throwing sticks, rabbit nets, and snares were also used, and though pottery was present in some areas, containers were typically still ‘suited to a mobile lifestyle and to
exploitation of wild plant foods’ (ibid, 464). This period, thus, was largely transitional, represented by a mixture of mobile and sedentary characteristics.

Lipe (1983, 463) connects ‘the considerable diversity among these sites’ with ‘variation both in cultural antecedents and in environmental adaptations.’ In the Mesa Verde region, this is characterised by the Eastern and Western Basketmaker peoples and their settlement of the associated borderlands. According to some archaeologists, those to the west likely descended from archaic peoples who migrated from southern Arizona, while those to the east represent descendants of the original inhabitants of the area (Crow Canyon 2011). While similar in some ways, these people shared a number of differences, expressed in artefact styles, housing construction, and (perhaps) language, which, when combined with evidence of conflict, suggests that the uninhabited area in the centre served as a buffer zone between them (ibid). Over time, however, this ‘buffer’ would fade as populations shifted (Figure 30), expanding, contracting, and interacting, each playing an important role in the spread of economic and socio-cultural materials and ideas. Naturally, as communities employing cultigen subsistence economies continued to develop, so too did the social tensions they created, particularly in the upland areas where success was less certain than in the southern deserts. According to Cordell (1984, 258):

‘Within the generally risky environment of the Southwest, agriculture was neither productive nor certain enough to provide subsistence security, and a number of cultural behaviours were used to mitigate subsistence problems.’

The transition to Basketmaker III (and each of the Pueblo periods to follow) epitomises the relationship between the developing subsistence economy and associated ‘cultural behaviours.’ This period saw the introduction of domesticated beans, an ever greater emphasis on farming (especially corn) and the use of pottery, and changes in hunting technology (i.e. the introduction of the bow and arrow) as points ‘were shaped differently from, and smaller than, those used in earlier periods’ (Crow Canyon 2011). It was at this time that large numbers of people moved into the central area of the Mesa Verde region (favourable conditions likely encouraging immigration from adjacent regions) where they settled in small, scattered farmsteads home to one, two, or three
Figure 30: Prehistoric occupation of the Mesa Verde region, indicating periods of integration and population dispersal through time (Crow Canyon 2011).
households, increasingly clustered together as the population grew to form early communities (Crow Canyon 2011). With these communities came the building of large public structures- great kivas- which served as focal points for events and ceremonies likely intended to promote unity. As Plog (1997, 64) points out:

‘Archaeological evidence from the Southwest shows that humans spent increasing amounts of time trying to direct and placate the forces and spirits that they believed controlled their environment.’

Collective ritual was an important part of this process, providing focus, a greater sense of community and a reduced chance of internal and external conflicts. Ensuring stability via this sort of cultural behaviour represents a key coping mechanism within the changeable socio-economic environment of the Southwest, one which would continue to develop throughout the Late Prehistoric period. By Pueblo I on Mesa Verde (c. A.D.750-900), for example, large villages of up to several hundred people had come into existence, and with them an increase in living and storage spaces and large public buildings as society became increasing complex (Crow Canyon 2011). Later in this period, as population across the Mesa declined, perhaps a result of warmer, drier conditions which threatened the growing success of corn, evidence points towards a southern emigration in and around Chaco Canyon, ‘an area that was to play a pivotal role in the developments of the next period’ (ibid). However, as Pueblo II progressed, and climatic conditions improved, people returned, now part of ‘a vast network centred on Chaco Canyon, 100 miles to the south,’ which ‘connected… the Mesa Verde region with new people, new ideas, and new goods from far beyond their traditional homeland’ (Crow Canyon 2011).

To return to Cordell’s (1984, 6) earlier statement, ‘people moved between periods of sedentism and mobility,’ enduring periods of greater and lesser interaction with each other, moving in and out of the surrounding environment, and responding (socially and technologically) to an ever-changing cultural landscape. Clearly, these shifts would have affected the adoption or rejection of innovation (such as the bow and arrow), the maintenance of tradition (such as the dart and atlatl), and the pace of changes taking place across the Southwest, providing an interesting backdrop upon which to consider the stone point assemblages of each of the seven sites discussed for this area.
6.1.1. Cougar Springs Cave 5MT4797 \( (N = 13) \)

**Context**

Excavated between 1980 and 1982 as part of the Dolores Archaeological Program (DAP) – an extensive salvage project conducted prior to the construction of McPhee Dam and Reservoir – Cougar Springs Cave represents a small, seasonal 'rockshelter located on the northwest-facing slope of Dry Canyon approximately 650m from where the canyon joins the Dolores River' (Gross 1988, 271) (*Figure 31*). The shelter, approximately 24 metres long and 7 metres wide, with an arcing roof to provide shade during the summer months, appears to belong to the Basketmaker II phase, dating between AD375 and 620 – a little later than the range typically associated with the end of the period, but as Gross (1988, 306) maintains, 'that Basketmaker II lifeways continued on the fringes of the Anasazi area while Basketmaker III sites were being created in the San Juan area is to be expected.' While 'unusual in the Dolores Project... in that it is an undisturbed preceramic site, and currently is the only evidence recognised for a Basketmaker II occupation in the project area,' it compares well to other Basketmaker assemblages in the Four Corners area, supported by

*Figure 31: Location and site setting of Cougar Springs Cave (Gross 1988, 302); note the steep slope and close proximity to the Dolores River (right).*
a series of radiocarbon and obsidian hydration dates (ibid, 271-272). Thus, based on this assignment, and on traditional interpretations of the bow and arrow as a post AD500 Basketmaker III phenomenon in the Southwest, one would expect the dominant projectile system represented at Cougar Springs Cave to be dart-based, thereby providing an interesting comparison with later, post-introduction sites in the area (including the four other DAP sites described below).

The archaeological remains at the site indicate a subsistence strategy based on a combination of expedient hunting (primarily of cottontail rabbit, though squirrels, beaver, porcupine, and mule deer are also represented) and plant gathering (both domestic and non-domestic, including the remains of charred corn and the seeds or fruits of various wild plants), and therefore ‘an adaptation that includes some agriculture but represents behaviour that is not as sedentary as in subsequent DAP Anasazi phases’ (ibid, 292, 304). The distribution of artefacts, too, reflects a spatial segregation of activities at the site; to the south of the shelter were two concentrations of flaked lithic debitage, between which was an area of bone and used flakes, and to the north two burned pits, ‘each with a metate and manos nearby’ (Gross 1988, 271).

Within this context, the dominant activity appears to have been ‘the reduction of one specific type of lithic raw material… a white to buff quartzite from the Burro Canyon Formation or Dakota Sandstone… probably collected at an outcrop located in the vicinity of the shelter,’ as indicated by the relative abundance of flaked lithic debitage compared to the other material types (ibid). The projectile points recovered from Cougar Springs Cave, though lacking any clear distribution pattern (Figure 32), account for 8.7 percent of the flaked lithic tool collection and are

Figure 32: The distribution of projectile points at Cougar Springs Cave (Gross 1988, 302).
characterised by a larger, heavier form than that of later periods (ibid, 287, 298-300), consistent with traditional assumptions regarding the dart-arrow divide. Also of interest is that ‘the only evidence recovered from the site indicative of contact or travel outside of the Dolores area consisted of the presence of nonlocal materials in the flaked lithic tool and flaked lithic debitage assemblages’ (ibid, 306), an important consideration when addressing technological innovation in and around the study area.

Finally, despite lacking any direct evidence regarding the composition of the group or groups that occupied Cougar Springs Cave (such as age, gender or state of health), Gross (1988, 305-306) suggests a population of around 5 to 10 individuals organised at the family or task group level, based on the limited available floor space and presence of just two centres of domestic activity (the two burned pits). Considering the seasonal nature of the site, though – ‘apparently not a base camp’ – it seems reasonable to suggest that these people may have belonged to a larger group system, ‘probably part of some sort of base camp unit that may have been organised along band lines’ (ibid). Again, this has important implications for how we view the relative integration or isolation of people and the transfer of knowledge within and around the area in question.

Analysis

What follows is a brief review of morphological and classificatory trends at the site-level; the comparison and contextualisation of sites within and between study areas will be covered in the later intra- and inter-study area sections.

Included in Table 1 is a basic summary of the quantitative attribute values derived from the Cougar Springs Cave specimens, with particular reference to the range of variation and presence (or absence) of any ‘outliers’.

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<th></th>
<th>Mean</th>
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<th>Highest Value</th>
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In this case, while the range in values is not insignificant, the only outliers recorded were for basal width, representing, perhaps, the least-tightly controlled characteristic within an otherwise morphologically-consistent sample (or ‘cluster’). Combination analyses using simple two- and three-dimensional descriptors of point morphology (Figure 33) provide a useful measure of this consistency based upon the relative closeness of each data point (specimen) to another, and to the trend line. That few specimens stray from the trend line implies good proportional comparability across the sample, and thus consistency in overall shape. The distance between the specimens along the trend line, however, attests to a certain amount of variability in associated point size. Supported by the qualitative observations offered below, these results can be used to infer the presence of a dominant technology at Cougar Springs Cave, with limited deviations characterised by unusually larger/smaller forms still morphologically comparable to the wider sample, rather than the introduction of a notably different form.

Typologically speaking, the points studied belong to Justice’s (2002, 195, 216) San Pedro (or Cienega) cluster (Figure 34), an apt fit with the Basketmaker II assignment of the site, further supported by observations of blade type, routinely excurvate, and base type, typically straight to convex (Figure 35). Of the 13 specimens studied, however, not all retained the necessary (completeness of) features required for inclusion in the analysis,
providing useful insight into the issue of artefact/attribute visibility within the archaeological record. In this case, point thickness and blade type were most visible and length least so (Figure 36).

Closely linked to the issue of attribute visibility (the number of ‘useable’ attributes available for inclusion in the analysis) is the applicability of classification schemes for a given dataset (different schemes require the presence of different attributes). A simple comparison of the percentage of total specimens used for each of the approaches tested in this study, however, indicates that all three (Shott’s represented here by the one-variable solution) are equally applicable among the Cougar Springs Cave sample (Figure 37).

Taken together, Shott’s (1997) single and multiple variable solutions produced a mixed set of results; the one- and two-variable solutions revealing
similarly dart-dominant classifications, the three-variable an arrow-dominant classification, and the four-variable solution an equal divide between the two (Figure 38). Based on Shott’s appraisal of the single-variable (width/shoulder width) solution – suitably accurate and more widely applicable than the others (i.e. the less attributes required, the greater the number of specimens available for inclusion) – it is this result, demonstrating a clear preponderance towards dart-based technologies at the site, which is used in comparisons with the other methods.

The range of TSA (tip sectional area) and TP (tip perimeter) values derived from the Cougar Springs specimens correlate closest with Hughes’ (1998) dart threshold values, although in both cases the lower end of those ranges also overlap the arrow threshold (Figure 39). Overlap between the two classes is further attested to among the mass values, which cover the range

**Figure 36:** Comparable visibility of quantitative and qualitative attributes among the Cougar Springs Cave specimens.

**Figure 37:** Percentage of total specimens used in each classification approach for the Cougar Springs Cave site.
proposed for both fletched darts (3-8g) and arrows (0-11g). On the other hand, Hildebrandt and King’s (2012) dart-arrow index reflects an entirely dart-based system, with all specimens scoring above the 11.8mm threshold value (Figure 40).

![Multiple and Single Variable Solutions](image)

**Figure 38:** Shott’s multiple and single variable solutions for the Cougar Springs Cave specimens.

![TSA, TP, and Mass](image)

**Figure 39:** Hughes’ TSA, TP, and mass values for the Cougar Springs Cave specimens. The blue dashed lines for TSA and TP represent the threshold value for dart-based systems, the red lines arrow-based systems.

![Dart-Arrow Index](image)

**Figure 40:** Hildebrandt and King’s Dart-Arrow Index values for the Cougar Springs Cave specimens.
Summary

Quantitative and qualitative measures derived from the Cougar Springs Cave sample combine to support the presence of consistently shaped specimens comparable to those typically used to define the Basketmaker II period in the prehistoric Southwest. Primarily associated with dart-based projectile technologies, each of the three classification schemes applied to the sample appear to support this cultural assignment, though to varying degrees. While Hildebrandt and King’s (2012) dart-arrow index reflects an exclusively dart-based system, Shott (1997) and Hughes’ (1998) methods also accommodate the (limited) presence of values associated with arrows, a product, most likely, of the size range described in the combination analyses.

Among the raw material types used to manufacture the points recovered from Cougar Springs Cave are obsidian and jasper. Obtained from sources further afield than the more local (and more commonly used) Burro Canyon orthoquartzite, it is interesting that the specimen made from jasper is also the specimen responsible for the arrow-based features expressed in both Shott and Hughes’ classification schemes (and among those which stray further from the trend lines depicted in the combination analyses). Pictured in Figure 34 (bottom right), this point represents the lower (smaller) end of the Basketmaker II range at the site and is likely a smaller/later/reworked dart point. That the site itself sits late within the Basketmaker II phase, and that the jasper was sourced from elsewhere – perhaps from an area already beginning to move towards a smaller (perhaps arrow-based) point system – should, nonetheless, be borne in mind. However, applicability between classification approaches being equal, and the results suitably in agreement, it is the dart-and-atlatl which best characterises the projectile technology in use at Cougar Springs Cave.
6.1.2. Payne 5MT12205 \( (N = 14) \)

**Context**

The Payne site, located on a ridge crest between Sandstone and Payne Canyons in the Yellow Jacket district of southwestern Colorado, was primarily investigated by a field school from Wichita State University in 1974 (Rohn 1974, 50). Excavations at the small, stockaded Basketmaker III village (dating to the early 7th century AD, according to associated ceramics and artefact styles), were intended as a way of contextualising settlement patterns in the area; in particular, those recorded at the larger, contemporary Gilliland site (ibid, 50-52). Gilliland, comprising ‘four semi subterranean earth lodges, at least eight ramadas or shades, some 22 subsurface storage pits, five small above-ground storage structures in circular and rectangular shapes, and a wide variety of above-ground pole and mud structures that may or may not have been roofed,’ was ‘completely encircled by a stockade of vertical poles averaging some 15cm in diameter and spaced about 20 to 30cm apart,’ and featured among growing evidence that ‘most Basketmaker III peoples inhabited villages of three to a dozen or more pit houses’ (Rohn 1975, 113). By the same merits, architectural features at Payne – clustered into two primary groupings – revealed ‘one smallish semi-subterranean earth lodge and at least three slab-lined circular storage pits’ to the northeast, and ‘two houses, six slab-lined storage rooms, at least five hearth pits, one circular jacal storehouse, at least one ramada with hearth, and one outdoor hearth’ to the southwest, the latter surrounded by a circular post stockade roughly 30m in diameter in what appears to be a planned settlement structure (Rohn 1974, 51) (Figure 4). Based on this evidence, Rohn (1975, 116) proposes that:

‘... within the known chronological context of Basketmaker-Pueblo culture history, the smaller Basketmaker III village plan fits nicely... preceded by similar small clusters of Basketmaker II houses... [and succeeded by] Pueblo I settlements... of groups of pit houses with associated living and storage rooms above ground.’

In this sense, the Payne site – set within the broader Basketmaker-Pueblo cultural transition – provides valuable insight into the technological
developments (i.e. the adoption of the bow and arrow) associated with the period.

Figure 41: Topographic map and site plan for Payne (top right and centre, Rohn 1974), comparable to the Gilliland site (top left, Rohn 1975, 114).
Among the tools recovered from the site were trough metates, manos, and flaked stone projectile points, evidencing a combined subsistence strategy based primarily upon simple horticulture, supplemented by wild plants and animals (Rohn 1974, 51-52). The ceramic assemblage, dominated by gray wares, points toward a local manufacturing economy, though in the absence of any burial remains, little is known about the health and status of the inhabitants, or of the nature of the surrounding stockade, defensive or otherwise. Nevertheless, ‘whatever its practical functions may have been, the stockade served to delineate the boundaries of an effective social unit, or community… [within which] a separate household apparently occupied each house’ (Rohn 1975, 115). Set in a seemingly transitional – potentially defensive – context, the technological responses of this community are of special interest.

Analysis
A fairly broad – but acceptable – range in variation persists at the Payne site, with only one outlier recorded (in the thickness category) across the entire collection (Table 2). By the same merits, the spread of values (both along and across each trend line, relative to point size and shape) depicted in the combination analyses (Figure 42) attests to diversity in point morphology, confirmed by closer inspection of the various type categories represented. These range from earlier, typically larger (dart-based) forms attributed to Archaic and early Basketmaker phases, including those comparable to Justice’s (2002, xviii-xx) Great Basin Stemmed, San José/Pinto, and San Pedro type clusters, to late Basketmaker forms characteristic of the Cienega type (Figure 43). The latter – a transitional Basketmaker to Pueblo projectile point – provides evidence of the ‘scaling down’ process traditionally associated with the

| Table 2: Summary of attribute averages, range, and outlier values for Payne. |
|-----------------------------|----------|---------|-----------|-----------|---------|-------------|
| Weight (g) Length (mm) | Mean    | Median  | Lowest Value | Highest Value | Range | % Outlier Values |
| Weight (g) Length (mm) | 3.37    | 2.10    | 0.52       | 8.79       | 8.27   | 0.00         |
| 35.24       | 35.03   | 21.67   | 56.94       | 35.27       |        | 0.00         |
| Width (mm) Thickness (mm) | Mean    | Median  | Lowest Value | Highest Value | Range | % Outlier Values |
| Width (mm) Thickness (mm) | 15.84   | 13.25   | 10.24       | 28.51       | 18.27  | 0.00         |
| 4.59        | 4.12    | 2.49    | 8.94        | 6.45        |        | 0.00         |
| Basal Width (mm) Neck Width (mm) | Mean    | Median  | Lowest Value | Highest Value | Range | % Outlier Values |
| Basal Width (mm) Neck Width (mm) | 9.54    | 8.66    | 3.41        | 18.91       | 15.50  | 0.00         |
| 8.60        | 7.38    | 3.58    | 14.31       | 10.73       |        | 0.00         |
Figure 42: Simple combination analyses applied to the Payne site specimens.

Figure 43: The Payne site collection, including a range of types associated with the Archaic and Basketmaker periods. Larger ‘dart’ types (top row, from left to right) span the Early Archaic through Basketmaker III, while the smaller ‘arrow’ types (bottom row) are derived exclusively from the latter.
adoption of the bow and arrow, so that Cienega forms effectively ‘bridge the gap’ between the earlier San Pedro (dart-based) and later Dolores (arrow-based) type categories (Figure 44). Broadly speaking, a tendency towards the lower end of the scale (as in the combination analyses) indicates a preference

Figure 44: A description of the morphological developments associated with the Basketmaker to Pueblo, dart to arrow point transition, using examples from Justice’s (2002, 197-243) San Pedro, Cienega, and Dolores type clusters.
for (and greater consistency among) this smaller ‘arrow’ type, although the presence of various dart-based specimens provides an important reminder of the value placed upon maintaining an awareness (if not active use) of traditional forms at the site.

A variety of material types across each category prevents any type-specific associations, although the most common appears to be locally-derived Burro Canyon orthoquartzite. Similarly, there is no obvious pattern in spatial distribution, with an Archaic specimen recovered from the same context as several Basketmaker III forms, yet, while base type sits predominantly within the straight to convex range (the indented category represented by a single Archaic specimen), blade type covers a broader range from excurvate to incurvate, the latter reserved for later Basketmaker III ‘arrow’ forms alone (Figure 45).

Attribute visibility is especially good at Payne (Figure 46), with all but length and weight represented by at least 75 percent of the collection, three of

![Attribute Visibility](chart)

**Figure 45:** Basic qualitative attribute values for the Payne specimens.

![Comparable Visibility](chart)

**Figure 46:** Comparable visibility of quantitative and qualitative attributes among the Payne specimens.
which – neck width, thickness, and blade type – scored 100 percent. As a result, Hildebrandt and King’s (2012) classification index produced the highest applicability score (100 percent), although Shott (1997) and Hughes’ (1998) methods were still widely applicable at 85.7 percent (Figure 47).

![Classification Application](image1)

**Figure 47:** Percentage of total specimens used in each classification approach for the Payne site.

All four of Shott’s (1997) solutions agreed upon the presence of an arrow-dominant projectile system at the site, with an arrow:dart ratio of exactly 3:1 (Figure 48). The majority of TSA and TP values, too, fell within the arrow range suggested by Hughes (1998), and a significant proportion of mass values below the lower (3g) limit proposed for darts (Figure 49). That being said, each measure (TSA, TP, and mass) also accounted for a fairly significant amount of crossover into dart territory, highlighting the continued presence of traditional forms among the collection, while the results derived from Hildebrandt and King’s (2012) index offered a more balanced impression, with darts accounting for 42.9 percent of the total studied (Figure 50).

![Multiple and Single Variable Solutions](image2)

**Figure 48:** Shott’s multiple and single variable solutions for the Payne specimens.
Summary

The morphological diversity represented at Payne points towards the presence of (and engagement with) both dart- and arrow-based projectile systems – perhaps, unsurprisingly – given the transitional nature of the site’s Basketmaker III temporal-cultural assignment. Within this context, each of the three classification schemes applied to the data (all widely applicable – a product of excellent attribute visibility at the site) agreed upon a preference for arrow types, though to varying degrees (the divide considerably more prominent in Shott’s (1997) than in Hildebrandt and King’s (2012) approach). Irrespective of the results produced, differences such as these provide important insight with regards to the vagaries surrounding the dart-arrow divide. Indeed, distinctions
between the two are rarely as clear (or consistently determined) as the classificatory ‘ideal’ demands, especially in contexts where both systems are apparently in use and neither type especially dominant. It could even be argued that, in some situations, an ‘intermediate’ point form – such as the Cienega type – served for use with either weapon, negating the relevance of distinct dart/arrow type categories altogether. In any case, differences in point morphology among the Payne site collection, though present, are not always simply explained.

That specimens of seemingly different ages were recovered from the same context further complicates the ability to assign function and meaning to the different types, whether ‘sacred’ or ‘mundane’, as does the variety in associated raw material. Diversity, thus, is a key feature of the collection, a likely response to the shift towards/adoption of newer (arrow-based) technologies, whilst simultaneously maintaining the older (dart-based) ones. Naturally, this interplay between tradition and innovation, as demonstrated at Payne, necessitates a process of experimentation, development, and eventual implementation, which, contrary to traditional interpretation, was rarely a quick and simple one, accounting for the effective range of variation and lack of distinct clustering within the sample studied.
6.1.3. Duckfoot 5MT3868 \((N = 62)\)

**Context**
Located approximately 1945masl atop a ridge between Crow Canyon and Alkali Canyon (Figure 51), excavations at Duckfoot – conducted between 1983 and 1987 by the Crow Canyon Archaeological Center and thought to represent an estimated 90 percent of the total site – revealed ‘a late Pueblo I Anasazi habitation site consisting of 19 contiguous surface rooms, four pit structures, and an extensive midden… typical for this period’ (Lightfoot et al. 1993, 1) (Figure 52). A product of abrupt abandonment and associated burning events, the remains at Duckfoot were especially well-preserved, making it an excellent case-study of Puebloan culture (ibid). ‘Characterised by rolling uplands dissected at intervals by medium-size canyons,’ the area surrounding the site was fed by two main water supplies: Alkali Canyon, slightly less than 1km west of the site, and Crow Canyon, 2.2km to the east (ibid, 2). In this sense, it was well-placed to access a critical resource, accounting, perhaps, for the popularity of its location throughout prehistory. Of particular interest is the prevalence of

![Figure 51: The location of the Duckfoot site, with Alkali Canyon to the west and Crow Canyon to the east (Lightfoot et al. 1993, 2).](image-url)
sites attributed to the preceding Basketmaker phases (or sites with a Basketmaker component), which 'not only suggests continuity of prehistoric occupation of the area but has implications for the interpretation of Duckfoot artefact data as well. With so many earlier sites in the immediate vicinity, including one located within 30m and six others within 300m of Duckfoot, it is possible that materials were deliberately transported or inadvertently mixed between sites' (ibid, 9). The effect this may have had upon the composition of the assemblage in question should, therefore, be borne in mind when considering the nature of technological (and cultural) changes within and around the site.

‘On the basis of architectural style, pottery types, and tree-ring dating results, the site is believed to have been built in the mid- to late AD850s and occupied for a relatively short time, perhaps 20 to 25 years,’ and ‘with the possible exceptions of two intrusive features in post-abandonment structure fill and [an] isolated surface room of unknown date,’ appears to represent just a

Figure 52: A plan of the excavations at Duckfoot (right) with topographic map (left) (Lightfoot et al. 1993, 5, 11).
single occupation (ibid, 1). The end of this occupation is characterised by rapid abandonment – as marked by the aforementioned burning episode – which saw several structures destroyed with useable items and numerous bodies inside; the result, perhaps, of a funerary/abandonment ritual conducted in response to ‘some catastrophe that caused the death of six or more individuals, including men, women, and children’ (Lightfoot 1993, 298). In the absence of any clear evidence regarding the nature of this ‘catastrophe’ (such as interpersonal trauma), however, the precise reason for abandonment remains unknown.

Based on construction details, ‘the roomblock… is believed to have been built as three distinct room suites… each… associated with a pit structure and an area of intervening courtyard to form an architectural suite interpreted to be the facilities used by a single household’ (Lightfoot 1993, 299). Their subsistence economy, similar to that of other contemporary sites in the area, consisted of ‘a balance of cultigens, wild plant foods, and wild animals,’ contextualised by a diversity of structures that likely accommodated year-round activities and storage (ibid, 300). Analyses of the human remains suggests good health and nutrition, while ‘the incidence of dental caries and abscesses typical of agricultural populations with a high-carbohydrate diet’ serves as evidence that ‘agricultural productivity was good during the Duckfoot occupation’ (ibid, 299). ‘Protein from meat seems to have been derived mostly from small mammals (cottontail, jackrabbit, and prairie dog) that probably were procured using an opportunistic “garden-hunting” strategy,’ while ‘several slab metates and manos suitable for use with slab metates’ provide evidence of plant processing activities across the site (ibid, 299-301). Of particular interest here is that ‘generally, slab metates are not thought to have been used until the Pueblo II period’ (ibid, 301). Combined with the fact that more than half of the projectile point collection at Duckfoot represents ‘dart points of styles typically identified with the Archaic and Basketmaker periods’ (ibid), it is clear that the Pueblo I assignment of the site is far from a discrete entity; rather, it is part of a more complex series of temporal-cultural transitions involving experimentation, integration, and the interplay between tradition and innovation.

Adding to this complexity is the presence of nonlocal materials at the site, an indicator of intra- and inter-regional systems of exchange (and their inevitable effect upon cultural and technological developments at Duckfoot). Within the projectile point category, for example, nonlocal materials
(agate/chalcedony, obsidian, Washington Pass chert, and nonlocal chert/siltstone, including jasper) account for 32.3 percent (Etzkorn 1993, 172), and while local Mesa Verde gray wares predominate the ceramic assemblage (almost 90 percent), accompanied by local Mesa Verde white wares, nonlocal red wares comprise just over five percent of the total studied (Etzkorn et al. 1993, 135). According to Etzkorn et al. (1993, 156), the latter:

‘… provide different, and complementary, lines of evidence. That is, the diversity of white ware designs, the evidence for small-scale local production, and the presence of different white ware types within the region indicate the expression of social differences at various levels... However, concentrated red ware production in southeastern Utah and widespread distribution of the red wares (including to Duckfoot) are indicative of a broad regional social network. Thus, social differences were maintained at one level, although at another level, economic ties were far-reaching.’

The notion of varying levels of social and economic identity is, arguably, applicable to each and every category of material culture, and has important implications for the effective interpretation of artefact diversity and openness to change. At Duckfoot, the incorporation of traditional and more innovative items, for instance, may be taken as an indication of more gradual processes of change, where older systems were maintained alongside the new, and while engaged in a system dominated by local production, the occupants appear to have retained a willingness (i.e. a desire) to remain connected with developments further afield.

Analysis
Table 3 attests to a fairly broad range in values among the Duckfoot collection, with outliers recorded for three of the six attributes listed (width, basal width, and thickness). By the same merits, the combination analyses (Figure 53) reflect a broad spread of data along both axes (i.e. both along and across the trend line, according to variability in size and shape), lacking any definitive clusters or indication of bimodality (relative to point type/technology) among the assemblage. At the extreme ends of the scale, earlier dart-associated types (including Archaic specimens comparable to Justice’s (2002, 151) Northern
Side Notched type cluster) sit towards the upper limit, and later arrow-associated types (such as the Pueblo II affiliated point comparable to Justice’s (2002, 246) Chaco type cluster) towards the lower limit (see Figure 54). Those in the centre, however, are less easily distinguished, as is the case for some of the smaller Basketmaker and larger Pueblo I points, comparable to Justice’s (2002, 195, 240) San Pedro and Dolores type clusters respectively (Figure 55). In this case, the two types overlap in size (the traditionally smaller ‘arrow’ point sitting above the typically larger ‘dart’ type on the trend line, as in the

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Table 3: Summary of attribute averages, range, and outlier values for Duckfoot.

**Figure 53:** Simple combination analyses applied to the Duckfoot specimens. The red arrows represent the extreme ends of the scale (as in Figure 54), the black arrows size-derived technological ambiguity (as in Figure 55).
length:width combination, Figure 53) superseding the morphological bimodality traditionally associated with the two projectile technologies.

Aptly demonstrated in Figure 56, a broad range of morphological variability persists throughout the collection, both within and between point types; perhaps unsurprisingly, though, those with greater antiquity are typically less morphologically consistent and fashioned from a greater variety of materials than those affiliated with the site’s Pueblo I temporal-cultural assignment (Figure 57).
**Figure 56:** A selection of Basketmaker ‘dart’ points (top) and Pueblo ‘arrow’ points (bottom) recovered from Duckfoot, clearly indicating the range of morphological variability within and between types.

**Figure 57:** A diverse selection of earlier dart-affiliated points (top row), compared to the later, more consistent Pueblo I (Dolores type cluster) arrow-affiliated points (bottom row) recovered from Duckfoot.
While base type sits predominantly within the straight to convex range, blade type embraces the full range of styles from excurvate to incurvate (Figure 58), the latter almost exclusively a Pueblo I – Dolores type cluster – trait. The visibility of blade type, too, is high at Duckfoot (98.4 percent), exceeded only by point thickness (98.4 percent), while weight and length retain the lowest visibility (54.8 percent) (Figure 59). Furthermore, the high visibility of neck width (87.1 percent) compared to maximum width (62.9 percent) accounts for the difference in applicability between classification schemes, Hildebrandt and King’s (2012) approaching a little over 20 percent more representative than the others (Figure 60).

Figure 58: Basic qualitative attribute values for the Duckfoot specimens.

Figure 59: Comparable visibility of quantitative and qualitative attributes among the Duckfoot specimens.
Each of Shott's (1997) classification solutions agree upon the use of an arrow-dominant projectile system at Duckfoot, with an arrow:dart ratio of approximately 3:1 (Figure 61). By the same merits, the majority of TSA and TP values derived from Hughes' (1998) methods sit within the proposed arrow range, and point mass predominantly below the lower (3g) limit suggested for darts, while still accounting for notable overlap into dart territory (Figure 62). The results produced by Hildebrandt and King's (2012) dart-arrow index, on the other hand, indicate a more even divide between the two, with dart points accounting for roughly half (47.2 percent) of the assemblage (Figure 63).

Figure 60: Percentage of total specimens used in each classification approach for the Duckfoot site.

Figure 61: Shott’s multiple and single variable solutions for the Duckfoot specimens.
Summary
The broad spread of point data detailed in the attribute summary and combination analyses testifies to the presence of a variety of types (and technologies) at the Duckfoot site, confirmed by observations of various stylistic traits. Within the range demonstrated are Archaic, Basketmaker, and Pueblo point types, covering a broad spectrum of temporal-cultural periods during which – at some point – the bow and arrow was introduced to the area. The results derived from each classification scheme are of special interest here, with Hildebrandt and King’s (2012) approach (arguably the most reliable, based on applicability score) providing a more even dart:arrow ratio than the others; a result which stands in closest agreement with the original site report where approximately half were assigned to earlier (dart-associated) type categories. Supported by stylistic (type-cluster) observations, it is this result that provides
the best ‘match’, leading us to question the validity of the other methods tested. One suggestion might be that the Duckfoot ‘arrow’ types were more visible than the ‘dart’ types (i.e. they retained a higher percentage of the attribute values required for Shott (1997) and Hughes’ (1998) analyses), producing a classification bias that favoured the former. In any case, whether dart-dominant, arrow-dominant, or evenly distributed, the results derived from the Duckfoot data provide a valuable cautionary tale regarding the implications of attribute visibility and effective interpretation, an all-too-common reality in artefact classification.

Projectile point distribution across the site encompassed a wide variety of contexts, including midden and courtyard areas, on floors, or in collapsed wall and roof debris (confirmed by Etzkorn 1993, 172-173), with little evidence of distinct separation between technologies. Supported by expressions of diversity both within and between point types, and an apparent indifference to strict morphological control, differences exist only in the broadest sense, with earlier styles typically less consistent and manufactured from a wider range of material types than later ones. According to Lightfoot (1993, 301):

‘The substantial proportion of earlier styles of dart points in the Duckfoot collection may be interpreted as indicating that the use of darts propelled by atlatls remained popular into Pueblo I times. On the other hand, these points may have been collected as curios or as objects that were thought to possess magical power.’

It is intriguing, then, that the only point described as having a notably ‘special’ context at the Duckfoot site was a ‘particularly well made’ Pueblo I point, which, ‘found in the fill of the capped sipapu in Pit Structure 1… appeared to have been deliberately placed, perhaps as part of a ritual dedication’ (Etzkorn 1993, 173). In the absence of similar evidence regarding older points recovered from the site (combined with the relatively high proportion of earlier styles), it seems likely that at least some of them served a more practical, everyday function. In this sense, it is not unlikely the Duckfoot collection represents combined – perhaps complementary – use of both projectile systems, the dart and atlatl and the bow and arrow, defying traditional assumptions of a distinctly abrupt transition from one technology to another.
6.1.4. Rio Vista Village 5MT2182 \((N = 119)\)

**Context**

Excavated in 1980 under the direction of the Dolores Archaeological Project, Rio Vista Village – ‘situated on a large bench on the east side of the Dolores River’ – represents a large (post-introduction of the bow and arrow) Pueblo I habitation with at least four roomblock structures (Wilshusen 1986a, 211) (Figure 64). ‘As is the case for all Pueblo villages in the area, the site is located

![Topographic map of Rio Vista Village and vicinity (Wilshusen 1986, 213).](image)

**Figure 64:** Topographic map of Rio Vista Village and vicinity (Wilshusen 1986, 213).
close to a permanent source of water’ and ‘to an elevation that might have provided distinct advantages for prehistoric agriculture’ (ibid, 214). Contemporary with population increases in the area, the village was also well-placed socially, with seven surrounding sites classified as habitations, and numerous other limited activity/storage/flaked lithic processing sites nearby (ibid, 215-218). Rio Vista itself, divided into six key areas for study (moving southwards from 1-6, defined by the various roomblocks and associated midden deposits) appears to have been occupied as early as AD725 or 750 and (finally) abandoned no earlier than AD900 (Wilshusen 1986d, 449).

Area 1 (Figure 65), characterised by the smallest of the site’s four roomblocks, comprises three major components. The first, dating around AD790 (during the DAP’s Sagehen Phase, AD600-850), is represented by a pitstructure and one or more masonry surface rooms; the second, only minimally tested, is assigned to the latter part of the Sagehen Phase, based on the associated ceramics; and the third, represented by at least one pitstructure

![Figure 65: Plan of the major cultural units in Area 1 at Rio Vista Village (Fields and Nelson 1986, 227).](image-url)
and at least eight contiguous masonry surface rooms, refers to the McPhee Phase (AD850-975), ‘probably dating to the latter half of the ninth century’ – the site’s ‘major occupation’ period (Fields and Nelson 1986, 224). Among the material recovered from this area was a coiled basketry fragment, small quantities of corn, beans, and pinyon pine nuts, mammal bone, bone tools (including awls and spatulas), two-hand manos, trough metates, hammerstones, and primarily locally-produced pottery sherds (ibid, 310-311). Large quantities of flaked lithic debitage, too, featured heavily among the assemblage, with comparably small numbers of projectile points and specialised tool forms (ibid). In this case, ‘the large number of utilised flakes and small number of projectile points… point to an expedient lithic technology,’ while ‘the close correspondence between tool grain size and debitage grain size suggests that many of the tools being used by the occupants of Area 1 were being made on the site’ (ibid).

To the south of Area 1 is Area 2 (Figure 6), encompassing ‘a single courtyard architectural group… defined by surface evidence of architectural features, surface distribution of artefacts, and topographic features,’ the full extent of which is assumed to be much larger than the area collected (Wilshusen 1986b, 315). As before, the assemblage is characterised by locally-produced vessels, expediently-produced flaked stone tools, and non-flaked lithic items such as two-hand manos and trough metates (ibid, 356-357). Although ‘the synthesis for Area 2 is necessarily dependent on the limited pitstructure testing and stratigraphic profiles within the midden… four elements were formally defined,’ so that occupation dates ‘between approximately AD740 and 900, with a possible hiatus sometime between AD800 and 850’ (ibid, 358). The earliest element, represented by Pitstructure 108, corresponds with the Sagehill Subphase (AD700-780) of the DAP’s Sagehen Phase (AD600-850), while Pitstructures 104 and 102 combine to represent the second, with ‘evidence of significant occupation during the latter half of the 8th century’ (ibid). The third element, including at least Pitstructures 101, 102, and 107, as well as Rooms 101, 102, 103 and portions of the plaza, represents the Periman Subphase (AD850-900) of the area’s main McPhee Phase (AD850-975) occupation, defined by the largest roomblock structure at the site (ibid). According to Wilshusen (1986b, 359), ‘the stratigraphic break between early and late trash in the area suggests that there might have been a hiatus in the early AD800’s,
followed by a large resettlement of the site in the middle of the AD800’s.’ The fourth element represents a continuation of this resettlement, characterised by Pitstructures 105 and 106 and the final period of occupation attributed to the Grass Mesa Subphase (AD880-925) (ibid, 359).

By comparison, the synthesis of Area 3 (Figure 67), ‘defined as a courtyard group on the basis of a large roomblock rubble mound... a single, large, possible pitstructure depression... and a large, potential plaza area,’ is less complicated (Wilshusen and Varien 1986, 359). In this case, ‘three elements of occupation... are defined by three stratigraphically distinct periods of construction... the earliest... assigned to the Sagehen Phase (AD600-850)... the final two to the McPhee Phase (AD850-975)’ (ibid, 436). The first element relates to the minimal remains of Pitstructure 204, dated to the late AD700’s, while the second, comprising Pitstructures 201 and 203, Rooms 201-206, as well as other unnumbered surface rooms, the majority of the plaza and the trash at the site, refers to the main occupation of Area 3 during the Periman Subphase (AD850-900) (ibid). The third element, represented by Pitstructure
202 (as well as non-structural units 204 and 205- perhaps associated courtyards, and the stone-lined features of Pitstructure 201 and Room 205), appears to date to between AD880 and 900, coinciding with the final abandonment of Rio Vista Village during the site’s latest Grass Mesa Subphase (AD880-925) (ibid, 437). Similar to that recovered from Areas 1 and 2, associated material culture includes ceramic items made primarily from locally-available materials, expediently-manufactured flaked stone tools (only a small proportion of which represent formal projectile point categories), and non-flaked lithics such as hammerstones, two-hand manos, and trough metates, as well as a number of shell beads (ibid, 432-435).

Figure 67: Plan of the major cultural units in Area 3 at Rio Vista Village (Wilshusen and Varien 1986, 361).
Last to be detailed is the southernmost roomblock, as described in Areas 4 and 6 (Figure 68). Excavations in this area were more limited than in the others, the latter being the only area actually gridded and sampled (Area 5 was originally designated on the possibility it represented a great kiva, which was later eliminated) (Wilshusen 1986c, 437). In this case, Area 6 ‘is interpreted as a midden that was probably the main trash disposal location from the Area 4 roomblock,’ thus providing an indirect source of evidence regarding occupation(s) in that portion of the site (ibid, 439). While the ceramic profile reveals similarities to Areas 2 and 3, a comparison a wares ‘suggests that Area 6 does not have an early component, as do the other areas of the site, and that the majority of the occupation... occurred sometime between AD825 and 900’ (ibid, 444). In the absence of clearly defined elements, ‘the only evidence of a time specific event in this area is [a] human burial, and based on the lack of datable grave goods, this burial can be only assigned to the latter part of the occupation period noted above (ibid, 446).

Figure 68: Plan of the major cultural units in Areas 4 and 6 at Rio Vista Village (Wilshusen 1986c, 438).
Based on this brief overview, it appears that Rio Vista Village comprised three main components, the first attributed to the Sagehen Phase (early-mid Pueblo I) occupations, the others to the largest and latest McPhee Phase (late-Pueblo I) occupations respectively (Wilshusen 1986d, 450-453). Similarities among the assemblages for each area testify to the use of locally-sourced/produced ceramics and stone tools, while contemporary use of tool types associated with hunting and plant processing activities points towards a combined subsistence economy (the latter the more dominant of the two). The presence of non-local materials and designs (albeit in small quantities) should, nonetheless, be borne in mind when approaching the question of inter-site contact and the exchange of ideas and technologies, as should the suggestion that at least some of the stone tools were manufactured on-site.

**Analysis**

An especially broad range in values persists at Rio Vista Village, with outliers present in all but the basal width category (Table 4) – evidence, perhaps, of unusual forms among the collection, standing in contrast to the site ‘norm’. Closer study of the outliers revealed a tendency towards the upper (larger) end of the scale, a trend also reflected in the combination analyses (Figure 69), with at least three specimens placed above the ‘normal’ distribution in each the length:width and weight:thickness diagrams. However, while one specimen remained a clear outlier in the width:thickness combination, in this case, a loosely-defined second cluster (beyond the ‘norm’) was identified, providing valuable insight regarding the nature and prominence of morphological variability at the site.

**Table 4:** Summary of attribute averages, range, and outlier values for Rio Vista Village.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Median</th>
<th>Lowest Value</th>
<th>Highest Value</th>
<th>Range</th>
<th>% Outlier Values</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weight (g)</strong></td>
<td>2.10</td>
<td>1.21</td>
<td>0.33</td>
<td>21.17</td>
<td>20.84</td>
<td>20.00</td>
</tr>
<tr>
<td><strong>Length (mm)</strong></td>
<td>28.44</td>
<td>27.89</td>
<td>15.73</td>
<td>61.05</td>
<td>45.32</td>
<td>4.44</td>
</tr>
<tr>
<td><strong>Width (mm)</strong></td>
<td>18.26</td>
<td>16.98</td>
<td>9.58</td>
<td>38.60</td>
<td>29.02</td>
<td>7.69</td>
</tr>
<tr>
<td><strong>Thickness (mm)</strong></td>
<td>4.16</td>
<td>3.81</td>
<td>1.76</td>
<td>10.63</td>
<td>8.87</td>
<td>1.98</td>
</tr>
<tr>
<td><strong>Basal Width (mm)</strong></td>
<td>11.27</td>
<td>7.91</td>
<td>2.39</td>
<td>26.72</td>
<td>24.33</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Neck Width (mm)</strong></td>
<td>7.43</td>
<td>5.73</td>
<td>2.68</td>
<td>21.69</td>
<td>19.01</td>
<td>3.90</td>
</tr>
</tbody>
</table>
The most common (and most consistent) point type at Rio Vista belongs to Justice’s (2002, 240) Dolores cluster (*Figure 70*), sitting neatly within the Pueblo I temporal-cultural assignment awarded to the site. For the most part, this type characterises the dominant point cluster at Rio Vista Village, while the proportionally smaller cluster (and outliers) are primarily defined by forms more commonly associated with the preceding dart-based Basketmaker phases, such as the San Pedro type (as in Justice 2002, 195). It is interesting to note, however, that these two (supposedly technologically distinct) types overlap (i.e. when there are smaller San Pedro forms and larger Dolores forms), and that not all dart-associated forms are necessarily ‘outliers’ but sit neatly within the morphological groupings associated with Pueblo I arrow points. Qualitative measures of base and blade type (*Figure 71*), too, reveal characteristic similarities (the majority falling within the straight to convex and straight to excursive ranges, respectively), excepting a limited number of incurvate blade forms among the Dolores type. In this sense, the points recovered from Rio Vista are lacking the distinct parameters traditionally associated with the dart-
Figure 70: A selection of points belonging to the dominant Dolores type cluster (left, Areas 1-3 and 6, from top to bottom) at Rio Vista Village, comparable to the examples provided by Justice (2002, 243).
arrow divide, morphological variability present both within and between type categories (Figure 72). Thus, while the largest ‘dart’ points in the collection may be classed as outliers and easily distinguished from the rest, the smaller ones fit comfortably within the accepted range of variation.

Both ‘dart’ and ‘arrow’ forms were recovered from each of the areas with projectile point evidence (Areas 1-3 and 6), and a distribution pattern based

**Figure 71:** Basic qualitative attribute values for the Rio Vista Village specimens.

**Figure 72:** A selection of traditional ‘dart’ (top row) and ‘arrow’ (bottom row) point forms recovered from Area 2 at Rio Vista Village – comparable to Justice’s (2002, xix-xx) San Pedro and Dolores type clusters – aptly demonstrating the potential for intra-type variations in size.
upon point type made unlikely by the recovery of different forms from the same contexts (as in Figure 73). As such, despite being less common, (typically, but not exclusively, larger) dart forms appear to have co-existed alongside the more typical Dolores type associated with Pueblo I – primarily arrow-based – projectile technologies at Rio Vista Village.

![Figure 73: The largest ‘dart’ point (left) and one of the smallest ‘arrow’ points (right) were recovered from the same context in Area 2 at Rio Vista Village.](image)

Of all the attributes considered, weight and length were the least visible (representing less than 40 percent of the total sample), and thickness and blade type the most visible (representing more than 80 percent) (Figure 74). It was the difference between neck width and maximum width, however, which ensured that Hildebrandt and King’s (2012) method of classification had the highest applicability of all three tested by a margin of almost 10 percent (Figure 75).

![Figure 74: Comparable visibility of quantitative and qualitative attributes among the Rio Vista Village specimens.](image)
All four of Shott’s (1997) classification solutions agreed upon the presence of an arrow-dominant projectile system at Rio Vista Village (Figure 76), with an arrow:dart ratio of approximately 2:1 (as in the one variable solution). A similar pattern was expressed in the results derived from Hildebrandt and King’s (2012) dart-arrow index (Figure 77), though in this case the distinction was nearer 3:1. TSA and TP values, too, primarily fell below the arrow threshold provided by Hughes (1997), and mass typically below the lower value suggested for darts (Figure 78), yet – as before- there was notable crossover with dart values in all three categories.

Figure 75: Percentage of total specimens used in each classification approach for the Rio Vista Village site.

Figure 76: Shott’s multiple and single variable solutions for the Rio Vista Village specimens.
Summary

All three of the classification schemes applied to the dataset agreed upon the presence of an arrow-dominant system at Rio Vista Village, with the continued presence of some dart forms. In this case, the arrow:dart ratio appears to fall somewhere between 2:1 and 3:1, but as the variability in Table 4 and the combination analyses demonstrate, distinctions between the two are rarely clear-cut. At the extreme ends of the scale, dart-type and arrow-type distinctions can easily be made (e.g. Figure 73), but reality rarely deals with extremes alone. Morphological variability within and similarities between type clusters, for
example, ensures that the dividing line between (presumably) larger dart points and smaller arrow points at Rio Vista remains blurred. That different point types (and the technologies they appear to represent) were often recovered from the same context, and manufactured from the same range of materials types, too, makes it difficult to assign a notably different (i.e. ‘special’) function to those considered less typical. In the absence of further evidence, therefore, it appears that both forms (the Dolores ‘arrow’ type the most dominant) were visible and utilised by the site's occupants in some way. Set in the sites' Pueblo I temporal-cultural context, a period that had only recently (by traditional accounts) received the bow-and-arrow, the continued presence of earlier (Basketmaker) forms alongside newer, seemingly more-dominant ones seems entirely plausible, as the interaction between traditional and more innovate projectile technologies persisted well into the succeeding Pueblo periods.
6.1.5. Periman Hamlet 5MT4671 \((N = 56)\)

**Context**

Excavated under the direction of the Dolores Archaeological Project during the 1979 and 1980 field seasons, Periman Hamlet represents a large multi-component Pueblo I – early Pueblo II (post-introduction of the bow and arrow) site in the Periman Locality of the Dolores River Valley. Measuring around 150m north-south by 85m east-west, the site sits ‘on the second terrace of an alluvial fan… approximately 450m east of the Dolores River’ \(\text{(Yarnell 1983, 1)}\), an ‘unusual’ location ‘for year-round habitation sites in the project area’ where ‘both the vegetation and climatic factors make farming difficult on the flood plain’ \(\text{(Wilshusen 1986e, 25)}\). Situated ‘halfway between two of the largest sites in the project area: Grass Mesa Village to the north, and the McPhee Pueblo (contemporaneous with Area 1 at Periman) to the south,’ and with Rio Vista Village only 1km away, the hamlet does, however, appear well-connected with the wider Pueblo community, population density increasing dramatically within a 2-3km radius \(\text{(ibid, 28)}\).

The site itself has been subdivided into seven areas, three of which (Areas 1, 4, and 7) ‘showed surface evidence of discrete architectural units’ or roomblocks, each with associated pitstructures \(\text{(ibid, 25)}\), forming the basis for subsequent interpretation regarding the nature and longevity of occupation \(\text{(detailed below)}\). Excavations in Area 4 \(\text{(Figure 79)}\) reveal what appear to be two occupations. The first – ‘manifested by a roomblock, an isolated room, a pithouse, a special-use pitstructure, and the middens and outdoor use areas associated with these structures’ – represents the earliest at the site, dating c.AD780-810 during the region’s Pueblo I phase, while the second – ‘represented by a field house and associated burial and midden’ – ‘was short-lived and occurred sometime between AD880-910’ during the region’s early Pueblo II phase, the latest known occupation of the site \(\text{(Yarnell 1983, ix)}\). The human remains from this area represent a total of five individuals, including those of a young to middle-aged adult female \(\text{(from the burial in Pitstructure 2)}\) with potentially ritual implications \(\text{(Yarnell 1983, 263)}\). The faunal assemblage (dominated by mammal bone) describes a preponderance towards the exploitation of smaller species, while manos and metates form the majority of the well-shaped non-flaked lithic category \(\text{(ibid, 240-247)}\). Projectile points,
Figure 79: Plan of the major cultural units in Area 4 at Periman Hamlet (Wilshusen 1986e).

however, represent just 3.2 percent of the flaked lithic tool total, only 36.8 percent of which were considered complete, revealing an ‘assemblage typified by low-input items... probably a reflection of expedient tool technology in which items with low production input tend to be discarded in a more complete condition than do tools with high production input’ (ibid, 235-238), to be borne in mind when considering the nature and visibility of technological change.

Based on the material evidence, Yarnell (1983, 287) produces an estimate of 10-12 individuals for the initial and final populations associated with Area 4, households whose subsistence strategy combined horticulture and the procurement of locally available nondomestic plants and animals. In this case, the ‘fairly large amount of storage space suggests a year-round occupation, which generally implies an emphasis on horticulture for the production of plant foods (probably corn, beans, and squash) as well as seasonal procurement of nondomestic foods that could be stored’ (ibid, 283). In the absence of evidence for a catastrophic abandonment, the end of the earliest associated occupation appears to have occurred in a leisurely manner (ibid, 281). By contrast, the later
occupation is characterised by seasonal visits to the field house. On this occasion, thin floor surfaces and midden deposits indicate an occupation of less than five years, while ‘the presence of shell bracelets… indicate status and may reflect ritual abandonment in association with the interment of an individual [the aforementioned adult female] and associated fireplace’ (ibid, 290). The effective combination of practical and (potentially) ritualised use-contexts provides an important consideration for the interpretation of finds recovered from this area.

Unlike Area 4, the remains associated with Areas 1 and 7 reveal only single occupations. Roughly contemporaneous (though Area 7 may, perhaps, be slightly earlier), these areas were occupied sometime between AD800-860 during the region’s Pueblo I phase, a little after the initial occupation in Area 4 (Wilshusen 1986e, 28). Comprising an unusually configured roomblock and associated pithouse (Figure 80), Area 7 appears to have been occupied only briefly, as supported by the absence of a use-compacted surface in any of the rooms investigated (Yarnell 1983, 282). Among the non-flaked lithics recovered were hammerstones, manos, and ornaments, and while medium to large mammals dominate the faunal assemblage (a product of comparative preservation, perhaps), projectile points appear absent in a flaked lithic tool collection typified by more expedient forms (ibid, 270-274). Based on a comparison of roofed space, Yarnell (183, 284-288) proposes a population ratio of 2:3 between Areas 7 and 4, further arguing that ‘the amount of energy required to build the roomblock in association with the pithouse indicates the intent… to provide living and storage space for a year-round occupation. Therefore, although the occupation appears to have been brief, it is inferred that the household subsistence strategy was based on horticulture supplemented by seasonally available nondomestic plant and animal resources,’ just as in Area 4.

Again, in the absence of evidence for catastrophic abandonment, the area appears to have been abandoned in a leisurely manner during the Pueblo I phase at the site (ibid, 290).

Area 1 (Figure 81), on the other hand, represents a considerably longer and larger Pueblo I occupation, including the expansion of an ‘original core of rooms to the 18… found in excavation,’ ‘interpreted as evidence of growth and budding off of family units… not… as a sign of significant change in the structure of the community’s social organisation’ (Wilshusen 1986e, 161-171). Within this community, Wilshusen (1986e, 165-171) defines four household
units with a maximum population of 24 individuals, and although ‘the total arrangement of structures at the site suggests a very “planned” development… no evidence suggests status differences between the households.’ As in Area 4, remains indicative of small mammal exploitation are accompanied by a limited number of projectile points (representing just 4.2 percent of the flaked lithic tool assemblage) and tools associated with plant processing activities (including metates and two-handed manos) (ibid, 114-154), hinting at the commonality of a mixed subsistence strategy throughout each of the site’s various areas and phases of occupation. Based on the availability of local resources, Wilshusen (1986e, 170) suggests that wild greens and stored food in were consumed in spring; green maize, small game and wild fruits in summer; maize, beans, wild plant seeds, and possibly squash or pinyon nuts during autumn; and maize, beans, other stored vegetal resources and big game in winter; though

\[ Figure 80: \text{Plan of the major cultural units in Area 7 at Periman Hamlet (Wilshusen 1986e).} \]
admittedly ‘this is a simplified and idealised seasonal round and certainly was much more complicated and flexible in reality, depending on the fortunes and fluctuations of various food supplies.’

On a broader, intra- and interregional level, contact with neighbouring Pueblo and non-Pueblo communities, whether socially or economically driven, is evidenced by limited quantities of non-local raw material such as stone and shell, and the presence of ceramic trade wares from Cibola, Mogollon, and possibly Kayenta Culture categories, as well as those from various manufacturing tracts across the Mesa Verde region (Yarnell 1983, 288). Too few in number to derive any firm interpretation, however, Wilshusen (1986e, 165) suggests that ‘while the prehistoric inhabitants of Periman certainly were involved in the exchange of goods with other communities, the community was essentially economically self-sufficient…’ [a] major assumption… based largely

Figure 81: Plan of the major cultural units in Area 1 at Periman Hamlet (Wilshusen 1986e).
on a lack of evidence for the specialisation and sophistication necessary in a more exchange-oriented economy.' Naturally, assumptions such as these should be borne in mind when considering the presence (or absence) of technological diversity within a site’s assemblage.

Analysis

As Table 5 attests, a broad – yet acceptable – range in variation was demonstrated among the points recovered from Periman Hamlet, confirmed by the absence of any outlier values, and while combination analyses of length:width and width:thickness describe a fairly even spread of the data, weight:thickness can be seen to reveal two potential groupings (Figure 82).

Table 5: Summary of attribute averages, range, and outlier values for Periman Hamlet.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Mean</th>
<th>Median</th>
<th>Lowest Value</th>
<th>Highest Value</th>
<th>Range</th>
<th>% Outlier Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (g)</td>
<td>2.16</td>
<td>1.36</td>
<td>0.20</td>
<td>6.92</td>
<td>6.72</td>
<td>0.00</td>
</tr>
<tr>
<td>Length (mm)</td>
<td>29.26</td>
<td>29.25</td>
<td>12.11</td>
<td>54.46</td>
<td>42.35</td>
<td>0.00</td>
</tr>
<tr>
<td>Width (mm)</td>
<td>16.78</td>
<td>17.35</td>
<td>7.74</td>
<td>24.86</td>
<td>17.12</td>
<td>0.00</td>
</tr>
<tr>
<td>Thickness (mm)</td>
<td>4.00</td>
<td>3.81</td>
<td>1.96</td>
<td>7.29</td>
<td>5.33</td>
<td>0.00</td>
</tr>
<tr>
<td>Basal Width (mm)</td>
<td>10.85</td>
<td>7.96</td>
<td>3.76</td>
<td>21.80</td>
<td>18.04</td>
<td>0.00</td>
</tr>
<tr>
<td>Neck Width (mm)</td>
<td>7.57</td>
<td>5.89</td>
<td>3.08</td>
<td>15.66</td>
<td>12.58</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Figure 82: Simple combination analyses applied to the Periman Hamlet specimens, the Archaic point indicated by the arrow.
The largest of the two groups, towards the lower end of the scale, correlates closely with Justice’s (2002, 240) Dolores type cluster (Figure 83) and ties in well with the site’s Pueblo I (arrow-based) temporal-cultural assignment. By contrast, the other group is more closely-aligned with earlier (dart-based) systems (Figure 84), including forms similar to those expressed in Justice’s (2002) Northern Side-Notched (Middle-Late Archaic), San Pedro (Basketmaker II-III), and Cienega (Basketmaker II-Pueblo I) clusters, though, admittedly, the latter does overlap the early Pueblo phase. Stylistically similar but larger overall, the three values that lie beyond this cluster are also typical of earlier (dart-based) systems, notably the San Pedro (Basketmaker II-III) type (Figure 85).

Figure 83: Periman Hamlet specimens typical of the site’s Pueblo I assignment (top), comparable to those described in Justice’s (2002, 243) Dolores cluster (bottom). This type characterises the lower cluster in the weight-thickness combination analysis.
A study of base types places the assemblage almost exclusively within the straight to convex range, irrespective of cluster designation, while blade type, seemingly more diverse, roughly correlates with the differences expressed between the two groups (the Dolores type covering a broader excurvate to incurvate range compared to the predominantly excurvate ‘dart’ group) (Figure 86). Of all of the attributes recorded, quantitative and qualitative, point thickness...
and blade type were the most visible (at 87.5 and 83.9 percent each), and weight, length, and basal width the least so (at 50 percent or less) (Figure 87). Of particular interest is the comparable visibility of width and neck width, which – when combined with thickness values – produced near even applicability scores between each of the classification schemes (Shott and Hughes at 57.1 percent; Hildebrandt and King at 60.7 percent) (Figure 88).

Figure 86: Basic qualitative attribute values for the Periman Hamlet specimens.

Figure 87: Comparable visibility of quantitative and qualitative attributes among the Periman Hamlet specimens.

With the exception of the four-variable analysis (which produced an equal dart:arrow ratio), the results derived from Shott’s (1997) solutions describe a predominantly arrow-based projectile system (Figure 89). Within this system,
however, dart points (and, thus, the atlatl) remain a prominent feature, accounting for almost one third of the sample studied. In a similar fashion, Hildebrandt and King’s (2012) index classified 38.2 percent as dart points (Figure 90), attesting to the potential for contemporary dart and arrow use at the site. Hughes’ TSA, TP and mass values, too, combine to describe a primarily arrow-based system (the majority falling within the proposed arrow range or below the lower dart limit), yet with notable overlap into dart territory (Figure 91).

![Classification Application](image)

**Figure 88:** Percentage of total specimens used in each classification approach for the Periman Hamlet site.

![Multiple and Single Variable Solutions](image)

**Figure 89:** Shott’s multiple and single variable solutions for the Periman Hamlet specimens.
Summary

The results produced by each of the quantitative, qualitative, and classification analyses combine to support the presence of two morphologically different clusters at Periman Hamlet, a distinction closely related to traditional assumptions regarding the large dart – small arrow point divide. In this case, all three classification schemes concur on the presence of a predominantly (smaller) arrow-based system at the site, with a roughly 2:1 (arrow:dart) point ratio – the proportionally larger Dolores type cluster characteristic of the site’s Pueblo I temporal-cultural assignment. Those belonging to the second cluster (both larger and stylistically different), on the other hand, correspond much
more closely with earlier (Archaic and Basketmaker) forms associated with the dart and atlatl. It is interesting, however, that the three specimens placed highest of the weight:thickness trend line – characteristic of the San Pedro (Basketmaker) type – should sit above the Northern Side-Notched (Archaic) specimen (located towards the centre, see Figure 8), despite belonging to a younger type cluster. While on a basic level, at least, the traditional distinction between older-larger and younger-smaller projectile technologies holds true at Periman, the limitations of assumptions regarding point size and antiquity are thus demonstrated.

Point size is far from constant; rather, it fluctuates throughout time (and space), something to be considered when interpreting the presence or absence of associated technological change. By the same merits, we must be mindful of the range of variation within each group (for example, in the Dolores type cluster, Figure 8), so that the classificatory ideal (of a simple morphological-functional divide) is placed within a more realistic interpretive context. At Periman Hamlet, specimens from each cluster include a variety of (overlapping) material types and recovery contexts (in Areas 1 and 4, the only areas with projectile point remains), demonstrating little evidence of ‘unusual’ pieces or ‘special’ functions. If, therefore, the two clusters derive from two different technologies – dart-based and arrow-based – then it appears that the site’s Pueblo I occupants maintained contact with, if not active use of, an older system alongside a newer (seemingly more dominant) one. Thus, while a clear morphological distinction between the two persists, the continued presence of older dart forms in what can be considered a relatively high proportion, attests to the value placed on maintaining tradition. The function of these ‘older’ forms remains unclear, whether collected as curios or intended for use, but, based on the contemporary recovery contexts of at least some of the points, it seems likely they held an active, practical, and perhaps complimentary function, as the interplay between technological tradition and innovation continued into the succeeding Pueblo periods.
6.1.6. House Creek Village 5MT2320 ($N = 16$)

**Context**

The site, ‘a large, aggregated Anasazi habitation located on the south rim of House Creek canyon about 0.65km east of where House Creek enters the Dolores River canyon,’ ‘is considered to be 1 of 9 central nodes in a settlement system’ that existed in the area during the DAP’s ‘McPhee Phase’ (AD850-975), broadly characterised as Pueblo I to early Pueblo II, a period that witnessed ‘a shift from dispersed or semiaggregated hamlets toward larger, aggregated villages’ (Robinson and Brisbin 1986, 661-664). Excavated in 1979 (Area 1) and 1983 (Areas 2-8), House Creek Village was divided into eight areas based on building rubble distribution and predicted site layout, though the focus here remains primarily upon Areas 1 and 3 (*Figure 92*) – the contexts of the majority of the sample studied (the remainder lack definitive context).

The roomblock-pitstructure complex defined in Area 1 ‘is small and spatially isolated on the west end of House Creek Village,’ with ‘wall abutments, construction style, and stratigraphic superposition’ hinting at two occupations, ‘the second… represented by an expansion of the existing roomsuite’ (ibid, 670-672). Northeast of Area 1 are three rubble mounds. These mounds account for

*Figure 92: Topographic map of House Creek Village, showing site locations and spatial relationship of major cultural units (Robinson and Brisbin 1986, 662). Area 1 is highlighted in blue, Area 3 in red (within which Pitstructure 4 is circled).*
the ‘major portion’ of the site, the most central of which belongs to Area 3, where, ‘during a period of three weeks, a roomsuite and three pitstructures were excavated’ (ibid, 705). Based on the study of surface ceramic assemblages from the site, it appears that ‘the eastern end… may have been occupied earlier than the western end,’ Areas 1, 2, and 3 dating c.AD860-910, the others a little earlier, providing ‘hints about how the village grew through time’ (ibid, 738). In this case, both Areas 1 and 3 are associated with the late Pueblo I period (the latter including potentially earlier Pueblo I deposits below), while surface-collected ceramics account for the crossover into early Pueblo II (ibid, 751), traditional associated with an arrow-based projectile system.

Located in an area of pinyon-juniper woodland, ‘the majority (approximately 75 percent) of soils within a 1-km radius… are rated as being poorly suited for agriculture,’ yet despite this, ‘the data from House Creek Village suggest a wide variety of resources were exploited by the prehistoric inhabitants at the site’ (ibid, 664, 751), both plant and animal. Over 90 percent of the faunal remains are from mammals (with large and small in roughly equal amounts), including rabbit, hare, deer and pronghorn, and 7.5 percent from birds, including domesticated turkey and grouse (ibid, 752-753). For the smaller animals, Robinson and Brisbin (ibid) propose ‘an informal procurement strategy associated with cultivated fields,’ while the capture of larger game ‘was perhaps a cooperative effort.’ Macrobotanical remains, on the other hand, serve as evidence for the cultivation of corn, while beans and squash remain absent – a product, perhaps, of preservation issues rather than a true absence (ibid, 753).

Dominated by food-processing tools, the non-flaked lithic assemblage includes both manos and metates, as well as a number of generalised pieces such as grinding/abrad ing stones, anvils, and shaped stone slabs, while the ceramic assemblage contains mainly sherds from gray ware jars made with locally available clays and tempering materials, consistent with other villages in the area (ibid, 751-752). By contrast, the dominant material type associated with the flaked lithic tool assemblage (itself dominated by utilised flakes and a fairly typical expedient technology) is Morrison Formation orthoquartzite (rather than the more local Burro Canyon type), indicating energy expenditure in raw material acquisition that differs to that at other sites in the area (ibid). That ‘most of the structure floor appear to have been subjected to cleaning or some sort of selection process for items that were still wanted’ prior to abandonment,
however, means that ‘few distinct work areas are recognisable,’ with the exception of Room 10 (in Area 3), perhaps an area of tool production (ibid).

Population estimates are difficult to calculate with the relatively small amount of excavated site data at House Creek Village, though the architectural patterns of Area 1 imply the presence of two household clusters and only one pitstructure – implying shared use and cooperation – a pattern likely reflected in Area 3 as well (ibid, 753). The presence of what appears to be a high status burial in Pitstructure 4 of the latter (Figure 93), too, sheds light on social organisation at the site. Of particular interest are the high proportion of complete or partially complete vessels not noted elsewhere, the placement of a large bear skull (perhaps with ritual implications), and the age of the associated female – a little younger than usually expected for high status individuals (ibid, 754).

Figure 93: Plan of Pitstructure 4 (Robinson and Brisbin 1986, 662).
Similar to other sites in some ways and different in others, the presence of unusual features should be borne in mind when contemplating internal and external influences, intra- and interregional contact, and systems of knowledge transfer and material exchange. A product of these systems, ‘the presence of small amounts of Olivella and Glycymeris shell indicate some fairly long-distance contact,’ as do several nonlocal items among the flaked lithic assemblage and minimal numbers of sherds from other (Cibola or Kayenta) regions, though it is intraregional contact – as represented by the ceramic assemblage – which is more widely represented (ibid).

Analysis
Despite the broad range of attribute values expressed in Table 6 (for length and basal width in particular) only one outlier value was recorded for the entire sample (for maximum width), so that the overwhelming majority of specimens studied represent an acceptable range of variation – an important observation considering the variety of forms described below. Base and blade types (Figure 94), for example, though typically straight to convex/excurvate, encompass a broad spectrum of forms, while typological assignments include characteristic Pueblo I-II types as well as those associated with the preceding Basketmaker and Archaic periods. Pictured in Figure 95 are those most commonly associated with the Pueblo I-II temporal and cultural assignment suggested for House Creek Village, comparable to Justice’s (2002, xx) Dolores type cluster and characterised by a thin, wide, triangular blade, narrow straight to expanded stem and long barbs. By contrast, Figure 96 represents those more typical of the preceding Basketmaker phases in the area, with traits comparable to Justice’s (2002, xix-xx) San Pedro and Livermore clusters, characterised by

| Table 6: Summary of attribute averages, range, and outlier values for House Creek Village. |
|-----------------------------------------------|----------|----------|----------|----------|----------|-----------|
| Weight (g)                                    | Mean     | Median   | Lowest   | Highest  | Range    | % Outlier |
|                                              | 1.89     | 1.19     | 0.74     | 4.57     | 3.83     | 0.00      |
| Length (mm)                                   | 30.09    | 29.57    | 20.80    | 42.96    | 22.16    | 0.00      |
| Width (mm)                                    | 18.06    | 17.50    | 14.97    | 23.36    | 8.39     | 12.50     |
| Thickness (mm)                                | 4.19     | 4.64     | 1.54     | 5.48     | 3.94     | 0.00      |
| Basal Width (mm)                              | 13.74    | 13.39    | 4.19     | 21.65    | 17.46    | 0.00      |
| Neck Width (mm)                               | 9.33     | 9.31     | 4.52     | 18.13    | 13.61    | 0.00      |
corner notched to expanded stems, straight to convex bases, large notches and (for the latter) robust serration. One of the largest (complete/near complete) points in the sample, recovered from Pitstructure 4, demonstrates features representative of an even earlier Late Archaic assignment, with similar characteristics to those defined by the region’s Gypsum and Durango type clusters, while a couple of unprovenienced specimens recovered from the site correspond with the Middle Archaic Northern Side Notched assignment (ibid) (Figure 97).

Brief observation of the combination analyses described in Figure 98 suggests that three-dimensional descriptors – weight and thickness in particular – provide the clearest impression of morphologically-derived clustering within the sample. Located towards the lower end of the trend line, the cluster highlighted here corresponds directly with the Pueblo I-II group (Figure 95). Typically lighter and thinner than the rest, this group represents the most consistent, dominant point type at House Creek Village. By contrast, the two-
dimensional descriptors – length and width – used fewer specimens and lacked any obvious correlation, a product, most likely, of poor attribute visibility and the fact that length (and, to a lesser extent, width), is more subject to change (via rejuvenation and reworking processes) than, say, thickness. At this site visibility was especially poor; only 50 percent of the sample had four of the six quantitative attributes selected for study; thickness the most visible, accounting for 87.5 percent, followed by neck width and the qualitative measures of blade and base type (Figure 99). That the sample included such a large proportion of damaged/incomplete specimens had a direct effect upon the applicability of each classification scheme (based on the presence or absence of required attributes); only 50 percent were viable for inclusion in Shott and Hughes’ calculations, 68.8 percent for Hildebrandt and King (Figure 100).

For Shott’s (1997) approach, all but the four-variable solution agreed upon a predominantly arrow-based system with the presence of some darts or dart-like features (Figure 101). Oddly, the four-variable solution produced an
Figure 98: Simple combination analyses applied to the House Creek Village specimens.

Figure 99: Comparable visibility of quantitative and qualitative attributes among the House Creek Village specimens.

Figure 100: Percentage of total specimens used in each classification approach for the House Creek Village site.
exclusively dart-based classification (distorted, perhaps, by fluctuations in the length variable), though, as before, it is the one-variable solution which will be used in this study. Generally speaking, the results derived from Hughes’ (1998) methods provide a similar picture to that of Shott’s. In this case, both TSA and TP values support a predominantly arrow-based system, the latter with limited extension into dart territory, while the range of mass values overlaps those assigned to both systems, but with the majority falling below 3g – the lower value suggested for darts (Figure 102). Hildebrandt and King’s (2012) index scores, on the other hand, produced a much more even point ratio (with only a marginally higher percentage of darts), representative of neither a dart nor arrow dominant system, but a mixture of the two (Figure 103).

**Figure 101:** Shott’s multiple and single variable solutions for the House Creek Village specimens.

**Figure 102:** Hughes’ TSA, TP, and mass values for the House Creek Village specimens. The blue dashed lines for TSA and TP represent the threshold value for dart-based systems, the red lines arrow-based systems.
While the results derived from Shott and Hughes’ methods point towards a predominantly arrow-based system (centred on the morphologically consistent Pueblo I-II type cluster described in the combination analyses) and account for the limited presence of darts or dart-like features within the assemblage, Hildebrandt and King’s approach provides a more even distribution. In this case, the dart-arrow index produced a higher number of dart than arrow values, though only by 9 percent (a difference of a single specimen), so that there does not appear to be a dominant projectile system in use. If applicability is taken into consideration, it seems that Hildebrandt and King’s results provide the most representative picture. However, that it stands in contrast with both other schemes, as well as traditional assumptions regarding the technological preferences (for the bow and arrow) associated with Pueblo I-II, gives cause for concern. While characteristic Pueblo I-II (Dolores cluster) ‘arrow’ points represent the most consistent form represented at House Creek Village (Figure 95), the presence of other seemingly older ‘dart’ points or dart traits cannot be ignored, and that neither form was restricted to a single location, but recovered from both areas (1 and 3), and from the same specific context within Area 3, hints at the potential for contemporaneity. The implication here, if we assume each form represents a different projectile system, is that knowledge (if not active use) of both the dart and atlatl and the bow and arrow existed at the site.

It is also of interest that one of the largest points in the sample was recovered from the same context (Pitstructure 4) as several of the Pueblo I-II...
points, despite demonstrating features more typical of Late Archaic forms. While other (unprovenienced) Archaic forms were recovered from the site, hinting at interaction with ancestral styles and projectile systems beyond the more recent past, either replicated, left by previous occupants, or else consciously collected and deposited by those at House Creek Village, the precise nature of such pieces is difficult to establish. It might be suggested, however, that Pitstructure 4, with its associated burial and ‘unusual’ accompaniments (including the bear skull and ceramic vessels), provides a suitable context for this more atypical form, likely associated with a symbolic rather than practical function. For more closely (temporally) related specimens, such as the Basketmaker and early Pueblo forms, particularly when in relatively even numbers, the distinction between practical and symbolic or ‘ritual’ utilisation is more difficult to establish. Indeed, at House Creek Village it is not unlikely that the range in point forms represents a broader functional shift from one system to another as people adapted to a new form of technology (the bow and arrow), rather than an explicit act of ritual symbolism.
6.1.7. Marshview Hamlet 5MT2235 \((N = 22)\)

**Context**

Excavated in 1978 as part of the Dolores Archaeological Project, Marshview Hamlet represents a small Pueblo III habitation site (dates derived from dendrochronology and archaeomagnetism, as well as artefact sequences) within the Sagehen Flats Locality, a region characterised by its low humidity, mild summers and cold, dry winters (Wilshusen 1988, 17-18). The site, comprising a ‘small pitstructure… and an indeterminate number of small surface structures’ characteristic of an associated roomblock, occupies a small hillock surrounded by numerous intermittent drainages that converge along the valley floor and flow towards the Dolores River on the eastern boundary (Figure 104). ‘Before and after the main occupation of the site’ – attributed to the DAP’s ‘Sundial Phase’ (AD1050-1200) or late Pueblo II-Pueblo III – ‘hunting bands probably used the favourable position of Marshview Hamlet as a promontory overlooking the Sagehen Flats,’ attesting to the suitability of its location within the wider landscape over an extended period of time (ibid, 49). At 2103masl, ‘in an area where beans, wheat, and corn are currently cultivated… dryland farming produces adequate yields during years of average precipitation,’ while

**Figure 104:** Topographic map of Marshview Hamlet (left) and its major cultural units (right) (Wilshusen 1988, 18; 27).
'the surrounding community of willow, thistle, and numerous grasses… [provide] a haven for small game and birds… the marsh… a seasonal stop for migratory waterfowl' (ibid, 18). Set within this context,

'[The] materials and artefacts collection from Marshview Hamlet indicate the prehistoric inhabitants were a family of horticulturalists subsisting on crops grown in fields near the site… [and that they] augmented their diet by hunting small game.'
(Wilshusen 1988, 17)

While the majority of ceramic material recovered represents the main late Pueblo II or early Pueblo III occupation at the site (including diagnostic Mancos Corrugated, Dolores Corrugated, Mancos Black-on-white, and McElmo Black-on-white types), a limited number of sherds from earlier types were also recorded, though ‘their scarcity and position of occurrence indicate they are not directly associated with the primary occupation (AD1100-1150)’ (ibid, 40). Manos, metates, hammerstones, and peckingstones feature among the non-flaked lithic assemblage, alongside a relatively high number (538) of flaked lithic implements, ‘tentatively interpreted as a result of multiple uses of the site as a hunting camp, in addition to the habitation during the Sundial Phase’ (ibid). Unfortunately, overlapping occupations, disturbance, and the expedient nature of the assemblage combine to produce a rather mixed impression of presumed multiple activities, the (heavily damaged) projectile point collection revealing seemingly little about temporally associated distributions and preferences in material (ibid, 44-45). For the most part, however, lithic raw materials appear to be locally sourced – ‘with only a few exceptions’ – and ceramic styles common to the Mesa Verde region – ‘with only a few trade wares noted’ (ibid, 49).

Despite the virtual destruction of the roomblock (probably in historic times), similarities in material culture provide sound evidence for its contemporaneity with the pitstructure (ibid, 25-26). During the abandonment process that followed, the latter received a multiple burial, though ‘the relationship of the burial to the main occupation of the site remains uncertain’ (ibid, 17), as do the associated social implications. Moreover, while the site’s architecture ‘showed evidence of at least one major remodelling, no way exists
to accurately measure the length of time the site was occupied,’ presumably no longer than a single generation (ibid, 50). According to Wilshusen (1988, 50):

‘During late Pueblo II times the majority of people in the Mesa Verde region were living in pueblos, with field houses used for seasonal or daily occupation away from the pueblo. Marshview is interpreted as being part of this lifeway as an agricultural outpost connected by social ties with some pueblo in the sector.’

In this sense, ‘the main occupation of the site may represent a family having left a pueblo because of economic or social reasons,’ and while ‘it is not evident why a single social unit had to locate itself over 5km from the nearest large pueblo’ (the likely centre for trade and social interaction), that ‘two other Sundial Phase residential sites are within 2km of Marshview Hamlet’ ensure it ‘is not a completely isolated phenomenon’ (ibid). In the absence of more detailed information, thus, it seems ‘the site is explained best as a final attempt to exploit the Dolores River valley’ (ibid) centred primarily (though not exclusively) on horticultural practices attributed to the Pueblo III period. That the site received visits from other groups, both before and after this period, however, makes it an interesting site for studying variability in subsistence technologies.

Analysis
Quantitative attribute visibility was particularly poor at Marshview Hamlet, with <40 percent of the sample represented by weight, length, and neck width measurements (Figure 105), while qualitative measures of blade and base type

![Attribute Visibility](image)

**Figure 105:** Comparable visibility of quantitative and qualitative attributes among the Marshview Hamlet specimens.
were typically easier to record, the former predominantly within the straight to 
excurvate range, the latter straight to convex (with a few concave/indented) 
(Figure 106). Of those studied, only two outlier values were derived (one for 
weight, one for thickness), the majority representing a fair – but acceptable – 
range in variation (Table 7).

Combination analyses using poorly represented length and weight values 
(each utilising <50 percent of the sample) provide little evidence of 
morphological clusters within this range, while width and thickness – 
considerably better represented at Marshview Hamlet – combine to describe 
two broadly-defined groups (Figure 107). Towards the lower end of the scale 
are smaller, triangular points characteristic of Justice’s (2002, 261) Western 
Triangular type cluster (and the site’s main Pueblo II-III occupation), as well as 
an unusual bevel-edged specimen (top row, Figure 108). The upper end, on the

Table 7: Summary of attribute averages, range, and outlier values for Marshview Hamlet.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Mean</th>
<th>Median</th>
<th>Lowest Value</th>
<th>Highest Value</th>
<th>Range</th>
<th>% Outlier Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (g)</td>
<td>1.90</td>
<td>1.42</td>
<td>0.94</td>
<td>3.95</td>
<td>3.01</td>
<td>14.29</td>
</tr>
<tr>
<td>Length (mm)</td>
<td>26.70</td>
<td>25.09</td>
<td>21.77</td>
<td>33.52</td>
<td>11.75</td>
<td>0.00</td>
</tr>
<tr>
<td>Width (mm)</td>
<td>16.95</td>
<td>18.08</td>
<td>8.69</td>
<td>24.76</td>
<td>16.07</td>
<td>0.00</td>
</tr>
<tr>
<td>Thickness (mm)</td>
<td>4.98</td>
<td>5.09</td>
<td>3.10</td>
<td>7.83</td>
<td>4.73</td>
<td>5.88</td>
</tr>
<tr>
<td>Basal Width (mm)</td>
<td>13.02</td>
<td>12.89</td>
<td>6.26</td>
<td>18.59</td>
<td>12.33</td>
<td>0.00</td>
</tr>
<tr>
<td>Neck Width (mm)</td>
<td>10.35</td>
<td>10.41</td>
<td>7.32</td>
<td>12.99</td>
<td>5.67</td>
<td>0.00</td>
</tr>
</tbody>
</table>
other hand, features a broader mix of typically larger specimens, most of which are traditionally associated with earlier periods (*Figure 109*). The expression of morphological diversity among this group, combined with the presence of larger triangular forms also characteristic of the later Western Triangular type (bottom...
row, *Figure 110*), however, limits the potential for a simple dart-arrow divide within the collection.

![Image of point forms](image)

*Figure 109*: A diverse range of point forms was recovered from Marshview Hamlet, among them, many typical of earlier Archaic and Basketmaker phases in the region.

As expected, the limited visibility of various attributes had a direct effect upon the applicability of each classification scheme (*Figure 110*; Shott and Hughes’ methods utilised 54.4 percent of the sample, Hildebrandt and King’s only 36.4 percent), something to be borne in mind when forming subsequent interpretations. Shott’s (1997) approach produced a broad spectrum of results, best characterised by the one variable solution, for which there was an equal

![Classification Application graph](image)

*Figure 110*: Percentage of total specimens used in each classification approach for the Marshview Hamlet site.
division of dart and arrow points (Figure 11). For Hughes’ (1998) TSA and TP values, on the other hand, the majority fell below the arrow threshold, and although there was clear overlap into dart territory, point mass, too, tended to fall below the lower value stated for darts (3g), thus producing a predominantly arrow-based result (Figure 112). This stands in stark contrast to Hildebrandt and King’s (2012) index, which represents a predominantly dart-based system, with only limited presence of arrow technology (Figure 113).

![Multiple and Single Variable Solutions](image)

Figure 11: Shott’s multiple and single variable solutions for the Marshview Hamlet specimens.

![TSA, TP, and Mass Values](image)

Figure 112: Hughes’ TSA, TP, and mass values for the Marshview Hamlet specimens. The blue dashed lines for TSA and TP represent the threshold value for dart-based systems, the red lines arrow-based systems.
Summary
The finds recovered from Marshview Hamlet reveal a diverse assortment of point types stretching far beyond the site’s main Pueblo II-III temporal-cultural assignment. In this sense, it is very much a 'mixed bag', lacking any obvious distribution pattern or dominant point type (and associated projectile technology). The assemblage comprises a mixture of heavily damaged specimens scattered across a commonly reused and thus disturbed context, combining evidence of later triangular forms (characteristic of Pueblo arrow point technologies) with those typical of earlier (Archaic and Basketmaker dart-dominant) phases in the region. That such a large proportion of the sample were incomplete (and therefore lacked many of the necessary attributes for making clear morphological distinctions) had obvious implications for the applicability of each classification scheme, the results of which spanned the full range from dart-dominant to arrow-dominant systems. Variability in the size of stylistically similar points, such of the Western Triangular type, further blurred the division between traditionally-defined large-dart and small-arrow point traditions, helping explain, in part, the differences described by each approach.

In the absence of a more clearly defined context (and a lack of information regarding intra-site temporal and spatial relationships), the presence of specimens traditionally associated with earlier, pre-introduction phases presumably stems from the use of the site outside of the main Pueblo II-III occupation, reminding us of the link between locational popularity and diversity in material culture, as more visitors equals greater opportunity for the disposal.
and (re)discovery of different forms (and their associated technologies). Whether the Pueblo II-III occupants actively engaged with these earlier forms by combining traditional dart-based and contemporary arrow-based practices remains to be seen. The commonality of ‘larger’ forms at Marshview Hamlet, nonetheless, provides useful insight into how we view the proportional visibility and apparent dominance of one technology over another. That traditional dart-based systems prevailed for centuries – millennia even – before the bow and arrow was introduced makes them considerably more visible at sites like this one, whose occupation(s), temporary or permanent, spans the change in emphasis from one technology to another. In a similar fashion, we must also be mindful of the site’s overall subsistence focus, whether animal or plant-based, the visibility of dominant tool systems potentially much poorer at the latter (as is the case at Marshview Hamlet) as occupants typically appear less engaged in hunting practices.
6.1.8. Study Area One: A Summary of the Southwest

For the Southwest, at least, a *simple* and *abrupt* shift from larger dart points to smaller arrow points does not hold true. Indeed, the supposed ‘replacement’ of the dart and atlatl by the bow and arrow is much more complex, as is the distinction between the two projectile systems in the archaeological record. Based on the temporal-cultural assignments awarded to each of the sites studied (*Figure 114*), traditional assumptions (based on size) would expect a clear trend from larger to smaller attribute values through time. As the data presented in *Figures 115-120* attests to, this simply is not the case. Sure enough, Cougar Springs Cave – the Basketmaker II, pre-introduction of the bow and arrow site – averages highest for each of the attributes studied, a difference confirmed by t-test probability scores of <1 percent compared to post-introduction sites (except Payne), thus supporting claims of a basic difference in size. The range in variation expressed across the study area sample more broadly, however, provides evidence for extensive morphological and – in effect – technological diversity, as overlapping dart and arrow values cause any proposed *clear* lines of division to become blurred.

*Figure 114*: Temporal-cultural assignments of each site relative to the other within the Southwest study area.
Figure 115: Weight data (with and without outliers) for the Southwest sites.

Figure 116: Length data (with and without outliers) for the Southwest sites.
Figure 117: Width data (with and without outliers) for the Southwest sites.

Figure 118: Thickness data (with and without outliers) for the Southwest sites.
Figure 119: Basal width data (with and without outliers) for the Southwest sites.

Figure 120: Neck width data (with and without outliers) for the Southwest sites.
As expected, the transitional Basketmaker III site – Payne – describes an especially broad range in point morphology, a product – most likely – of experimentation and innovation as new and old technologies converged at the site. This variability in point form is, however, far from exclusive, with later sites revealing similarly diverse trends. Irrespective of the dataset used (modified or unmodified) the same general patterns persist, and although the presence of extreme values becomes less pronounced upon the removal of outliers, considerable variation within and morphological overlap between sites assigned to different phases remains clear. With or without the outlier values, then, the expected large to small, varied to consistent trend in point morphology typically associated with the (supposedly abrupt) adoption of a new technology is lacking. At Duckfoot and Rio Vista Village (Pueblo I-Pueblo II sites), for example, morphological variation within and comparability between the various forms identified complicates the inherently divisive classification process, and although type clusters (relative to dart and arrow forms) could be identified in some cases, morphological overlap was prevalent throughout.

At the extreme ends of the scale, dart forms tended to sit above (i.e. were larger than) arrow forms on the trend line (see various combination analyses), but this does not account for the various shades of grey in between. Indeed, at Periman Hamlet, the placement of an Archaic specimen near the centre of the trend line confirms the limitations of a simple correlation between point size and antiquity. Compared to the various ‘dart’ types featured at the post-introduction sites, ‘arrow’ types were typically more consistent (morphologically), a reflection – perhaps – of their more dominant status. That earlier forms (variable as they may be) persisted until later times, does, however, suggest that they retained some level of importance within society, economic or otherwise, and that the transition from one technology to another was neither simple nor abrupt. Generally speaking, there is an absence of direct evidence for ‘special’ contexts associated exclusively with these earlier forms. Instead, a mixture of point types recovered from the same or associated contexts hints at contemporary/complimentary use of both darts and arrows, and their respective launch devices. Thus, the data, while in the broadest sense attests to a shift towards the growing popularity of smaller ‘arrow’ forms, provides evidence of a decidedly more complex process of change than
traditionally proposed, accounting for the introduction, adoption, and normalisation of a new technology *alongside* an older one.

In a similar manner to the attribute analyses discussed above, traditional perceptions of the introduction of (and ability to distinguish) a new technology would have the results derived from various classification schemes clearly describe the decreasing popularity of the dart and atlatl relative to the increasing popularity of the bow and arrow. Again, perhaps unsurprisingly, the patterns revealed in this study lack such simplicity. Sure enough, all three of the approaches tested here (Shott 1997, Hughes 1998, Hildebrandt and King 2012; *Figures 121-123* respectively), on average, align themselves with the adoption of ‘arrow’ forms during the Basketermaker III phase (as noted in the differences between the results for Cougar Springs and Payne). However, the presence of arrow features at Cougar Springs and dart features among the rest, as in Shott’s (1997) single variable solution, demonstrates considerable technological overlap as an arrow:dart ratio of roughly 3:1 persists. In this case, the data fails to describe the predicted decrease in dart types (over a period of more than 500 years) associated with post-introduction sites. Instead, the ratio remains fairly constant throughout and even *increases* at the site with the latest occupation – Marshview Hamlet (though the effects of site popularity, reuse, and disturbed contexts must be borne in mind here).

Hughes’ (1998) TSA, TP, and mass values, too, while typically placed within the range proposed for arrow types, reveal significant crossover into dart

![Shott's One Variable Solution](image)

*Figure 121: The results derived from Shott’s (1997) single variable classification solution for the Southwest sites.*
territory and, thus, the maintenance of dart forms at later sites. Generally speaking, Hildebrandt and King’s (2012) dart-arrow index produces an even higher proportion of dart values, with significant implications for the interpretation of this period of technological change. While a more comparable dart:ratio might be expected during the earlier, transitional Basketmaker phase

*Figure 122: The results derived from Hughes’ (1998) TSA, TP, and mass values for the Southwest sites, relative to the proposed dart (blue) and arrow (red) thresholds.*
(as at Payne), traditional accounts predict a more pronounced, arrow-dominant divide by the succeeding Pueblo periods. That the results derived from the two sites with the latest occupations (House Creek Village and Marshview Hamlet) tend towards a dart-dominant divide, then, is of particular interest. At Marshview, at least, this discrepancy might be explained, in part, by disturbed contexts, but with dart values maintained consistently at all sites in the study area, the presence of darts (or dart-like features) attests to their continued importance well into Pueblo times.

As expected, each classification approach produced a different result, highlighting the dangers of assuming that there exists a distinct difference between stone points used with the dart and atlatl and those used with the bow and arrow, and that this difference can be consistently determined. Differences range from subtle (as at Cougar Springs Cave) to absolute (as at Marshview Hamlet), and serve as a valuable reminder of the implications surrounding the creation and application of each method, and the link with attribute visibility. For the Southwest, Shott and Hughes’ approaches produced consistently equal scores, a result of their utilisation of the same maximum/shoulder width descriptor, while Hildebrandt and King’s approach – which used the more visible neck width descriptor – typically scored slightly higher (Figure 124). In this sense, it is possible that the different approaches used different (sub)samples from the available dataset, accounting for variability in the results produced and any associated interpretation.

In relation to this project’s key questions (refer to Figure 13), then, while a clear difference in size may hold true at the extreme ends of the scale, lines of

**Figure 123:** The results derived from Hildebrandt and King’s (2012) dart-arrow classification index for the Southwest sites.
division are typically more blurred than traditional assumptions account for, and in many cases qualitative and quantitative differences less distinctive than predicted. Combined with the results derived from each of the three classification schemes (and their associated applicability scores), thus, it appears that – for this study area at least – the identification and categorisation process is, in large part, a subjective one, and the change from dart- to arrow-based projectile systems far from simple and abrupt. In an area where flexibility was the key to survival and society effectively ‘in a constant state of cultural change’ (Fagan 1991, 247), this is hardly surprising. Although people had become increasingly dependent upon domesticated plant foods, faunal evidence attests to a continuation of hunting practices and, in effect, the maintenance of various projectile systems. That these practices were supplementary, however, may account for the lack of standardisation in point form (and associated launch device) reflected at some of the later sites. The diversification of assemblages at this time might also be linked to the movement of people across the landscape (refer to Figure 30), the implication being that traditions and innovations were disseminated on a large intra-regional scale, causing people to receive and experiment with a variety of different forms. With this borne in mind, interpretations regarding technological change in the Southwest should seek to avoid taking an exclusive, deterministic, and divisive approach, and instead attempt a more accommodating assessment of the process surrounding the interaction between old and new, tradition and innovation, the spearthrower and the bow.

Figure 124: Applicability scores for the classification schemes applied to each of the Southwest sites.
6.2. Study Area Two: The Northern Plains

Climate, landscape and the local economy

‘Despite the uniformity implied by their usual designation, the Great Plains exhibit much geographical diversity. Topographically, they include flatlands, tablelands, badlands, dunes, hills, stream valleys, and detached mountain masses.’

(Wedel 1983, 205)

As in Figure 125, ‘the Great Plains cover an enormous area of North America’s heartland,’ stretching ‘from the Rockies in the west to the Eastern Woodlands near the Mississippi… they are a grass sea that covers about a half-billion acres from Canada in the north to Mexico’s Rio Grande in the south’ (Fagan 1991, 120). The various subareas assigned to this vast expanse include the Central, Southern, and Northwestern Plains, and, the focus of this study, the Middle Missouri and Northeastern Periphery. The Plains ‘were, and still are, a harsh place to live, with often brutally hot summers and long, bitterly cold winters,’ yet, in a similar fashion to the Southwest, they represent ‘a very diverse

Figure 125: The distribution of sites studied (below, in red) within the broader Middle Missouri of the Plains’ various subareas (right) (adapted from Lehmer 1971, 29 & 98).
environment, where complicated changes in climatic conditions produce major variations in local rainfall and climate’ (ibid). Fagan (1991, 120) describes the circulation of three major air masses (from the Pacific, the Gulf of Mexico, and Canada), whereby:

‘… a strong westerly air flow over the Plains enhances arid conditions over the Western Plains. But there are constant local changes caused by ever altering air mass circulation patterns that weaken prevailing westerlies and allow moist tropical air over the grasslands. The result is constant variations in plant and animal distributions throughout the Plains…’

These variations are best expressed in the contrasting landscapes (and associated local economies) of the east and west. In the drier growing conditions of the west the environment was dominated by short-grass prairie and desert grassland, shifting to mixed- and tall-grass prairie – and a higher total forage production – further east (Figure 126). Naturally, this had a profound effect upon the development of suitable subsistence economies and

![Figure 126: Major grassland types on the Great Plains (left: Bamforth 1988, 59), and an example of mixed-grass prairie at Wind Cave National Park, South Dakota (right).](image)
technological/cultural solutions adopted in each of the Plains’ various subareas:

‘In the western shortgrass plains, hunting economies centred on bison procurement by individual and communal systems alike seem to have been the mainstay of human existence throughout. There was, however, an Altithermal interlude when bison and human populations both seem to have declined. Few archaeological sites of this period are known, except in the fringing mountain areas. Farther east, bison were supplemented by other game animals and relatively abundant vegetal foods that were not generally available except in limited quantities in the short-grass country. Here, eventually, under appropriate environmental conditions, food-producing subsistence economies based on a maize-bean-squash triad were developed or introduced, and greater population aggregates and densities resulted.’ (Wedel 1983, 235)

In the mixed tall-grass prairies of the Middle Missouri and Northeastern Periphery, an advantageous ecotone between grassland types (thus drawing on multiple resource bases), Late Woodland peoples (increasingly focussed upon horticultural pursuits) developed a more settled way of life characterised by the subsequent Plains Village cultures evolving across the eastern part of the region. According to Wedel (1983, 207):

‘Fertile, easily worked valleys bottom soils made possible an increasingly productive subsistence economy, often with sufficient crop surpluses to support trade with the nonhorticultural bison hunters to the west.’

Considering the blurred nature of boundaries between the Plains and its surrounding environment, these sorts of trade relationships likely extended even further. The eastern frontiers, for example, ‘pass imperceptibly into the Eastern Woodlands as annual rainfall rises and… prairie gives way to tall, lusher grasses, then woodland’ (Fagan 1991, 120). This borne in mind, the potential for movement between regions, and any resulting exchanges in ideas and materials, should not be underestimated.
Lifeways through time

During its earliest occupation (the Paleoindian period, up to c.6000BC), ‘the geographic centre of the Plains lay in the western grasslands,’ and was characterised by a sparse, scattered and transient population with large, distinctive projectile points used to hunt large game (Lehmer 1971, 30; see also Wedel 1983, 210). Although originally believed to have been used to tip thrusting or throwing spears (ibid), experimental studies (e.g. Frison and Bradley 1999, 23-25) have since produced data that confirms their effectiveness with atlatl darts, making it possible they served in either capacity. Later, during the Archaic period that followed, subsistence economies diversified as people began to rely upon a wider variety of game and vegetable foods (resulting from changes in climate, landscape, and the extinction of various mega fauna), with increasing evidence for the scheduling of economic activities, storage practices, and a proliferation in point styles (Fagan 1991, 126-128). In the eastern Plains, this Archaic lifeway – ‘the cyclical or scheduled hunting of small game, the gathering of seeds, tuber, nuts, berries, and other vegetal foods in season, and, when and where the opportunity existed, the hunting of bison – continued into the final centuries of the pre-Christian era and eventually gave rise to a number of locally and temporally distinct complexes, basically of eastern origin or else strongly influenced by eastern cultures’ (Wedel 1983, 224). Known as the Plains Woodland (c. 250BC-AD950), these complexes represent ‘a simple creek-valley hunting and gathering subsistence economy’ (ibid) where:

‘The majority of known [Plains Woodland] sites are in or adjacent to the smaller stream valleys, and the culture itself seems to have been strongly oriented toward the exploitation of the wooded bottom lands which reproduced in miniature the forest environment of the East.’

(Lehmer 1971, 31)

Eastern influences were also responsible for the introduction of pottery into the area, and the Plains Woodland trait list soon expanded to include a wide variety of comparable artefacts fashioned from stone, bone and shell. ‘Occasional shells of Pacific Coast origin indicate far-reaching trade relations’ to the West as well as the East, while evidence of ‘elaborate rituals in connection with the
disposal of the dead,’ such as burial mounds, demonstrate further similarities to the cultural practices of neighbouring Woodlands groups (ibid). A number of changes in projectile point form and size, too, ‘are thought to reflect the transition from the Late Archaic dart weapons system to a Middle or Late Woodland bow and arrow system’ (Wedel 1983, 227, see also Kornfeld et al. 2012), with traditional assumptions placing it the north as early as AD200, present and in widespread use towards the northeast no later than AD800 (Henning 2005, 162; see also Blitz 1988, 128-9; Thomas 2000, 48) (Figure 127). In this case, it appears to have been equivalent cultures to the north in the
Canadian Plains who were most influential. Here, the Avonlea complex and its associated projectile points (*Figure 128*) are thought to represent the first arrow tips and, thus, the Athapascans most likely responsible for the introduction of the small-point weapons systems southward, although ‘the cultural relationships between Avonlea in the north and similar projectile point assemblages in the region [remain] unclear’ (Kornfeld et al. 2010, 130).

For the most part, scholars agree upon a fairly rapid adoption of the bow and arrow across the Plains, although results from a recent review of the application of various classification schemes highlight the potential for an extended period of co-use (Walde 2014), to be borne in mind when observing any notable differences, subtle or distinct, in the collections studied below.

By c.AD800-900, when ‘climatic events were especially favourable to a dependence on gardening’ (Henning 2005, 178-9), the Woodland complexes of the eastern Plains gave way to others of more ‘sedentary character’ (Wedel 1983, 229). In contrast to the earliest occupants of the region, these ‘Plains Villages’ were geographically centred in the Middle Missouri and Central Plains subareas (Lehmer 1971, 32), the former the focus of sites in this study, and were based around a dual subsistence economy ‘combining horticulture in stream bottoms, and game and wild vegetable resources in wooded bottomlands and nearby grassy uplands’ (Wedel 1983, 229). Villages of the Initial Middle Missouri (AD900-1400) ‘shared a number of characteristics, including tightly organised, often fortified villages, rectangular semi-subterranean houses with long entrances,
intensive gardening, hunting and gathering, use of the bow and arrow, and increasing reliance on bison hunting’ (Henning 2005, 163). Lehmer (1971, 73) describes the arrow points of this period as ‘small, light, generally well-made objects of chipped stone,’ one form with fairly prominent side notches, the other unnotched, both with a tendency towards convex edges and bases ranging from concave through straight to convex (Figure 129), and, according to Wedel (1983, 229), ‘easily differentiated from the weapons of earlier times.’

As in much of the preceding Woodland complex, ‘Plains Village cultures seem to have derived from farther east’ (Lehmer 1971, 32), reflected, in part, by their broad range of ceramic, stone, bone, horn, shell, and other artefacts. As Wedel (1983, 207) describes:

‘Their [Plains Village] way of life – in its horticultural practices and crops, its houses and settlement patterns, its ceramic and other industries – reveals strong relationships with the Eastern Woodland cultures of the Mississippi-Ohio valley- whence the culture, and probably most of the people as well, were apparently derived. By contrast, the nonhorticultural, equestrian bison hunters of the short-grass steppe were only the last variants in a long succession of people following a “true” Plains life-way based on mobility, portability of possessions, and prime reliance on bison hunting.’

That the eastern and western peoples of the prehistoric Plains followed different lifeways does not, however, discount the exchange of materials and ideas between them (as attested to in the archaeological record), an integrative process which, on both an intra- and inter-regional scale, appears to have featured heavily in the development of Plains Woodland and Plains Village cultures. With material evidence connecting them with neighbouring (and, on occasion, far-flung) cultures in each of the cardinal directions, the relationship between external and internal influences (and their subsequent effect upon technological and socio-cultural developments) is likely complex. The study of sites attributed to the earlier village traditions of the Middle Missouri (a period when the bow and arrow had been well-established), as below, provides interesting insight into the relative presence or absence of these competing influences, including the remnants of previous traditions, as expressed in their stone point assemblages.
6.2.1. Mitchell 39DV2 \( (N = 161) \)

**Context**

‘Located on a bluff above Firesteel Creek, in the James River Valley of southeastern South Dakota’ (Figure 130), the remains at Mitchell reveal a large Initial Middle Missouri period Plains earthen lodge village dating c. AD1000-1150 (Karr et al. 2011, 281). The site, comprising at least 80 lodges – each of which ‘probably served an extended family group of parents, grandparents, children, grandchildren, aunts and uncles’ (Robinson and Hannus 2011, 26) – ‘was surrounded on the south and west by a palisade and ditch, and on the north and east by a steep bluff descending to the creek below’ (Karr et al. 2011, 281).

Following a series of earlier investigations, the Archaeology Laboratory of Augustana College assumed responsibility for the site in 1983 (later partnered with the University of Exeter’s Archaeology Department in 2003), and a climate-controlled ‘archeodome’ erected in 1999 in order to facilitate long-term

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**Figure 130**: The location of the Mitchell site regionally (left) and locally (right), set within the Middle Missouri of southeastern South Dakota (Karr et al. 2011, 282).
open area excavations (Robinson and Hannus 2011, forward). In this respect, Mitchell is unique. Unlike traditional approaches to Middle Missouri archaeology, typically focussed upon isolated house features, Mitchell provides the opportunity for a more comprehensive account of associated settlement and subsistence by realigning interpretations of intra- and inter-dwelling spaces and placing them within their broader socio-economic context. As Karr et al. (2011, 283) confirm,

‘Investigating the large, open areas between lodges at sites such as Mitchell is of critical importance for understanding prehistoric settlements… Many food-processing activities, especially those requiring large hearths and fires, and those occurring at an industrial scale, were likely performed outdoors of the Mitchell site where efficiency and facility were greater than inside earthen lodges. The size of the deposits at the site suggests large-scale, possibly communal activity, which has implications for understanding population dynamics and refining occupation chronology.’

Indeed, Mitchell’s ‘highly complex soil horizons that often crosscut one another and rarely continue across large areas of the site suggest extensive human interference’ (ibid, 284). Plant and animal remains hint at a combined subsistence strategy based primarily around key domesticates (corn, beans, and squash) and the American bison, (although evidence for a diverse diet – including fish, freshwater clams, ducks, geese, and wild fruits and nuts – should also be accounted for), the bones of which feature prominently throughout the site (Robinson and Hannus 2011, 20). That the meat of the latter was so lean meant that the people of Mitchell looked to supplement their diet with fat derived from the centre of the bones (bone grease), as evidenced by the fractured bone deposits revealed during excavation (Areas A and C – Figure 131 – represent normal roasting debris and bone grease processing residue, respectively) (Karr et al. 2011, 284). The scale at which this task was carried out (i.e. the size of the deposits) serves as confirmation of its value to the local (and perhaps more distant) economy of the region, as well as the continued importance of hunting (i.e. the use of projectile systems) within the Plains Village tradition.
According to Karr et al. (2011, 284), ‘the complex structure of the site is further complicated by the discovery of items of special meaning.’ As Robinson and Hannus (2011, 34) suggest,
'Not all objects found at the village had applications related to survival. Non-pragmatic matters such as decoration and recreation figured in daily life, as well.'

Items manufactured from mollusc shell – some traded from as far away as the Gulf of Mexico – for example, evidence careful workmanship and the manufacture of likely gaming pieces, jewellery and clothing decoration (ibid, 35). A collection of worked bone artefacts (including a carved whistle, two decorated knife handles, and a highly polished projectile point) found together in a tightly sealed context, too, appear to have ‘special’ meaning, with nearby finds including ‘Mississippian-influenced ceramics, Avonlea projectile points, and ceremonial goods that indicate long-distance cultural interaction’ (Karr et al. 2011, 281-284). ‘The nature of these relationships remains unclear, but Mitchell appears to be at the crossroads of cultural influence extending from the Canadian Plains to the American Bottomlands’ (ibid, 285), and therefore represents an important link between physically and culturally diverse environments (and associated favoured technologies). Considered in this light, Karr et al. (2011, 281) suggest that:

‘The Mitchell site may have represented an important processing centre for trade goods, especially products derived from bison. This hypothesis is supported by the large-scale bone marrow and bone grease processing activities apparent in the archaeological record and by evidence for long-distance interaction with cultural groups hundreds of miles from the Mitchell site, including the Mississippian cultural zone centred around Cahokia and the Avonlea zone centred on the Canadian Plains.’

In the absence of evidence for conflict or warfare, thus, the site’s associated palisade may well be explained as ‘a means of protecting those trade interests from destruction by others or by natural dangers such as animals and fires’ (Karr et al. 2011, 281) rather than an outright fortification, and the site peacefully abandoned (and relocated) for reasons pertaining to the exhaustion of local resources as opposed to impending external pressures. That Mitchell was so well-connected (and thus well-informed) has clear implications for the
absorption of new materials and cultural ideals, to be borne in mind when reviewing the relative presence or absence of technological diversity among the site’s projectile point collection.

**Analysis**

As in Table 8, a fairly broad range of variation persists across the collection, with outliers recorded in each of the six attribute categories. Accompanied by the results derived from the various combination analyses (Figure 13), it appears that this variation was introduced mainly by the outlier values and, as such, is not necessarily typical of the collection more broadly. Indeed, for the

<table>
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<th>Attribute</th>
<th>Mean</th>
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<th>Lowest Value</th>
<th>Highest Value</th>
<th>Range</th>
<th>% Outlier Values</th>
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<td>23.86</td>
<td>13.35</td>
<td>4.93</td>
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<td>7.57</td>
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<td>15.24</td>
<td>2.61</td>
</tr>
<tr>
<td>Neck Width (mm)</td>
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<td>9.54</td>
<td>7.00</td>
<td>15.86</td>
<td>8.86</td>
<td>4.03</td>
</tr>
</tbody>
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**Figure 132**: Simple combination analyses applied to the Mitchell specimens, the dominant cluster highlighted in red.
most part, the points recovered from Mitchell tend to cluster towards the lower end of the scale, with specimens generally in close vicinity to the trend line (i.e. similar in terms of shape). Notched and unnotched forms associated with the site’s (arrow-based) Initial Middle Missouri temporal-cultural assignment (refer to Figure 129) characterise this dominant cluster, although at Mitchell the former side-notched type is the more common of the two (Figure 133). Excepting the presence of an unusual curated/reworked Paleoindian point, the ‘outliers’ described in the combination analyses describe similar – only larger – manifestations of these forms (Figure 134), leaving associated interpretations of function – whether dart- or arrow-based – open to debate.

The most commonly-used material type at Mitchell is Knife River flint, with a relatively smaller number of points manufactured from locally sourced cobble cherts and Bijou Hills orthoquartzite. More or less subtle variations in size, shape, and quality of execution are evidenced in each, from large to small,
finely to roughly worked specimens (Figure 135). Generally speaking, the majority of the collection falls toward the smaller, cruder end of the scale, describing a fairly ‘expedient’ approach to the manufacture of an arrow-based technology. The more finely-worked specimens, on the other hand, demonstrate excellent workmanship, seemingly deliberate attention to detail and, rather intriguingly, Avonlea-like (and in one case, Mississippian) type characteristics (Figure 136, refer also to Figure 128). That traded (or else externally-influenced) forms were of a seemingly higher quality and, for the most part, undamaged, implies a rather less utilitarian function than the more typical Mitchell point type.

A study of base type reveals a mixture of styles among the Mitchell collection, both convex, straight and concave (the latter predominantly attributed to the more finely-worked group), whereas blade type sits consistently within the

![Figure 135: Specimens manufactured from Knife River flint (left) and Bijou Hills orthoquartzite (right), encompassing a broad spectrum of both size and quality of execution. The latter spans the full range from retouched flake to roughly- and finely-worked pieces.](image1)

![Figure 136: Finely-worked specimens recovered from the Mitchell site, including those with Avonlea-like characteristics and the Mississippian ‘Cahokia’ point (far right).](image2)
straight to excursive range, irrespective of point type (Figure 137).

Attribute visibility is fairly good at the site (Figure 138), scoring highest for thickness and blade type (98.8 and 96.9 percent, respectively), and lowest in the weight and length categories (59.0 and 65.2 percent, respectively). Of particular interest is that overall width is more visible than neck width, having a direct effect upon the relative applicability of the three classification schemes tested. On this occasion, Shott (1997) and Hughes’ (1998) approaches score just over 10 percent higher than Hildebrandt and King’s (2012) (Figure 139).

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**Figure 137:** Basic qualitative attribute values for the Mitchell specimens.

**Figure 138:** Comparable visibility of quantitative and qualitative attributes among the Mitchell specimens.
Shott’s (1997) single and multiple variable solutions produce a consistently arrow-dominant result for the site (Figure 140). By the same merits, the overwhelming majority of TSA and TP values calculated using Hughes’ (1998) approach fall within the proposed arrow range, and point mass typically below the lower (3g) limit suggested for darts (Figure 141). The results derived from Hildebrandt and King’s (2012) dart-arrow index, on the other hand, reveal a rather more dart-dominant system (with a dart:arrow ratio of roughly 3:1, Figure 142), standing in stark contrast to both Shott and Hughes schemes, and the typically arrow-based assignment awarded to the site’s characteristic notched and unnotched forms.

Figure 139: Percentage of total specimens used in each classification approach for the Mitchell site.

Figure 140: Shott’s multiple and single variable solutions for the Mitchell specimens.
Summary

Despite the range in variation described in Table 8, the Mitchell site comprises a fairly consistent collection of projectile points, as characterised by the expected Middle Missouri notched and unnotched point types associated with its primarily arrow-based cultural-temporal assignment. It appears, thus, that any definitive differences within the sample (i.e. deviations from the dominant type clusters defined in Figure 13) are a product of unusually large pieces (i.e. outliers) rather than explicit, widespread diversity in point form (and associated projectile technology). More or less subtle differences in morphology are present, but the majority of the collection describes a clear tendency towards the lower end of

Figure 141: Hughes’ TSA, TP, and mass values for the Mitchell specimens. The blue dashed lines for TSA and TP represent the threshold value for dart-based systems, the red lines arrow-based systems.

Figure 142: Hildebrandt and King’s Dart-Arrow Index values for the Mitchell specimens.
the scale, accounting for the predominantly arrow-based results produced by Shott (1997) and Hughes’ (1998) classification methods. This stands in close agreement with traditional accounts regarding the standardisation of bow and arrow technology across the Plains by AD1000 (and relative absence of ‘darts’), as evidenced by an overwhelming preference for smaller forms. That Hildebrandt and King’s (2012) index produced such a contrasting result is, therefore, especially intriguing, for the presence of larger manifestations of these forms (as in Figure 134) is not enough to account for such a high proportion of ‘darts’ at the site. In this case, a possible explanation may be that the neck width value used to derive the relevant dart/arrow threshold in their index is inadequate (i.e. unrepresentative) for the Plains types described here (an idea to be explored in later inter-area discussions).

Beyond the more ‘conventional’ forms discussed, the presence of finely-worked specimens indicative of external influences provides valuable insight into potentially non-utilitarian pieces. Those displaying characteristic Avonlea-like and Mississippian traits, for example, support claims that Mitchell was engaged in long-distance cultural interaction and innovation, while an apparently curated and reworked Paleoindian point provides a link with former tradition. Their relatively small proportion, completeness, and closely-associated recovery contexts (the Avonlea-type pieces, for example, were recovered from an area less than one quarter of the size of the total excavation) combine to support the notion that these were more likely ‘special’ pieces that served a different – perhaps symbolic – function compared to the others. That this group straddles the morphological range attributed to both larger (outlier) and smaller forms (i.e. darts and arrows), however, limits the potential for an association between ‘special’ pieces and a given projectile technology. In this case, the role of larger and more unusual specimens remains open to debate, although the maintenance of earlier technologies in a well-connected (i.e. ‘up-to-date’) and otherwise predominantly ‘arrow-based’ environment seems limited at best.
6.2.2. Cattle Oiler 39ST224 \((N = 118)\)

**Context**

One of several sites located along the Missouri River to be excavated during the River Basin Surveys salvage project (which ran from 1945-1969), Cattle Oiler – a prehistoric village of bison hunters and horticulturalists – was tested in 1956 with extensive archaeological investigations following in 1964 and 1966 (Ludwickson et al. 1993, 153). Located on the west bank of the river (Figure 143), it 'contained over 30 large oval depressions (house ruins) in the sodded surface, as well as additional archaeological features exposed in the face of the cut bank,' and, on this occasion, 'no fortification system was observed either on aerial photographs or in trenches dug to find such feature' (ibid). According to studies of associated material culture, the site’s major (temporal-cultural) component belongs to the Initial Middle Missouri (c. AD1000-1100), although limited extension into the Extended Middle Missouri (c. AD1200-1300) was also evidenced (Rogers Archaeology Lab 2013).

*Figure 143: A map of the Cattle Oiler site (Moerman and Jones 1966, in Rogers Archaeology 2013)*
Over the course of the investigations ‘cumulatively, four IMM houses and one EMM house were completely excavated (or nearly so), and two other IMM houses... substantially tested’ (Ludwickson et al. 1993, 153), ‘the material culture of each group... enmeshed with the other’ (Rogers Archaeology Lab 2013). In this sense, Cattle Oiler is fairly unique, for ‘no other site has produced such clear evidence of occupation by people of both variants of the Middle Missouri tradition’ (Ludwickson et al. 1993, 153). For the most part, the archaeological record suggests an abandonment of similar sites located further south along the river between AD1100 and 1200 (before the beginning of the EMM phase), raising questions about the relationship between the two components at Cattle Oiler, whether an earlier intrusion or a later adoption of the site by EMM groups (Rogers Archaeology Lab 2013).

Among the thousands of artefacts recovered from the site, ‘only a small number of artefacts throw light on the external relationships of the site occupants, and by extension, of the Middle Missouri tradition as a whole’ (Ludwickson et al. 1993, 155), including the effects of external influences upon technological adaptation in the Big Bend region of the Plains. Among the more exotic artefacts featured at Cattle Oiler are a pulley-type ear spool, eight marine shell artefacts, seven freshwater snail shell beads, and three catlinite pieces (ibid). Excepting the catlinite, most of these are attributed to the Initial Middle Missouri component, a phase which saw comparably greater interaction with distant locales – in particular, within the Mississippian trade net:

‘The Extended Middle Missouri variant virtually lacks evidence for extensive trade in exotic artefacts from the east and south (i.e. with Mississippians). Early EMM was contemporary with the Cahokian florescence but did not participate in the trade. This is one significant difference between the IMM and EMM. A small amount of exotic goods occurs, which may have come via IMM sources, but the EMM was apparently outside the periphery of Mississippian trade.’

(Ludwickson et al. 1993, 164)

Whether this affected the nature and composition of stone tool technologies at the site (and the inclusion of ‘special’ items) is unclear, although fluctuations in external (local and non-local) influences should always be borne in mind.
Analysis

A broad range in variation existed at Cattle Oiler, with outliers recorded for each of the six attribute categories listed (Table 9). For the most part, the collection clusters toward the lower (smaller) end of the scale (as in the combination analyses, Figure 14), standing in agreement with traditional accounts of a preference for arrow-based projectile technologies on the Plains during the Initial Middle Missouri period. That being said, a fair proportion of the data spreads further up the scale (the size-shape correlation weakening as the values become larger and increasingly dispersed), setting the cluster in a more ‘diverse’ context. In this case, variation exists on two levels: across the

| Table 9: Summary of attribute averages, range, and outlier values for Cattle Oiler. |
|----------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                      | Mean            | Median          | Lowest Value    | Highest Value   | Range           | % Outlier Values |
| Weight (g)           | 2.58            | 1.53            | 0.25            | 12.82           | 12.57           | 13.79           |
| Length (mm)          | 29.82           | 27.14           | 13.33           | 80.16           | 66.83           | 4.30            |
| Width (mm)           | 16.15           | 15.33           | 10.48           | 28.62           | 18.14           | 11.93           |
| Thickness (mm)       | 4.30            | 3.75            | 1.85            | 10.62           | 8.77            | 8.62            |
| Basal Width (mm)     | 15.04           | 14.27           | 9.96            | 27.71           | 17.75           | 10.87           |
| Neck Width (mm)      | 10.28           | 9.92            | 5.92            | 20.68           | 14.76           | 9.76            |

Figure 144: Simple combination analyses applied to the Cattle Oiler specimens.
collection more broadly (between the dominant cluster and the rest) and, more specifically, among the non-typical values beyond the dominant (internally more consistent) cluster.

The variety depicted in Figure 145 provides a good indication of broader trends in morphological diversity at the site, covering a full large to small (and, hence, dart to arrow) point spectrum. Based on this image alone, it would be difficult to assign Cattle Oiler a dominant projectile technology. Proportionally, however, smaller notched and unnotched ‘arrow’ styles typical of the Initial Middle Missouri dominate (Figure 146, comparable to Figure 129), yet - even here – more or less subtle differences in size and shape (shoulder prominence, straightness of base, notch placement etc.) persist, attesting to flexibility in

![Image of points from Cattle Oiler, attesting to the presence of morphological diversity at the site.](image)

*Figure 145: A selection of points from Cattle Oiler, attesting to the presence of morphological diversity at the site.*

217
design and execution. By comparison, the ‘non-typical’ types (beyond the dominant cluster), as in Figure 147, reveal even greater diversity, among them forms comparable to the smaller notched and unnotched styles, as well as larger lanceolate and stemmed forms attributable to much earlier periods in the region (although some may well have served as knives rather than points). Further to this, as at Mitchell, a number of intermediary points – typically more finely worked and with a longer blade section than the more typical Middle Missouri form at Cattle Oiler – demonstrate characteristics of the Avonlea type further north, while a rather unique specimen reveals close links with the Mississippian culture to the southeast (Figure 148).

In the absence of any clear distribution pattern it seems that both larger and more finely-worked pieces coexisted alongside those more typically associated with the site’s (predominantly) Initial Middle Missouri temporal-cultural assignment, although more information on context is needed to before making definitive statements on this topic. Manufacturing materials predominately include Knife River flint, Burro Canyon orthoquartzite, and various cobble cherts, cross-cutting each of the various point types described

![Figure 146: A selection of notched and unnotched specimens typical of the site’s Middle Missouri temporal-cultural assignment.](image)
above. Generally speaking, those of the highest quality appear to have been reserved for the more finely-worked specimens (or, perhaps, allowed for the production of more finely-worked specimens), orthoquartzite featuring less prominently in this case. Combined with their relative completeness it seems likely that these pieces served a non-utilitarian or ‘special’ purpose, although the relatively good preservation of points across the site makes it difficult to derive a direct relationship between completeness and utility.

![Figure 147: Some of the larger specimens and ‘outliers’ from the Cattle Oiler site.](image)

![Figure 148: Some of the more finely-worked pieces from Cattle Oiler, including those with Avonlea-like and Mississippian (far right) characteristics.](image)
A study of base type reveals a variety of styles encompassing the full spectrum from convex to concave and indented, and although predominantly straight (or straight to convex/concave), a single dominant type is lacking (Figure 149). Blade type, on the other hand, is consistently excurvate, thus representing a more tightly-controlled variable.

![Base Type Pie Chart](image1)

![Blade Type Pie Chart](image2)

**Figure 149:** Basic qualitative attribute values for the Cattle Oiler specimens.

The overall visibility of attributes is especially good at Cattle Oiler (Figure 150), with only two falling below 75 percent (weight and neck width, 73.7 and 69.5 percent, respectively), while thickness and blade type score especially high at 98.3 and 97.4 percent, respectively. Comparable visibility of width and neck

![Attribute Visibility Graph](image3)

**Figure 150:** Comparable visibility of quantitative and qualitative attributes among the Cattle Oiler specimens.
width ensures that, in this case, Shott (1997) and Hughes’ (1998) approaches have a better applicability rating than that of Hildebrandt and King’s (2012) dart-arrow index, scoring just over 20 percent higher (Figure 151).

![Classification Application](image1)

**Figure 151:** Percentage of total specimens used in each classification approach for the Cattle Oiler site.

Shott’s (1997) single and multiple variable solutions reveal consistently arrow-dominant scores (85.2 percent in the one variable solution, Figure 152), a pattern similarly reflected by Hughes (1998) approach – the majority falling within the suggested TSA and TP range for arrows, and below the lower (3g) mass limit proposed for darts (Figure 153). In both cases, extension into dart territory remains fairly limited. Hildebrandt and King’s (2012) index, on the other hand, proposes a complete reversal these results, revealing a rather more dart-dominant system than expected for this time period (86.4 percent, Figure 154).

![Multiple and Single Variable Solutions](image2)

**Figure 152:** Shott’s multiple and single variable solutions for the Cattle Oiler specimens.
Summary
As the combination analyses in Figure 14 attest to, a broad range in variation persists at Cattle Oiler, with point values stretching both along and across the trend line. The majority of the collection, however, clusters closest (i.e. most consistently) towards the lower (i.e. smaller) end of the scale, becoming fewer and more dispersed (i.e. more variable) as the values increase. This pattern describes a preference for smaller ‘arrow’ points at the site, typified by notched and unnotched forms typically associated with the site’s temporal-cultural assignment, with fairly limited overlap into larger (seemingly less consistent) ‘dart’ territory. Supported by the results produced in both Shott’s (1997) single
and multiple variable classification solutions and Hughes’ (1998) TSA, TP and mass threshold values, this trend stands in close agreement with traditional interpretations regarding the use of arrow-dominant projectile systems on the Plains by AD1000. It should be noted, however, that even within the more consistent cluster at Cattle Oiler, more or less subtle variations in size and shape persist (a result, perhaps, of the mixing of Initial and Extended Middle Missouri elements), highlighting the impracticalities of using explicitly-defined and discrete groupings to determine the relative presence or absence of various technologies. In this case, intra- and inter-cluster diversity may account for the contrasting dart-dominant result produced by Hildebrandt and King’s (2012) dart-arrow classification index, itself less applicable than the other approaches due to the comparable visibility of neck width (and, as suggested for Mitchell, a potentially inadequate set of threshold values according to the region), something to be borne in mind when assessing the utility and validity of classification approaches within and between study areas.

As at Mitchell, Cattle Oiler – a predominantly Initial Middle Missouri site (with limited extension into the Extended Middle Missouri) – evidences a series of connections with cultures further afield. As well as the ‘exotic’ materials referred to in the context section, the assemblage revealed what appears to be characteristic Avonlea-like features, as well as a point manufactured in the Mississippian style (Figure 148), linking the site to the north and southeast, respectively. It seems likely, therefore, that the occupants of Cattle Oiler were kept abreast of new developments (local and nonlocal) and ‘popular’ styles, and thus contributed to a much broader system of competing traditions and innovations. Other than the quality of manufacturing material, evidence that these more unusual pieces (as well as the other larger pieces among the collection) were utilised in a different fashion (i.e. maintained a ‘special’ use-context) to the rest is lacking, so that interpretation regarding their use (as darts, arrows, both, or neither), again, remains open to debate. Their very existence, however, provides valuable information regarding material cultural and idealistic connections with the past (tradition), present (relative to other cultures), and future (innovation), helping place each (local) development within a broader (regional/continental) context of technological change.
6.2.3. The La Roche sites (39ST9 and 39ST232)

Context

‘The high bluffs on the right bank of the [Missouri] river swing back and reveal a small, fertile floodplain known as the La Roche Bottoms’ (Hoffman 1968, 1), home to the La Roche sites: Over’s La Roche (39ST9) and Bower’s La Roche (39ST232) (*Figure 155*). ‘The archaeological sequence at La Roche is based on the habitation remains and refuse of four components of three regional traditions,’ predominantly associated with the Extended Coalescent Horizon, but with evidence of earlier (smaller) occupations (at Over’s La Roche) during the preceding Plains Woodland and Initial Middle Missouri periods (Hoffman 1968, 77). Five arbitrary areas were excavated at Over’s La Roche, revealing a range of materials including flaked and ground stone, bone and antler tools, decorative items (catlinite pendants, shell beads etc.), paint materials, daub, and pottery – the fabric of which ‘is similar, if not identical, to the bulk of pottery fabrics in the Middle Missouri region’ (ibid, 37). Bower’s La Roche, ‘located on a high terrace edge 1.75 miles north of the north edge of 39ST9,’ on the other hand, is characterised by surface phenomena including six earthen rings, revealing a similar – yet less extensive – array of material culture (a product, most likely, of its shorter occupancy) (ibid, 47).

The earliest occupation at La Roche, attributed to the Plains Woodland Tradition, was derived from Area A (Over’s La Roche) and comprised ‘an oval posthole pattern and fire pit inferred to represent structural remains… associated with Valley Cord Roughened pottery, additional cord stamped sherds, and corner-notched projectile points with convex sides and bases,’ among other items (ibid, 62). According to Hoffman (1968, 69), the people represented by this occupation ‘can be postulated as a small, seminomadic group of hunters and gatherers, well adapted to their locality,’ present ‘sometime between AD1 and 500 [when they] utilised their limited technologies to provide themselves with sufficient food, build a rude house, and settle briefly in the La Roche Bottoms.’

Radiocarbon dates of roughly AD1380 represent the next occupation, around 1000 years later, attributed to the latter part of the Initial Middle Missouri tradition in the area (ibid, 62). This phase ‘is defined on the basis of a limited number of habitation features, a distinctive pottery group, and certain bone and
Figure 155: The location of the La Roche sites, each highlighted in red (Hoffman 1968, 3). Over’s La Roche (39ST9) lies to the south, Bower’s La Roche (39ST232) to the north.

stone tools,’ including simple triangular projectile points (ibid, 62). With regards to the stone tools associated with this occupation, Hoffman (1968, 69) proposes
similarities to the Woodland tradition, only ‘more varied in form (and inferred function),’ representing an increasing use of bison and the bow and arrow. Pottery remains, too, reveal links with succeeding periods, for while the form and decoration of vessels appears typically Mississippian, ‘there is a retention of Woodland cord impressed decorations, as well as the basic Woodland trait of a stamped surface finish’ (ibid). In both cases, useful insight is provided into the relationship between the maintenance of technological tradition and the implementation of innovation. Based on the limited evidence, it seems likely that ‘the subsurface pit, timbers, and artefacts… represent a transient occupation of Initial Middle Missouri peoples… perhaps… a hunting camp or… a stop-over while searching for new garden plots’ (ibid, 70).

In contrast to these ‘limited antecedent occupations’ the final two (dated c.AD1460-1580 and AD1600-1695) – consisting of circular house occupations attributed to the Extended Coalescent Horizon – ‘comprise the bulk of the archaeological data’ recovered from La Roche (ibid, 62). Here, ‘various ornate and technically refined potteries… contrast sharply with previous… ceramics in both quality and quantity,’ whilst the stone tool kit becomes somewhat enlarged, including ‘simple triangular points, but as the dominant style, in contrast to side-notched triangular points’ (ibid, 62-63). Interpreted as ‘components of a vigorous, but short-lived complex that rapidly expanded to fill the lower reaches of the Middle Missouri Region during the 16th and 17th centuries’ the remains associated with this period ‘indicate a mobile population engaged in bottom land horticulture and big game hunting, primarily of bison’ (ibid, 75). While in many ways ‘appreciably different’ to those that came before (house structure, in particular, witnessed several changes), ‘there is continuity in the technological traditions of both bottom land horticulture and big game hunting as inferred from the archaeological materials’ (ibid, 70). Stone and bone tool kits, for example, ‘are carried over and greatly expanded… [and] both continuity and change interpreted from the ceramics’ (ibid). Thus, ‘the case for coalescence rests on the reinterpretation, continuity, and introduction of certain traits and technological traditions within the Middle Missouri Region,’ and whether internally (locally) or externally (from further afield, such as the Mississippian complex in the southeast) influenced, it represents a crucial element within the adoption, rejection, or modification of various Plains technologies, old and new.
Analysis

Over’s La Roche 39ST9 \((N = 63)\)

The collection at Over’s La Roche describes a broad range in variation, with outliers recorded for five of the six attribute categories listed (Table 10). While the combination analyses reflect this diversity in form – with values spread along and across each trend line – broadly-defined clusters can, nonetheless, be identified towards the lower end of the scale (Figure 15). Contrasting larger values are not, however, simply one or two isolated points on the scale, but represent a fair proportion of the sample. As size increases, these values become increasingly dispersed, with the implication that larger forms were apparently less tightly-controlled (i.e. less consistent) than the more ‘typical’ smaller ones.

While the dominant cluster is characterised by triangular notched and unnotched specimens traditionally associated with the bow and arrow (and the site’s later Initial Middle Missouri and Extended Coalescent occupations), the larger ‘group’ comprises points typically associated with earlier ‘dart-based’ traditions (Figure 15). These include corner-notched types attributed to the earlier Plains Woodland occupation at Over’s La Roche, as well as two Paleoindian points, although a couple of later triangular notched and unnotched specimens also stray beyond the upper limits of the dominant cluster. An especially small triangular unnotched point provides evidence of anomalies at the other end of the scale, too, although these are generally less common.

While a mixture of temporal-cultural styles might be expected within a midden feature (at Over’s La Roche an earlier lanceolate and a corner-notched

| Table 10: Summary of attribute averages, range, and outlier values for Over’s La Roche. |
|---------------------------------|-----|-----|-----|-----|-----|-----|
| Weight (g)                      | Mean| Median| Lowest Value | Highest Value | Range | % Outlier Values |
| Length (mm)                     | 30.43 | 25.83 | 14.88 | 59.79 | 44.91 | 11.36 |
| Width (mm)                      | 17.65 | 16.68 | 9.88  | 32.10 | 22.22 | 3.77  |
| Thickness (mm)                  | 3.87  | 3.49  | 2.27  | 7.43  | 5.16  | 4.76  |
| Basal Width (mm)                | 15.84 | 15.39 | 9.70  | 31.50 | 21.80 | 4.17  |
| Neck Width (mm)                 | 11.17 | 9.67  | 6.34  | 18.82 | 12.48 | 0.00  |
type were recovered alongside several later triangular unnotched forms), the recovery of two seemingly temporally-distinct forms from a more ‘secure’ context provides interesting topic for discussion. In this case, the smallest and one of the largest points among the collection (attributed to the Extended Coalescent and Paleoindian periods, respectively), were recovered from the same context within a house feature. According to Hoffman (1968, 27), the older of the two is ‘made of Tongue River silicified sediment… [and] appears exotic to the site.’ Study of material types more broadly, however, reveals a full range (including Tongue River silicified sediment, as well as jasper, chert, chalcedony, and Knife River flint) that cross-cuts each type category, so that definitive statements linking material type, point form, and context (‘special’ or otherwise) are far from simple.

A range of base types are evidenced at Over’s La Roche (Figure 158), with a slight tendency towards more concave styles – a product of the higher proportion of later triangular notched and unnotched forms including this feature. Convex styles, on the other hand, are generally limited to earlier corner-

**Figure 156:** Simple combination analyses applied to the Over’s La Roche specimens, the dominant cluster highlighted in red.
notched forms associated with the preceding Plains Woodland tradition. In contrast, blade type remains predominantly excurvate (or within the straight to excurvate range), irrespective of point type (Figure 158).

Attribute visibility is generally rather good at the site, with thickness and blade type scoring 100 percent, and base type, width and basal width at least 75 percent (Figure 159). The comparably poor visibility of neck width (based on its relative absence among unnotched specimens in the sample), however, had a direct effect upon the relative applicability of each classification scheme. In this case, Hildebrandt and King’s (2012) dart-arrow index scored only 31.7
percent, compared to Shott (1997) and Hughes’ (1998) 84.1 percent (Figure 160).

**Figure 158:** Basic qualitative attribute values for the Over’s La Roche specimens.

**Figure 159:** Comparable visibility of quantitative and qualitative attributes among the Over’s La Roche specimens.

**Figure 160:** Percentage of total specimens used in each classification approach for the Over’s La Roche site.
Shott’s (1997) solutions produced a predominantly arrow-based result (Figure 161), with an arrow:dart ratio of 3:1 (for the one variable solution) – as expected for a site characterised by a largely post-introduction presence with only limited earlier occupation in the area. TSA and TP values, too, fell mainly within the arrow range proposed by Hughes (1998), and the majority below the lower 3g mass limit for darts, again with only limited (yet expected) crossover into larger ‘dart’ point territory (Figure 162). In stark contrast to the above, Hildebrandt and King’s (2012) index revealed a decidedly dart-dominant result, with a dart:arrow ratio of 4:1 (Figure 163), a product of the lack of useable neck width values (those present primarily attributable to earlier ‘dart’ forms) amongst a predominantly triangular unnotched type assemblage.
The collection at Bower’s La Roche reveals a fairly limited range in variation compared to the other Plains sites studied, although outliers were recorded in four of the six attribute categories studied (Table 11). Identification of these ‘outliers’ in the combination analyses reveals a couple of slightly longer or wider pieces towards the upper limits, and slightly smaller, thinner points at the lower end of the scale (Figure 164). In this sense, deviations from the ‘norm’ do exist, although when compared to the more ‘typical’ specimens of the roughly defined clusters, these differences (or variations) are limited at best (Figure 165), with morphology seemingly tightly controlled – in the form of triangular unnotched (and notched) points – attributed to the site’s Extended Coalescent temporal-cultural assignment. A variety of material types (including Tongue River silicified sediment, chalcedony, chert, and jasper) provides an interesting feature within

**Table 11: Summary of attribute averages, range, and outlier values for Bower’s La Roche.**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Mean</th>
<th>Median</th>
<th>Lowest Value</th>
<th>Highest Value</th>
<th>Range</th>
<th>% Outlier Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (g)</td>
<td>0.97</td>
<td>0.87</td>
<td>0.42</td>
<td>2.69</td>
<td>2.27</td>
<td>12.50</td>
</tr>
<tr>
<td>Length (mm)</td>
<td>23.12</td>
<td>22.92</td>
<td>17.78</td>
<td>29.54</td>
<td>11.76</td>
<td>0.00</td>
</tr>
<tr>
<td>Width (mm)</td>
<td>14.97</td>
<td>14.70</td>
<td>11.57</td>
<td>20.98</td>
<td>9.41</td>
<td>21.05</td>
</tr>
<tr>
<td>Thickness (mm)</td>
<td>3.50</td>
<td>3.42</td>
<td>1.49</td>
<td>8.12</td>
<td>6.63</td>
<td>9.52</td>
</tr>
<tr>
<td>Basal Width (mm)</td>
<td>14.83</td>
<td>14.67</td>
<td>11.57</td>
<td>21.02</td>
<td>9.45</td>
<td>5.00</td>
</tr>
<tr>
<td>Neck Width (mm)</td>
<td>8.48</td>
<td>8.48</td>
<td>7.28</td>
<td>9.67</td>
<td>2.39</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Figure 164: Simple combination analyses applied to the Bower’s La Roche specimens, notable trends or clusters highlighted in red.

Figure 165: Some of the ‘outlier’ forms including slightly longer/narrower, wider/squatter, smaller/thinner specimens (top row), comparably similar to the more ‘typical’ triangular unnotched (and notched) points at the site (middle and bottom rows).
this otherwise fairly homogenous sample, although any indication of ‘special’ or ‘unusual’ pieces or contexts is lacking.

Base type falls predominantly within the straight to concave range, with blade type exclusively excurvate (Figure 166) – consistent with the type descriptions associated with the site’s dominant triangular unnotched point form. Attribute visibility at Bower’s La Roche is especially good (Figure 167), with all but neck width scoring above 75 percent (thickness, base type, and blade type all at 100 percent). As before, though, the exceptionally poor visibility of neck width (again, the product of a predominantly unnotched sample) results in an applicability score of just 9.5 percent for Hildebrandt and King’s (2012)

Figure 166: Basic qualitative attribute values for the Bower’s La Roche specimens.

Figure 167: Comparable visibility of quantitative and qualitative attributes among the Bower’s La Roche specimens.
dart-arrow index, compared to the 90.5 percent derived from Shott (1997) and Hughes’ (1998) approaches (Figure 168). In this case, Hildebrandt and King’s (2012) index provides an extremely limited (and essentially invalid) result (based on only two values), with one attributed to each category (Figure 169).

![Classification Application](image1)

**Figure 168:** Percentage of total specimens used in each classification approach for the Bower’s La Roche site.

![Dart-Arrow Index](image2)

**Figure 169:** Hildebrandt and King’s Dart-Arrow Index values for the Bower’s La Roche specimens.

Shott’s (1997) one variable solution produced an almost exclusively arrow-based result (with only one dart value accounted for, Figure 170), whilst, in a similar fashion, the TSA, TP and mass values derived from Hughes’ (1998) approach fell entirely within the proposed arrow range (Figure 171), as predicted for a fairly homogenous sample associated with an especially late prehistoric (post-introduction of the bow and arrow) temporal-cultural assignment.
Summary

Based on these analyses, the La Roche sites provide a useful case study regarding technological differences and diversity (or lack thereof) amongst single and multiple occupation locales. Despite being in close vicinity to Over’s La Roche – occupied during both the earlier Plains Woodland (early/pre-introduction of the bow and arrow) and the later Initial Middle Missouri and Extended Coalescent (post-introduction of the bow and arrow) periods – Bower’s La Roche – whose occupation was limited to the latter – describes a much narrower range in variation among a sample consistently classified as arrow points. The relative continuity (i.e. consistency) between Initial Middle Missouri and Extended Coalescent (triangular notched/unnotched) projectile
point traditions at Over’s La Roche, on the other hand, is contextualised by the contrasting Plains Woodland (side-notched) tradition that came before, revealing a shift in preferred technology (and associated system) during the early centuries AD.

Taken together, these sites encapsulate the move towards a single – internally more consistent – arrow-dominant technology, as in traditional accounts of the introduction of the bow and arrow. In this case, timing and duration both play an important role. Shorter, later occupancies – as at Bower’s La Roche – for example, reveal significantly less evidence of internal variation compared to longer occupancies with an earlier component, as the interplay between old and new/tradition and innovation ‘settles down’ and the ‘dominant’ technology firmly established. That older/larger specimens were retained/reused in later society is, nonetheless, still apparent – at Over’s La Roche, at least – for specimens attributed to the Paleoindian period several thousand years earlier were identified among the sample studied. As Hoffman (1968, 27) suggests, their relative scarcity likely does not indicate a Paleo-eastern occupation of the La Roche Bottoms, ‘more likely these objects were obtained elsewhere, perhaps as curiosities or potential tools by some of the La Roche peoples.’ With distribution patterns revealing little with regards to use-context, however, the distinction between ‘curiosity’ and ‘tool’ remains unclear, and the role of ‘traditional’ technologies in later society left open to debate.

Attribute visibility (especially good for all but neck width) ensured high applicability scores for both Shott (1997) and Hughes’ (1998) classification methods, the results of which stood in firm agreement with the sites’ various temporal-cultural assignments (by producing the ‘expected’ dart:arrow ratios, according to traditional accounts of the timing of the bow and arrow in the Plains area). By contrast, Hildebrandt and King’s (2012) dart-arrow index, with its significantly lower applicability scores (attributed to exceptionally poor neck width visibility), provided a decidedly less representative result, skewed towards the identification of earlier notched forms (and the effective elimination of later unnotched forms). In this case, the results derived from a simple compare-and-contrast approach serve as direct evidence for subjectivity within the classification process and attest to the significance of individual context (concepts to be explored in later chapters) – both core elements within the reassessment of artefact identification and interpretation.
6.2.4. Study Area Two: A Summary of the Plains

That the main component of each of the four Plains sites studied here occurred after the introduction of the bow and arrow to the area (according to traditional accounts), made them a good case study for identifying the continued presence (or lack thereof) of larger ‘dart’ points in later contexts, and deciphering, thus, the apparent pace and nature – gradual or abrupt, subtle or distinct – of associated technological change. One of the sites – Over’s La Roche – included an earlier (albeit limited) Plains Woodland element in addition to its primary occupation during the Extended Coalescent (Figure 172) and, perhaps unsurprisingly, it was this site which, for the most part, revealed the broadest (inter-quartile) range in variation, and – upon the removal of outliers – the highest values for all but point thickness, closely followed by Cattle Oiler (refer to Figures 173-178). Compared to the more restricted occupation duration of the others, the variability expressed at these multiple occupation sites is, presumably, borne out of their susceptibility to a greater number of different temporal-cultural forms (and associated projectile devices). Conversely, Bower’s La Roche – the latest single occupation site – described the narrowest range in variation across all attribute categories, as well as consistently reporting the lowest values. In this sense, the predicted shift from larger, more

![Figure 172: Temporal-cultural assignments of each site relative to the other within the Plains study area.](image-url)
Figure 173: Weight data (with and without outliers) for the Plains sites.

Figure 174: Length data (with and without outliers) for the Plains sites.
Figure 175: Width data (with and without outliers) for the Plains sites.

Figure 176: Thickness data (with and without outliers) for the Plains sites.
Figure 177: Basal width data (with and without outliers) for the Plains

Figure 178: Neck width data (with and without outliers) for the Plains
variable projectile point assemblages associated with pre- or early-introduction contexts, towards smaller, morphologically more consistent ones (associated with the introduction and subsequent predominance of the bow and arrow) appears justified and, thus, the data well-aligned with traditional interpretation.

Observations of point form reveal a tendency first towards adopting smaller, predominantly notched, triangular ‘arrow’ forms (not hugely dissimilar to the larger, preceding ‘dart’ pieces), before progressing to the more popular, unnotched triangular type characteristic of later periods. In this case, quantitative and qualitative differences between earlier (dart) and later (arrow) forms are visible, although they appear to graduate from subtle to more distinct as time progressed and preferences developed. In this respect, the change from one technology to another was not necessarily as simple and abrupt as sometimes inferred, although perhaps more so here than in other areas of the country.

The presence of dominant type clusters towards the lower end of the scale and, thus, the prevalence of consistently smaller ‘arrow’ forms in post-introduction contexts was similarly well-supported by the classification results derived from Shott (1997) and Hughes’ (1998) schemes. Shott’s (1997) one variable solution, for example, produced the expected dart:arrow ratios associated with each site’s given temporal-cultural assignment, all clearly arrow-dominant, with Over’s La Roche – the site with the earliest component – demonstrating the highest number of earlier ‘dart’ forms (Figure 179), just as Hughes’ (1998) TSA, TP, and mass values revealed a similar trend towards

![Shott's One Variable Solution](image)

**Figure 179:** The results derived from Shott’s (1997) single variable classification solution for the Plains sites.
arrow-based systems and only limited extension into dart territory (Figure 180).

![Diagram showing Hughes' TSA, TP, and mass values for the Plains sites, relative to the proposed dart (blue) and arrow (red) thresholds.]

**Figure 180:** The results derived from Hughes' (1998) TSA, TP, and mass values for the Plains sites, relative to the proposed dart (blue) and arrow (red) thresholds.

Both approaches were equally applicable and consistently represented at least 80 percent of the samples studied (owing to the relatively good visibility of point width and thickness), standing in stark contrast to Hildebrandt and King’s (2012)
dart-arrow index, which became increasingly less applicable among Plains sites with later components dominated by unnotched forms (Figure 181). On this occasion, the index produced an unlikely set of predominantly dart-based values (Figure 182), a product, most likely, of its bias towards the classification of earlier forms with the appropriate neck width measurements. Viewed in this light, the results – contextualised by the sites’ associated temporal-cultural assignments – suggest that Shott (1997) and Hughes’ (1998) approaches provide a better ‘fit’ for the Plains assemblages than that of Hildebrandt and King (2012), although the latter does provide useful insight regarding the limitations of artefact classification – relative to time, space, and the subjectivities of individual context.

Despite some internal variation, the data suggests that the move towards an arrow-dominant system was firmly established by AD1000, with the majority

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**Figure 181:** Applicability scores for the classification schemes applied to each of the Plains sites.

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**Figure 182:** The results derived from Hildebrandt and King’s (2012) dart-arrow classification index for the Plains sites.
of the points studied falling neatly within the parameters proposed by Shott (1997) and Hughes (1998). Although evidenced at later occupations in the area, their proportionally smaller numbers and relative inconsistency compared to the dominant ‘arrow’ clusters, implies that any larger ‘dart’ forms can generally be considered atypical. These pieces were sometimes more finely worked, manufactured from ‘exotic’ materials, and often recovered in a relatively complete condition, making it likely that at least some of them served a rather less utilitarian function than the rest. It should be borne in mind, however, that so long as typical and atypical types were recovered from the same context (as was commonly the case at these sites) there remains some difficulty in determining the likelihood and role of ‘special’ pieces and use-contexts, whether practical (i.e. continued use of traditional hunting technologies) or otherwise (i.e. ritual or symbolic).

Connections with cultures to the north and southeast (as evidenced by the presence of characteristic Avonlea-like features, Mississippian-style points and other exotic/prestige items and ceramics) provide a clear indication that the inhabitants of this area of the Plains were well-informed of intra- and interregional developments, both culturally and technologically. It seems likely that they received the bow and arrow relatively early on (Avonlea is generally considered to be one of the earliest arrow forms) and created increasingly arrow-dominant regional adaptations over time, contributing to a much broader system of competing traditions and innovations. Combined with a mixed subsistence strategy largely reliant on the continued importance of a successful (and refined) hunting device, their interaction within such a sizeable socio-economic sphere might, then, be used to imply a certain desire to remain ‘up-to-date’. This desire, bounded by social and economic concerns, provides a useful foundation upon which to base the seemingly clear shift from larger dart point to smaller arrow point technologies, which, for the most part, stands in fairly close agreement with traditional interpretations on the subject. A brief cautionary note, however, is that while these sites focus primarily on occupations that occurred c. AD1000 onwards, detailed interpretation of the earlier ‘transition’ years are lacking, and further study of sites occupied between AD500-1000 required before making any definitive statements regarding the relative abruptness of changes from one point form (and associated technology) to another.
6.3. Study Area Three: The Woodlands

Climate, landscape and the local economy

‘[The Eastern Woodlands] generally refers to the eastern half of Native North America, those millions of acres of primeval forests cut by countless coursing “river roads”.’

(Thomas 2000, 86)

From the Atlantic Ocean in the east to the Plains border in the west, the Great Lakes in the north and the Gulf of Mexico in the south (Figure 183), this broad definition covers a vast expanse of the continent; an area typically divided into further northern and southern subareas and associated cultural developments through time. Broadly speaking, the shift towards a progressively warmer and more diverse wooded environment at the end of the last Ice Age saw eastern peoples adapt to low-lying areas locally abundant in aquatic, game, and vegetable resources, a trend that would continue for thousands of years, eventually culminating in the development of increasingly sedentary lifeways, territoriality, the adoption of agriculture, and complex burial customs (Fagan 1991, 307). A multiplicity of local traditions is evidenced within this landscape (culturally and economically), as:

‘People adapted in many ways, with more-or-less equal efficiency, to different circumstances.’

(Fagan 1991, 307)

Mapping these traditions- defining their boundaries and range of influence- is not, however, a simple task. Contrasting descriptions of geographical boundaries (with particular reference to the north-south divide) and their associated cultural and temporal assignments, both online and in the literature, make it somewhat difficult to establish a consistent interpretative context. This borne in mind, the sites described in this study, situated in the Chesapeake region, appear to straddle both the northern and southern Woodland traditions, combining with influences from the nearby Atlantic Coast, to provide an
interesting perspective from which to assess environmental and socio-cultural influences upon technological change.

Formed as melting glaciers from the last Ice Age submerged the area now known as the Susquehanna River Valley, Chesapeake Bay represents the largest of more than 100 estuaries in the United States (Chesapeake Bay Program 2012). An area of transition between land and sea, it receives about

![Map of the Eastern Woodlands with notable sites highlighted](image)

**Figure 183**: Notable sites and regions of the Eastern Woodlands (Fagan 1991, 308). The broad location of sites studied here, within the Chesapeake region, is highlighted in red.
half its water volume from the Atlantic Ocean… the rest… from an enormous 64,000-square-mile watershed’ with more than 100,000 tributaries (Figure 184), the five largest of which are the Susquehanna, Potomac, Rappahannock, York and James rivers (ibid). Occupants of this highly productive area would have had access to resources from a broad range of different habitats,
‘including shallow waters, open waters, marshes and wetlands, sandy beaches, mud flats and oyster reefs’ (ibid), as well as the surrounding mixed deciduous forests and, in later periods, cleared areas of farmland, while various waterways would have acted as trade links, both locally and further afield. As such, the Chesapeake region of the Eastern Woodlands provides an excellent snapshot of well-supported, well-connected prehistoric peoples, relatable to both the wider study area and its neighbours.

Lifeways through time

The coniferous forests and large game associated with cold, Ice Age conditions combined to form the typical resource base exploited by the region’s earliest Paleoindian occupants. As the climate warmed, however, this landscape gave way to hardwood forests, coastal wetlands, and a plethora of new plants and animals, signalling the shift towards an increasingly diverse set of Archaic lifeways, some of which would continue until European contact (Chesapeake Bay Program 2012). The peoples of the Chesapeake region, for example, typically lived away from the Bay’s shores in more terrestrial areas where they exploited local game, plant foods and nut harvests, yet they also ‘made seasonal visits to fish, hunt, gather roots and harvest oysters’ (ibid). Generally speaking, groups in this area had access to a highly productive environment with a broad range of resources. It was this productivity, perhaps, that meant other than ‘minor stylistic alterations in ubiquitous stone projectile points’ (Fagan 1991, 309) – a product of various local manifestations of the hunting-gathering lifeway – the associated (spear or dart-based) toolkit saw seemingly little functional change for thousands of years. It is interesting to note, however, that while:

‘Archaic territories contained a diversity of food resources and raw materials… there was always something that was lacking- perhaps flint for making projectile points, red ochre for ornamentation, shells, stone for making ground-edged woodworking adzes used in dugout canoe building. Such items had to be sought from elsewhere, either by making a special journey, or by maintaining regular social and economic contacts with groups living closer to the sources of
one’s needs. Over time, these trading connections assumed ever greater importance in the yearly round. They became a source not only of valued possessions and raw materials traded for food or other commodities, but of social connections and prestige- a way of maintaining diplomatic relations with the outside world.’

(Fagan 1991, 335)

Thus, while the basic subsistence systems of the period remained stable, there were a number of cultural developments taking place across the region. The scale and scope of these developments was, however, highly variable according to each individual site or complex. The Poverty Point Culture of the Lower Mississippi Valley (1700-700BC), for example, arguably the most impressive pre-Woodland complex of the region, comprised over 100 sites, strategically placed for the exchange of raw materials and finished products both up and downstream to locations as far as 620 miles away, standing in stark contrast to ‘the humble base camps that characterised most of the Eastern Woodlands at the time’ (ibid, 351-352). An appreciation of the interaction (or lack thereof) between these seemingly dominant complexes and their peripheries (which continued to evolve in the succeeding periods), ranging from full-scale assimilation to selective incorporation or rejection, is crucial for understanding the extent to which one group had the power to influence another- whether socially, politically, or economically. This includes the incorporation of new technologies and is especially relevant to the sites covered in this study, focussed on an area traditionally placed a little outside of the dominant cultures used to characterise the Eastern Woodlands.

As the Late Archaic drew to a close, eastern societies witnessed a series of complex cultural changes, stemming ‘not from military conquests or major population movements, but from the culmination of long-term adaptive and cultural trends… more intensive exploitation of diverse food sources in highly localised environments, a move toward more sedentary living and better-established territorial boundaries, more intensive exchange of scarce material, and the emergence of more complex social orders’ (Fagan 1991, 355). Defined as the Early Woodland, this was a period characterised by three major trends: the manufacture of local pottery forms, the further development of horticulture
and riverine adaptations, and interment under funerary mounds (ibid; McNutt 1996, 204). The increasing importance of mortuary ceremonialism is perhaps best expressed in the Adena complex of the central Ohio Valley. Its sites, numbering hundreds in the heartland, consisted mainly of burial mounds. These became evermore elaborate as time progressed, featuring large chambers, multiple interments, and a rich variety of grave goods, as Intra- and inter-group social relations entered a period of further intensification which would continue into the Middle Woodland that followed.

Characterised by the dominant Hopewell and Marksville complexes – in the north and south respectively – the development of Middle Woodland cultures was heavily influenced by an expansion in trading systems, facilitated, perhaps, by the ‘Big Men’ figures reflected in occasional, more richly decorated burials (Fagan 1991, 373). The mapping of cultural materials associated with the Hopewell complexes (the ‘Hopewell Interaction Sphere’) provides excellent insight in this respect (Figure 185). As Griffin (1983, 265) proposes:

‘[Trade] reflects the wide geographical knowledge of much of the eastern United States that some of its aboriginal inhabitants possessed… [and] helps to explain the apparent speed with which new ideas and techniques moved across long distances.’

Among these ‘ideas and techniques’ are the technological innovations associated with the introduction of new tool types and hunting strategies (i.e. the adoption of the bow and arrow). The relative location and distance between associated raw materials (such as quartz) and study areas (such as the Chesapeake) within these wider complexes, therefore, provide valuable data for interpreting the relationship between technological changes and associated cultural developments. Nevertheless, as before, we must remain mindful that not all groups were equally integrated into these ‘core’ areas. Woodland adaptations in the southeastern and coastal regions, for example, demonstrate less elaboration of mortuary cults and mound-building, focussed instead upon local adaptations with cultural links to the preceding Archaic traditions (Fagan 1991, 380-381). As before, selective participation in cultural exchanges, often along the peripheries, remains an important consideration for the archaeologist concerned with the relationship between tradition and innovation.
It was a series of innovations which came to characterise the succeeding Terminal or Late Woodland period, a time when the dominant artefact types and mortuary rituals of the Hopewellian disappeared or were else heavily remodelled (Pauketat 2004, 7-8). As Benn (1995, 124) describes:

‘A transformation on the relations of production was taking place: the previous relationship between human beings and the natural environment (as an object of production) was shifting toward a relationship between human beings and their tools of production (i.e. the artificial horticultural environment, ceramics, bow and arrow).’

Populations expanded, shifting towards a more localised, sedentary lifeway focussed on the intensification of food production, setting the scene for the Mississippian climax to follow. Traditionally, it is within this context of change that archaeologists place the widespread adoption of the bow and...
arrow, though its earliest appearance in the region has been a topic of much debate. Bradbury (1997, 207-208) distinguishes between the traditional ‘late introduction’ group, who see ‘the bow and arrow as a technological innovation occurring sometime during the Middle or Late Woodland period… [and] argue that small triangular or stemmed forms are evidence of the first true arrow points,’ and the ‘early introduction’ group, who argue for an Archaic origin (Figure 186). Proponents of a later, more abrupt introduction view ‘the complete predominance of small projectile points pan-regionally… [as] a post-500 A.D. phenomenon’ (Blitz 1988, 131), the Jack’s Reef Corner-Notched and Racoon

![Figure 186: A chronology of the Eastern Woodlands (Fagan 1991, 306). Highlighted are the proposed early (blue) and late (red) introduction phases associated with the bow and arrow.](image)

253
Notched types among the first ‘true’ arrow points in the East (Justice 1987, 217-219) (*Figure 187*). On the other hand, those in favour of an earlier introduction and/or a longer period of contemporary use alongside the dart and atlatl, use results derived from various classification functions (Bradbury 1997; Shott 1993), use-wear analyses (Odell 1988), and evidence of different (yet contemporaneous) reduction technologies (Nassaney and Pyle 1999), to support their case. This borne in mind, an appreciation of the developments of earlier periods (and traditions), as in the Southwest and Plains, is vital for contextualising technological change. By the same merits, then, an awareness of post-introduction cultural traits, including the dominant Mississippian complex, provides a measure of the extent of this change, including the presence or absence of resistance to innovation and the maintenance of tradition.

The Mississippian, broadly defined by ‘the hundreds of farming societies that thrived between about AD800 and 1500 throughout the Tennessee, Cumberland, and Mississippi River valleys,’ was characterised by its distinctive pottery, maize horticulture, flat-topped mounds and associated plazas, stratified

*Figure 187: Jack’s Reef Corner
Notched (a-d) and Raccoon Notched (e-g) points and their distribution across the Eastern Woodlands (Justice 1987, 217-219)*
social organisation, and permanent (and probably hereditary) offices (Thomas 2000, 155), and represented the dominant and most impressive cultural complex of the Eastern Woodlands during the Late Prehistoric period. Within this complex, ‘is abundant evidence of great variation in social complexity, major centres like Cahokia in the so-called American Bottom near the modern city of St Louis at one end of the spectrum, and hundreds of small, local centres and minor chiefdoms at the other’ (Fagan 1991, 390), bound together by a vast network of exchange, best defined by its shared iconography, which, presumably, held some form of politico-religious significance (Muller 1983, 411-413). As in preceding periods, the sites in this study are located a little outside of these central developments, with groups in the Chesapeake region maintaining much of the Woodland tradition. While they, too, became increasingly reliant upon agricultural crops and formed more permanent villages, they also maintained the use of ‘small hunting camps to take advantage of the Bay’s bounty’ (Chesapeake Bay Program 2012). Again, selective participation along the peripheries, and the relationship between local adaptation and regional integration, provides an important perspective from which to view the (technological) changes that took place across the study area in question.
6.3.1. Hidden Valley Rockshelter 44BA31 \((N = 133)\)

**Context**

In 1970, approximately one quarter of the rockshelter was excavated, revealing a series of stone and bone items indicative of intermittent use ‘from Early Archaic times through the Late Woodland, a span of approximately 8,000 years’ (MacCord 1973, 227), covering both pre- and post-introduction (of the bow and arrow) periods. The site, around 800 square feet in size, was located at the base of an overhanging limestone cliff ‘in the mountain and valley province at the headwaters of the James River… overlooking the creek-size Jackson River… ideally situated for human occupancy’ (ibid) (Figures 188 and 189).

**Figure 188**: Hidden Valley Rockshelter and the surrounding area (MacCord 1973, 198).
The soil at the site ‘contained rather large quantities of wood ash, plus refuse animal bones, mollusk shells, potsherds, and stone artefacts and chippings’, as well as a fairly large number of angular stones interpreted as scattered hearthstones (ibid, 199). In the absence of any discernable burials or storage pits, ‘all cultural remains found seem to have been originally discarded on the (then) surface of the shelter’ and, thus, ‘should lie in levels roughly representing their antiquity’ (ibid, 205). Indeed, other than a little mixing produced by the activities of burrowing animals, MacCord (1973, 205) reports ‘definite trends in the sequences of pottery, projectile points, and in materials used for chipped artefacts.’ A broad range of point types associated with various stages during the Early Archaic to Late Woodland occupation interval were reported, alongside other stone tools used for cutting, scraping, perforating, battering, and chopping, all of which were manufactured from materials that ‘parallel those identified in the chippage,’ including chert, quartz, and quartzite (ibid, 207; 222). Pottery scraps, too, ‘indicate that some pottery manufacturing was done at or near the shelter,’ although the source of several steatite bowl fragments remains unknown. A limited number of bone tools (including awls, scrapers, and flakers) and a copper pendant were also recovered, the latter procured from
what appears to have been a native source (ibid, 225-226). In this case, the relative absence of exotic materials hints at the likelihood that ‘the occupants of the shelter were local people, with little or no contact with more distant areas’ (ibid, 207).

‘The presence of so many projectile points in the shelter indicates that this was probably a centre of a hunting band, and the points represent those that were worn out and discarded, or broken in manufacture’ (ibid, 224). Supported by extensive animal (i.e. hunting) remains at the site, which covered a broad range of fauna (including elk, deer, bear, wolf, fox, raccoon, skunk, otter, cougar, bobcat, beaver, groundhog, rabbit, squirrel, turkey, various small birds, fish, and tortoise) (ibid, 226-227), this interpretation appears to hold true. Although deer was the most common source of meat, ‘from the list it is obvious that the Indians at the site captured or collected anything and everything which they considered edible,’ with potential marrow/fat extraction evidenced among many of the larger bones at the site (ibid). Plant remains (limited mainly to wild nuts and seeds), on the other hand, were considerably less numerous, accounting – in part – for MacCord’s (1973, 228) description of a predominantly seasonal occupation and associated subsistence strategy:

‘The absence of cultivated crops, such as corn or beans, indicates that the site was probably not used during the summer or early fall months. The presence of charred black walnut and hickory nut shells indicates a fall and winter use of the site. A variety of tools, particularly the scraping, cutting, and perforating tools, indicates domestic activities of Indian women, and the variety of projectile points indicates that weapons were repaired and possibly repointed by the hunters of the families. From these indicators, we can presume that the shelter was used by one or more families as a late fall and winter base, and that they moved to other sites during the growing seasons, as part of the annual round of food-gathering.’

Analysis
The Hidden Valley Rockshelter assemblage displays a broad range in variation, with outliers recorded for each of the six categories listed (Table 12). This variation is aptly described in the combination analyses, with values spread both along and across each trend line, and lacking any clearly separable
clusters (*Figure 190*). Outliers tend towards the larger end of the scale and comprise mainly stemmed forms attributable to the Archaic and Early Woodland (pre-introduction of the bow and arrow) periods (*Figure 191*), although a few especially small pieces, mainly unnotched forms attributed to the Late Woodland (post-introduction of the bow and arrow) period and later, are also represented (*Figure 192*). At the extreme ends of the scale, then, the difference between early and late, pre- and post-introduction types is fairly obvious. It is the bulk of the material that lies in between, thus, that affects the practicality of a clear line of division (and separable type clusters) between presumably larger dart and smaller arrow points.

**Table 12:** Summary of attribute averages, range, and outlier values for Hidden Valley Rockshelter.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Mean</th>
<th>Median</th>
<th>Lowest Value</th>
<th>Highest Value</th>
<th>Range</th>
<th>% Outlier Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (g)</td>
<td>7.79</td>
<td>5.57</td>
<td>0.74</td>
<td>40.65</td>
<td>39.91</td>
<td>10.00</td>
</tr>
<tr>
<td>Length (mm)</td>
<td>41.88</td>
<td>38.53</td>
<td>17.78</td>
<td>96.15</td>
<td>78.37</td>
<td>3.66</td>
</tr>
<tr>
<td>Width (mm)</td>
<td>23.81</td>
<td>22.38</td>
<td>12.70</td>
<td>42.42</td>
<td>29.72</td>
<td>2.54</td>
</tr>
<tr>
<td>Thickness (mm)</td>
<td>8.06</td>
<td>7.88</td>
<td>3.60</td>
<td>15.46</td>
<td>11.86</td>
<td>0.78</td>
</tr>
<tr>
<td>Basal Width (mm)</td>
<td>16.78</td>
<td>17.00</td>
<td>5.73</td>
<td>32.12</td>
<td>26.39</td>
<td>1.96</td>
</tr>
<tr>
<td>Neck Width (mm)</td>
<td>16.31</td>
<td>15.85</td>
<td>8.25</td>
<td>27.08</td>
<td>18.83</td>
<td>1.19</td>
</tr>
</tbody>
</table>

*Figure 190: Simple combination analyses applied to the Hidden Valley Rockshelter specimens.*
Figure 191: Specimens placed at the upper end of the size scale at Hidden Valley Rockshelter, dominated by stemmed forms attributed to the Archaic and Early Woodland periods.
Closer observations of the collection revealed a diverse array of point traits (as expected for an assemblage associated with such a broad occupation interval), so that in this case, various types (and their associated technologies) could be distinguished by measures other than size (such as base type, the presence or absence of notching etc.), which was too often either internally variable (as in Figure 193) or outwardly comparable (Figure 194). For example, whilst blade type at the site fell consistently within the straight to excurvate range, base type described a much broader range from convex to concave (Figure 195), the former more typical of earlier stemmed types and the latter predominantly (although not exclusively) reserved for the later triangular notched type.

For the most part, the distinction between earlier stemmed/notched and later unnotched forms supports the presence of notably different types (and, presumably, different projectile technologies) within the collection, although lines of division were again blurred by a gradation in associated size parameters. A small notched point (such as Justice’s (1987, 217) Jack’s Reef type), for example, might represent one of the earliest arrows in the area, and a large unnotched triangular point one of the latest darts. Thus, although studies of style and morphology help provide a basic level of separation, precise divisions according to function (dart or arrow), remain open for debate in the absence of supporting organic material evidence.
Figure 193: Evidence of variability within the unnotched triangular type category at Hidden Valley Rockshelter. Differences are evident in both size and shape.

Figure 194: Evidence of overlapping morphological characteristics between notched and unnotched type categories, including comparable measures of width and thickness.
Information regarding point proveniences here provides a useful context for interpretation. Generally speaking, the larger, stemmed points in the sample were recovered from deeper (i.e. earlier) levels, and smaller, triangular points from the shallowest, thereby standing in agreement with traditional accounts of a shift from large to small, stemmed/notched to unnotched, ‘dart’ to ‘arrow’ technology through time. There were, however, some examples where different types (and their respective technologies) were recovered from the same context, the difference in size and shape ranging from subtle to more distinct (Figure 196). Typically, the triangular unnotched ‘arrow’ type associated with the Late Woodland and Mississippian periods (as in Justice 1987, 224), was missing from the earliest levels. Stemmed and notched forms, on the other hand, although noticeably smaller in the later contexts, were never completely phased out, hinting at the preservation of traditional forms at the site. It is difficult to ascertain whether these were assigned a different (‘special’) function to the others, although on this occasion the comparable state of preservation between types (as in Figure 196) implies a rather more similar use-context (i.e. as functional tools).
Attribute visibility was particularly good for measures of thickness and blade type (96.2 and 92.5 percent, respectively), with weight, length, and neck width (<65 percent) scoring less highly (Figure 197). The comparably higher score of width to neck width ensured that Shott (1997) and Hughes’ (1998) classification approaches were 25 percent more applicable than that of Hildebrandt and King (2012) (Figure 198).

Shott’s (1997) one, two, and three variable solutions evidence a dart-dominant result, with a dart:arrow ratio of approximately 3:1 (Figure 199). By the
same merits, Hughes’ (1998) TSA, TP, and mass values tend towards the upper end of the scale and the suggested dart thresholds, with limited overlap into arrow territory (Figure 200). Considering the broad occupation interval covered at Hidden Valley Rockshelter (the majority occurring pre-introduction of the bow and arrow, according to traditional accounts), and the proportionally smaller number of triangular unnotched ‘arrow’ points compared to the earlier stemmed and notched forms, this result is as expected. Hildebrandt and King’s (2012) exclusively dart-dominant result (Figure 201), on the other hand, discounted the smaller unnotched pieces altogether (in the absence of a suitable neck width measurement among this type), creating a clear bias towards dart forms, and relative exclusion of most ‘arrows’.

![Attribute Visibility](image1.png)

**Figure 197**: Comparable visibility of quantitative and qualitative attributes among the Hidden Valley Rockshelter specimens.

![Classification Application](image2.png)

**Figure 198**: Percentage of total specimens used in each classification approach for the Hidden Valley Rockshelter site.
**Figure 199:** Shott’s multiple and single variable solutions for the Hidden Valley Rockshelter specimens.

**Figure 200:** Hughes’ TSA, TP, and mass values for the Hidden Valley Rockshelter specimens. The blue dashed lines for TSA and TP represent the threshold value for dart-based systems, the red lines arrow-based systems.

**Figure 201:** Hildebrandt and King’s Dart-Arrow Index values for the Hidden Valley Rockshelter specimens.
Summary

Hidden Valley Rockshelter is especially well-suited to studies of technological change, with occupations spanning the Early Archaic to the Late Woodland – both pre- and post-introduction (of the bow and arrow) contexts. That a site with such a long (pre)history witnessed a broad range in point form – and an absence of clearly separable (dart/arrow) clusters – is, therefore, hardly surprising. In this case, whilst outliers (both large and small) attest to distinct differences at the extreme ends of the scale (supported by the separation of earlier stemmed/notched and later, unnotched types), gradations in size amongst the rest of the sample (including both intra-type variability and inter-type comparability) ensure that any clear lines of division remain blurred.

Stratigraphic information here provides a useful context for interpretation, standing in close agreement with MacCord’s (1973, 205) claim for a ‘definite trend’ from larger, stemmed/notched varieties in the earlier levels (associated with the dart and atlatl), towards smaller, predominantly unnotched varieties in the later ones (associated with the bow and arrow). There were, however, several instances where different types were recovered from the same context, and the more traditional stemmed/notched varieties commonly found in the latest levels – an indication, perhaps, of a maintained tradition. In this case, their relative quantity, comparable material type and state of preservation, implies a similar (rather than ‘special’) use-context (i.e. as a functional tool), so that if different point types are taken as evidence of different projectile systems, it seems likely that the occupants at Hidden Valley employed – for a while, at least – both the dart and atlatl and the bow and arrow.

Unlike groups (simultaneously) involved in both hunting and horticultural practices, the occupants of Hidden Valley – a local, seasonal hunting band – appear to have targeted a wider range of animals, which likely required a more extensive (i.e. varied) set of hunting strategies and associated tool types (both dart- and arrow-based). Moreover, whilst external interactions may account for some of the developments in point form (the triangular unnotched type, for example, is generally believed to represent a broader eastern phenomenon), the continued presence (and presumed use) of more traditional types in later periods implies that external pressures to affect changes in technology were, in this case, fairly limited. Thus, although differences among the collection are visible and – broadly speaking – testify to a decrease in point size over time, the
change from one technology to another was seemingly less abrupt than traditional interpretations suggest.

Finally, whilst the results derived from Shott (1997) and Hughes' (1998) classification approaches revealed a mixture of both dart and arrow forms – falling in line with the site's broadly-defined Early Archaic (pre-introduction) to Late Woodland (post-introduction) occupation interval – Hildebrandt and King's (2012) index produced a rather less accommodating (exclusively dart-based) interpretation of the data. The index – biased towards earlier stemmed/notched ‘dart’ forms (with the appropriate neck width measurements) – effectively excluded the later unnotched ‘arrow’ types from the study, highlighting two important considerations within the broader topic of classification: exclusivity and applicability.
6.3.2. Winslow 18MO9 \((N = 99)\)

**Context**

Located ‘on the left bank of the Potomac River… on a slight terrace 20 feet above normal river flow’ (Slattery and Woodward 1992, 9) (**Figure 202**), ‘Winslow was the site of Early, Middle, and Late Archaic period short-term encampments, Early and Late Woodland period villages, and a late 18\(^{th}\) through early 19\(^{th}\) century rural farmstead’ (Maryland Archeobotany 2014), occupied during both pre- and post-introduction (of the bow and arrow) periods in the area. Its popularity over such a long period of time likely owes itself the site’s diverse wetland habitat and ‘deep, well-drained floodplain soil… generally considered to be among the most fertile and productive in Montgomery County’ (Dent 2005, 2). In particular, the site’s main prehistoric component, assigned to the Late Woodland (with radiocarbon dates of c. AD1360), represents what appears to be ‘the remains of a small community of the first permanent agriculturalists to settle on the banks of the Potomac River’ (Dent 2005, 4).

Discovered in 1934 by Richard Slattery and Hugh Stabler, the first (limited) investigations at the site took place in 1940 and 1941, followed by more controlled excavation – led by Slattery, Bill Tidwell and Doug Woodward under the direction of the Southwest Chapter of the Archaeological Society of Maryland – in the late 1950s, ‘resulting in the recovery of a substantial collection

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**Figure 202**: The location of the Winslow site (Slattery and Woodward 1992, 7).
of artefacts and the mapping of numerous features’ (Maryland Archeobotany 2014). Among these were fifteen human burials (flexed and without grave goods), four canine burials (associated with the Late Woodland component), various flaked and ground stone Late Woodland tool types, ceramic sherds, bone tools, tobacco pipes, stone discoidals (possibly used as gaming pieces), several charred corn cobs, and a potential palisade (ibid; also detailed in Slattery and Woodward 1992, 15-76). A team from the Archaeological Society of Maryland (led by Richard Dent) then returned to the site in 2002 and 2003 and confirmed the presence of the palisade, ‘estimated to have been circular in shape, and about 275’ (86m) in diameter, enclosing an area of about 6,604 square yards (5,809 square metres),’ and revealed two house structures, and associated hearth and pit features (ibid). Taken together, the results of these investigations reveal ‘a community pattern marked by a palisaded village centre and a semi-circular arrangement of refuse pits… [which] contained a variety of refuse, including charcoal, ash, potsherds, animal bone, shell, fire cracked rocks, waste flakes, and stone tools’ (ibid) (Figure 203).

**Figure 234:** Plan of the Winslow site (featuring two structures, palisade postmolds, and pit features), with the 2002-2003 units superimposed onto the original base map (Dent 2005, 11).
Archeobotanical remains from the site are both abundant and diverse, hinting at the ‘exploitation of local forest environments for mast, fuel, and building materials, the utilisation of edible wild fruits, and the rigorous cultivation of maize and beans (ibid). A broad range of faunal evidence, too – including white-tailed deer, cervids, domesticated dog, fox, raccoon, cottontail, rabbit/hare, squirrel, chipmunk, vole, rodents, wild turkey, various birds, turtle, frogs, and fish – as well as the site’s ‘ubiquitous triangular projectile points… assumed to have originally functioned or been intended to function as true arrowheads,’ attest to the continued importance of hunting (Dent 2005, 15; 30). For the most part, earlier (stemmed) point types were recovered from the deepest soil horizons (alongside earlier pottery styles), and later (triangular) types from the rest, although occasional instances of earlier types among the upper levels provides an interesting case for prehistoric mixing/the maintenance of tradition, and should be borne in mind during the analyses that follow. In any case, a combined subsistence strategy was employed by the Late Woodland community at Winslow, who ‘likely occupied the site... for a decade or so,’ alongside ‘other similar settlements of people who on some level shared a common heritage’ (ibid, 45). With evidence for conflict with these other communities lacking, then, it seems likely that the aforementioned palisade served a more ‘benign’ function, perhaps as a marker of social space or to protect food stores from pests (ibid, 35), rather than a defensive measure rooted in rivalry and competition.

The variety of manufacturing materials witnessed among the triangular projectile point assemblage is, in this respect, of special interest. Although many can be attributed to local sources, ‘the presence of rhyolite in such quantity (about 35 percent) is curious,’ for ‘the closest known source... is the Catoctin Formation further west’ (ibid, 16-17). Exactly how this material was obtained remains open to debate (whether by travel or trade), although the various options proposed by Dent (2005, 18) provide valuable indirect evidence of peaceful relations with neighbouring communities and/or an apparent absence of external pressures:

‘The ability to trade for non-local raw materials would suggest good relations with peoples outside the immediate Winslow site vicinity... On the other hand, if the rhyolite and other non-local materials were procured directly by Winslow...
...villagers, it says something about the corridor west of the site to and from the quarry. Any occupants in that area were either friendly enough to allow safe passage, or alternatively perhaps there were few inhabitants within the Potomac corridor west of Winslow."

It appears, therefore, that the movement of people and/or goods across the landscape was closely linked to the design and function of various tool types, providing evidence of the role played by intra- and inter-area exchanges in materials, ideas, and innovations – to be considered during subsequent interpretations of the assemblage.

**Analysis**

*Table 13* denotes a fairly broad range in variation among the collection, with outliers recorded for three of the six attribute categories listed – weight, length, and thickness. The latter two, however, were limited enough to suggest that – barring several weight values – the Winslow specimens typically fell within what could be classed an 'acceptable' range. The combination analyses detailed in *Figure 204* appear to support this suggestion, with sample diversity described by values spread both along and across each trend line, and a relative absence of clearly-defined clusters – except in the weight:thickness diagram, where larger, heavier ‘outlier’ values were roughly separated from the rest.

Generally speaking, those at the upper end of the scale (including the outliers described above) were larger stemmed/notched types traditionally associated with earlier (predominantly dart-based) Archaic-Early Woodland occupations in the area (*Figure 205*, top and middle rows), although a number of larger, triangular unnotched forms (traditionally associated with Late Woodland occupations and the bow and arrow) also feature (*Figure 205*, bottom row, left), thus limiting the ability to distinguish between old and new, large and small, dart and arrow types at the site – based on measures of size alone, at least. Similar difficulties were encountered at the opposite end of the scale, too, with a limited number of smaller notched pieces featured alongside the more typical small, triangular unnotched type (*Figure 205*, bottom row, right). Naturally, the potential for morphological overlap between – and variability within – these different types was even greater among the rest of the sample (evidenced by the subtle differences described in *Figure 206*), making Winslow...
a good case for arguing against a clear difference in size between different point types used with (presumably) different projectile devices. Even when differences in stylistic features were accounted for, such as the presence or absence of notching, variability in related size parameters ensured that the line of division between supposedly different tool types remained blurred. Indeed, the distinction between small ‘darts’ and large ‘arrows,’ and the various early/late manifestations of each, suffers a great deal of ambiguity, especially – as is the case here – in the absence of detailed information regarding provenance.
Figure 205: A selection of large and small examples of different point types from the Winslow site. The top two rows include various stemmed/notched types attributable to the Archaic and Early Woodland periods. The bottom row features an example of a small notched point (attributed to Justice’s (1987, 208) terminal Middle Woodland-early Late Woodland Lowe cluster), and both large and small examples of the triangular unnotched type typically attributed to the Late Woodland.
As well as variation among quantitative measures, the Winslow sample featured a number of different base types, the most common being concave – typically, though not exclusively, reserved for the later triangular unnotched point type (Figure 207). The predominantly excurvate result for blade type, on the other hand, revealed a little more consistency, with limited incurvate specimens restricted exclusively to triangular forms (Figure 207).

Attribute visibility was highly variable across the assemblage (Figure 208), with thickness and blade type scoring highest (94.9 and 92.9 percent, respectively), and neck width and weight lowest (31.3 and 45.5 percent, respectively). In this case, the especially poor visibility of neck width (largely

![Figure 206: Examples of morphological overlap between, and variability within, some of the different point types recovered from the Winslow site.](image)

![Figure 207: Basic qualitative attribute values for the Winslow specimens.](image)
absent in a sample with a high proportion of unnotched specimens) compared to maximum width accounted for the comparably low applicability score produced by Hildebrandt and King's (2012) dart-arrow index, approximately 45 percent lower than for Shott (1997) and Hughes' (1998) approaches (Figure 209).

![Attribute Visibility](chart)

**Figure 208:** Comparable visibility of quantitative and qualitative attributes among the Winslow specimens.

![Classification Application](chart)

**Figure 209:** Percentage of total specimens used in each classification approach for the Winslow site.

Shott's (1997) solutions produced a predominantly dart-based result, with only very limited presence of arrows among the collection (Figure 210). In a similar fashion, the TSA, TP, and mass values derived from Hughes' (1998) approach saw the overwhelming majority placed above the proposed arrow threshold (Figure 211), whilst Hildebrandt and King’s (2012) index produced an exclusively dart-based result (Figure 212).
Multiple and Single Variable Solutions

![](image1)

**Figure 210:** Shott's multiple and single variable solutions for the Winslow specimens.

![Box plots for TSA, TP, and mass values](image2)

**Figure 211:** Hughes' TSA, TP, and mass values for the Winslow specimens. The blue dashed lines for TSA and TP represent the threshold value for dart-based systems, the red lines arrow-based systems.

![Bar chart for Dart-Arrow Index](image3)

**Figure 212:** Hildebrandt and King's Dart-Arrow Index values for the Winslow specimens.
These were an interesting set of results for a site with a major Late Woodland component, typified by the associated triangular unnotched ‘arrow’ type. Whilst Hildebrandt and King’s findings might be explained by the bias towards earlier stemmed/notched ‘dart’ forms with the appropriate neck width markers, another explanation is required for Shott and Hughes’ outcomes. In this case, the especially broad width and thickness characteristics of many of the triangular ‘arrow’ points (both important markers in Shott and Hughes’ methods) may, in part, be responsible for skewing the data. In particular, ‘difficult’ material types appear to have restricted the makers’ ability to manufacture consistently small, thin, and finely worked forms, with problems such internal flaws and ‘stacking’ combining to effect the modification of tool size and shape (as in Figure 213), thereby adding to the indistinction between supposedly larger ‘dart’ and smaller ‘arrow’ points.

Another observation relating to material type concerns the aforementioned triangular points made from rhyolite (refer to Context section). These appear typically – though not exclusively – more finely finished than those made using local materials (such as quartz and quartzite), despite otherwise displaying a comparable range of stylistic features and (broadly-defined) recovery contexts (e.g. Figure 214). Whether the rhyolite specimens were received from outsiders and replicated by local people, or the material gathered from further afield for
the manufacture of ‘special’ pieces in what had already become the local style, remains unclear. If more detailed information regarding the context of these pieces (relative to the others) became available, however, it could shed considerable light on the introduction and development of the triangular ‘arrow’ type to the area, and help explain some of the differences in size, shape and presumed function (practical or otherwise) among the collection.

Summary
With its long history of occupations – both before and after the introduction of the bow and arrow to the area (according to traditional accounts) – the variety expressed among the Winslow collection is hardly surprising. The site, desirably located in a diverse and productive environment, was frequented over a broad period of time spanning the Early Archaic to the Late Woodland (and later), making it an excellent case study for reviewing the prominence of any supposed old/new, large/small, dart/arrow point divide. Unfortunately, only very basic information regarding provenience was available for this study, so that Dent’s (2005) claims for a basic separation of stemmed forms from the deepest (i.e.
earliest) levels, compared to the predominantly triangular forms recovered elsewhere, had to be used as a basic guide to point type antiquity (contextualised by similar trends elsewhere in the region, and by Justice’s (1987) classification guide). Using simple observations of overall form and basal/edge modifications (stemmed, notched, or unnotched), the various stemmed/notched and triangular unnotched types – traditionally associated with earlier ‘dart’ and later ‘arrow’ contexts, respectively – were readily identified among the assemblage. The problem, then, was that while each type demonstrated a broad range of variation in size (and, on occasion, shape), and features comparable to other types, the simple large/small, dart/arrow point divide simply could not be applied.

As the various combination analyses attest to, Winslow comprised a diverse set of point types, with values spread both along and across the trend line, and a relative absence of any definable, dominant type clusters. In particular, the proportionally large number of wide, thick, and heavy triangular ‘arrow’ types – a product, perhaps, of issues with manufacturing materials – appeared to skew the result towards a predominantly dart-based one, as in Shott (1997) and Hughes’ (1998) approaches. Combined with the bias observed in Hildebrandt and King’s (2012) index (towards earlier ‘dart’ forms with the appropriate neck width measurements), the classification results for the Winslow site demonstrate, quite clearly, the limitations of what appears to be a subjective process shaped by individual context. Indeed, while large and small versions of different types exist (and overlap), a simple large dart/small arrow point distinction cannot be made, with classification schemes based upon this premise largely irrelevant.
6.3.3. Clarksville 44MC14 \(N = 89\)

**Context**

The Clarksville site, named for its nearness to the town, ‘lies in the Clarksville Magisterial District… on the north bank of the Roanoke River across from Occaneechi Island’ (Miller 1962, 24), broadly based ‘along the Virginia-North Carolina border… an area of great significance because it forms a link between the North and the South’ (Kerr Reservoir Archaeology 2014) (*Figure 215*). Preliminary investigations began here in 1947 as part of the Smithsonian’s River Basin Surveys salvage project, with excavations following in 1951 and 1952 (Miller 1962, 230). Having been rapidly destroyed by construction work on the nearby railroad, only two small areas of the original five acres remained free for study, thus providing the main focus of the investigation (*Figure 216*), during which ‘numerous midden pits, stone-lined wells, hearth areas, heaps of fire-cracked and/or broken stones, shell-filled pits, and burials were located,’ clustered without any clear plan or direct evidence of any structures (ibid, 150; 226). According to Miller (1962, 222), ‘the majority of traits listed are characteristic of the broad Woodland Pattern which occupied the eastern section of the United States from Maine to parts of the South Carolina,’ evidencing a broad interval of occupation at the site spanning the Middle to Terminal Woodland periods.

Subsistence at Clarksville, evidenced by plant and animal remains – including corn and beans, as well as black walnuts, hickories, acorns, wild grass seeds, the black bear, beaver, white-tailed deer, elk, gray fox, turtle, turkey, opossum, raccoon, rabbits, squirrels, and various fish, birds and waterfowl (ibid, 186; 218), reveals that although limited agriculture was practiced by the site’s inhabitants, ‘food gathering, hunting, and fishing, particularly for shellfish, still formed a major role in their lives’ (ibid, 312). Associated material culture includes various stone and bone tools, ceramics, worked shell and copper beads, and indirect evidence of textiles and weaving processes (as evidenced by pottery impressions). ‘Houses, if they ever existed, must have been of a very temporary nature since they failed altogether to register upon the site,’ and although relatively few and crudely made, tools were plentiful enough to meet the daily needs of the occupants (ibid, 218-222). Where possible, ‘rough natural stones were utilised which fitted the purpose at hand’ (including hammerstones
Figure 215: The location of the town of Clarksville (near the site), relative to the Virginia-North Carolina border and the surrounding river system (Miller 1962, 1).

Figure 216: Excavated areas at the Clarksville site (Miller 1962, 150-151).
and abraders), while ‘chipped stone objects were manufactured principally from chert, argillite, quartz, and quartzite’ (ibid, 195-203). Featured among the latter, the projectile point assemblage at Clarksville exhibits evidence of both crudely and finely made specimens:

‘Some are crudely fashioned but others display very fine chipping, demonstrating a mastery of the medium from which they were made…. The cruder, larger chert points were usually found in the lowest levels of the midden while the smaller, finer, thinner, isosceles forms of quartz and quartzite, were derived from the uppermost level. There was a slight commingling of these types in the upper middle layers of the midden as well as with certain burials. Among the chert forms are the lanceolate, stemmed, and large triangular varieties.’

(Miller 1962, 203)

This division between large and small, early and late, crudely- and finely-made pieces, combined with evidence for the commingling of types, is especially relevant to this study (which seeks to determine the prominence of assumed technological change), and should be borne in mind when reviewing the data. In a similar fashion, pottery types, too, reflect a merging (and commingling) of styles and technologies:

‘The ceramic remains indicated that the Clarksville site was first occupied by a small contingent of the makers of the Hyco Series. These people were not numerous… Later, a group of newcomers, the manufacturers of the Clarksville Series, came into the area. There was a peaceful amalgamation of the two groups as indicated by a certain blending of surface techniques… Once these Clarksville characteristics were definitely established and accepted, the Hyco method of manufacture and many of their exterior surface treatments were abandoned and the newer methods received the greater attention and were later elaborated on.’

(Miller 1962, 231)

That the Clarksville occupation covered such a broad and – in many respects – transitional timeframe, thus, makes it a valuable case study for examining the
effective visibility and pace of technological (and associated cultural) change. Shifts in tools and technologies, for example, are contextualised by other socio-cultural developments, such as the ‘gradual change in burial ritual from a flexed through semiflexed and ending with an extended form,’ accompanied by an increase in grave goods (ibid, 230-231). The quality and quantity of included worked shell items, also, implies an increased ‘labour and a love for adornment,’ whilst copper (in the form of rolled, tubular beads) – ‘used exclusively for ornamentation’ – bears witness to certain socio-political developments, for only a few individuals were the bearers of such artefacts (ibid, 191; 205).

Evidence of various trade complexes (including shells from the Gulf of Mexico and Florida, copper from either western Virginia, North Carolina, or the Lake Superior region, graphite from western Virginia or Pennsylvania, steatite from the Meherrin River area, and manganese from western Virginia; as in Miller 1962, 230), further testify to Clarksville’s position within a much broader sphere of influence, one that likely affected the adoption (and retention) of various traditions, innovations, and socio-religious beliefs though time. In one (maybe two) case(s) at the site, stone points were associated with cranial trauma, whilst another individual was recovered with a number of identical, finely worked, serrate-edged points, perhaps ‘once hafted and somehow attached to the upper arm to indicate a badge of office, or [as] a sheaf of arrows’ (ibid, 212-215). Whether these describe evidence of conflict or hunting practice remains to be seen, however, it is clear that the scale and role of certain items (projectile points, exotic materials, etc.) had diversified, associated with both the living and the dead, and attributed to more than one use-context (e.g. symbolic/ceremonial, as well as practical).

Momentum for these various cultural (and technological) developments (including external pressures, peaceful or otherwise) appears to have ‘flowed in from the north and northeast with the earliest of the Algonquian cultures… [and] met oncoming impetus out of the south and southeast just beyond the borders of Virginia and North Carolina’ (ibid, 313). The role of intra- and interregional connections, therefore, forms an important consideration for the interpretation of the Clarksville assemblage (specifically, the presence or absence of material cultural diversity, the prominence of change, and comparability to other sites and study areas).
Analysis

Table 14 attests to a broad range in variation among the Clarksville sample, with outlier values recorded for five of the six attribute categories listed. In the combination analyses (Figure 217), these are characterised by isolated points at the extreme upper end of the scale and are typically associated with earlier occupations at the site (Figure 218, top row). By contrast, the tightest morphological ‘clustering’ occurs towards the lower end of the scale, with points becoming more widely dispersed (i.e. morphologically less consistent) as size increases.

Table 14: Summary of attribute averages, range, and outlier values for Clarksville.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Mean</th>
<th>Median</th>
<th>Lowest Value</th>
<th>Highest Value</th>
<th>Range</th>
<th>% Outlier Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (g)</td>
<td>5.03</td>
<td>1.77</td>
<td>0.38</td>
<td>48.81</td>
<td>48.43</td>
<td>6.15</td>
</tr>
<tr>
<td>Length (mm)</td>
<td>33.40</td>
<td>27.14</td>
<td>11.43</td>
<td>101.61</td>
<td>90.18</td>
<td>6.76</td>
</tr>
<tr>
<td>Width (mm)</td>
<td>19.64</td>
<td>18.79</td>
<td>10.54</td>
<td>33.25</td>
<td>22.71</td>
<td>1.30</td>
</tr>
<tr>
<td>Thickness (mm)</td>
<td>6.24</td>
<td>5.12</td>
<td>2.35</td>
<td>17.80</td>
<td>15.45</td>
<td>2.27</td>
</tr>
<tr>
<td>Basal Width (mm)</td>
<td>17.29</td>
<td>17.06</td>
<td>9.43</td>
<td>28.04</td>
<td>18.61</td>
<td>1.47</td>
</tr>
<tr>
<td>Neck Width (mm)</td>
<td>17.15</td>
<td>16.20</td>
<td>13.56</td>
<td>23.89</td>
<td>10.33</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Figure 217: Simple combination analyses applied to the Clarksville specimens. The more tightly-grouped, consistent, and predominantly triangular type in highlighted in red, and the more dispersed, inconsistent, and predominantly stemmed types highlighted in blue. The black arrow represents a ‘typical’ triangular unnotched point and the red arrow an ‘atypically’ smaller stemmed point (refer to Figure 220), within the broader assemblage.
The main (i.e. the most consistent) group comprises various expressions of the triangular unnotched type (*Figure 219*), typically associated with Late to Terminal Woodland contexts, Mississippian influences, and the use of the bow and arrow. The secondary (i.e. more dispersed) group, on the other hand,

*Figure 218*: The larger ‘outlier’ specimens from Clarksville (top row) and a selection from the secondary large group (middle and bottom rows). Similar forms are described in Justice’s (1987, 98; 185; 210) Early Woodland Stemmed, Lowe (Middle Woodland), and Stanley Stemmed (Archaic) clusters (right column, from top to bottom), covering a broad temporal-cultural range.
combines various stemmed (and a few notched) forms more typical of the preceding Early to Middle Woodland (and potentially Archaic) phases at the site (according to Justice’s 1987 type cluster categorisations) (*Figure 218*, middle and bottom rows). Only loosely defined according to gradation in size, though, the presence of a notched point among the smaller triangular unnotched group, and more or less subtle variations in the latter (*Figure 220*), ensures that closer observation of qualitative features (such as basal type) are what make these groups more clearly separable. For the most part, however, a combined examination of size and shape, quantitative and qualitative type traits, attests to a fairly well-defined difference between earlier (typically stemmed) forms associated with the dart and atlatl, and later (unnotched triangular) ones associated with the bow and arrow, the latter accounting for roughly 70 percent of the assemblage based on basic observations of shape.

Base type falls predominantly within the range of straight to concave, with convex styles typically limited to the earlier, stemmed varieties, whilst blade

*Figure 219*: A selection of triangular unnotched form typically associated with the Late to Terminal Woodland (and terminal Middle Woodland) periods in the area.
type sits mainly within the straight to excurvate range, with incurvate forms reserved exclusively for the later triangular point type (Figure 221).

All of the attributes studied attained above 70 percent for visibility – except neck width, which was limited to just 9 percent (Figure 222). Thickness was the most visible (98.9 percent), followed by blade and base type (93.3 and 87.6 percent, respectively), and then maximum width (86.5 percent). In this case, the comparably poor visibility of neck width to maximum width accounts for the distinct difference in applicability scores, with Shott (1997) and Hughes’ (1998) classification schemes representing a much higher proportion of the sample than that of Hildebrandt and King’s (2012) dart-arrow index (Figure 223).

![Figure 220: Evidence of size overlap between types, and variation within a type. First and third from the left correlate with the red and black arrows in Figure 217, respectively.](image)

![Figure 221: Basic qualitative attribute values for the Clarksville specimens.](image)
Although there appears to be some disparity among the results produced by Shott’s (1997) various solutions, the most accurate of the four (the one and two variable solutions) agreed upon a fairly equal dart-arrow divide within the sample (Figure 224). Similarly, the TSA and TP values derived from Hughes’ (1998) approach describe a median closely associated with the proposed arrow thresholds (with a fairly equal division of specimens above and below the line), and a range in mass values attributable to both darts and arrows (Figure 225). This reveals a more even type divide than described by simple shape observations (above), with some of the larger (wider) triangular points (typically associated with the bow and arrow) overlapping into dart territory and revealing a key limitation of type categorisation based on size parameters alone. Hildebrandt and King’s (2012) index, on the other hand, reveals an exclusively dart-based result (Figure 226), a product – quite clearly – of extremely poor applicability and the non-representation of the site’s unnotched triangular ‘arrow’ form (which lacked the appropriate neck width measurements).
**Figure 224:** Shott's multiple and single variable solutions for the Clarksville specimens.

**Figure 225:** Hughes’ TSA, TP, and mass values for the Clarksville specimens. The blue dashed lines for TSA and TP represent the threshold value for dart-based systems, the red lines arrow-based systems.

**Figure 226:** Hildebrandt and King's Dart-Arrow Index values for the Clarksville specimens.
Unfortunately, much of the information regarding point proveniences was missing for the sample studied here, thus limiting the potential to explore distribution patterns. Of the information that was available, however, there was evidence of both mixing and temporal separation of types. In one case, three smaller triangular points and one larger, more roughly-worked specimen were recovered from the same feature, but the latter from a decidedly lower (earlier) level than the others (Figure 227). Conversely, on another occasion, this temporal distinction was missing, with a portion of an earlier (potentially Archaic, see Justice’s (1987, 151) Ledbetter Cluster) point recovered from the same level as later triangular forms (Figure 228). Although based on only two examples, this corroborates the aforementioned occasional ‘commingling’ of types more typically found in different levels expressed in the original site report (Miller 1962, 203), and should be borne in mind when considering the potential for the combined use of types (and associated projectile technologies).

**Figure 227**: A fragment of a potentially Archaic point (left) found in a lower level of the same context as these triangular points.

**Figure 228**: Part of a larger, more roughly-worked specimen (left) recovered from the same context as these smaller, triangular points.
Summary

The variations expressed in Table 14 are presented as two broadly-defined groups in the combination analyses (Figure 21), standing in agreement with the trend from large to small, roughly- to more finely-worked points through time, as described in Miller’s (1962) original report – and, essentially – traditional interpretations regarding the introduction and standardisation of the bow and arrow. While undoubtedly a useful marker, though, size alone does not account for the distinction between seemingly larger ‘dart’ and smaller ‘arrow’ point types. As the closeness of the groups along each trend line and the results derived from Shott (1997) and Hughes’ (1998) classification analyses attest, more or less subtle variations in each form reveal a certain amount of crossover. Thus, closer observation of more specific point traits – in this case, the distinction between typically earlier, stemmed/notched and later, unnotched forms – combines with supporting quantitative analyses to provide a much clearer impression of typological (and associated technological) change.

The relatively high proportion of (and consistency among) the later triangular type (and a lesser number of Middle to Late Woodland stemmed/notched varieties) sits in accordance with the site’s primary occupation during the Middle to Terminal Woodland period. In this case, however, the sample also evidenced several Early Woodland (and even Archaic) type traits, and thus the presence of an earlier component at Clarksville, or else continued use of traditional tool types (and associated technologies). Indeed, Miller’s (1962) original report confirms the presence of ‘special’ use-contexts at the site (as in the burials described in the Context section) and, thus, the non-utilitarian role of less ‘typical’ pieces (which could, potentially, include those larger ‘dart’ forms recovered from later, primarily ‘arrow-based’ contexts). Either way, it seems as though earlier forms were both visible to the later occupants and, on occasion, (re)incorporated into their lifeways, even if in a somewhat different or diminished role.

Evidenced in gradual changes elsewhere at the site – including pottery manufacture and burial practice – the transition from one technology to another took time. Smaller stemmed/notched and larger triangular unnotched specimens – although fewer in number than their more ‘typical’ counterparts – describe a key element within the broader process of implementation, experimentation, and subsequent standardisation. Smaller versions of the more
traditional form, for example, may represent the earliest use of the bow and arrow, and larger versions of the newer form the latest use of the dart and atlatl. In this respect, although the more broadly-defined difference between types and their associated technologies appears to hold true, a precise temporal-functional division cannot be made without the supporting organic material evidence (bows, atlatls, associated foreshafts etc.). Once the new technology reached the standardisation stage, however, the difference between early and late, large and small, typically ‘dart’ and ‘arrow’ forms appears more prominent, a reflection, perhaps, of external pressures or influences and a growing trade complex, with the late isosceles triangular form increasingly ‘widespread… wherever Late Woodland or Mississippian influences [had] been felt’ (Miller 1962,126). In this case, the location of Clarksville (based on the North-South border), and the continued importance of hunting at the site, combine to provide a good case for maintaining an ‘up to date’ (both functionally and culturally) projectile point (and associated system).
6.3.4. Virginia Burial Mounds (sites 44RM281 and AU35M)

Context

‘At least 13 accretional earthen mound and earth-stone burial mounds were constructed and used in interior Virginia during the eleventh through the fifteenth centuries (and possibly later)’ (Gold 2004, 31) (Figure 229). Among them are the Linville (44RM281) and John East (AU35M) mound sites, studied here in an attempt to shed light on materials (in this case, flaked stone projectile points) associated with ‘alternative’ use-contexts. Defined by Gold (2004, 31):

‘These mounds are the only Late Woodland mounds in the area, and all were used for mortuary purposes. All are of earthen or earth and stone construction, of roughly similar size, and most are located on the floodplains of major rivers or tributaries, many in close proximity to Late Woodland village sites. Ceramic and lithic artefacts deliberately and accidentally included in the mounds suggest temporal and cultural affinity among them.’

Figure 229: The location of the Virginia burial mound sites (Dunham et al. 2003, 110). Linville (8) and John East (6) are highlighted in red.
Although varied in type, size, and associated population estimate (Table 15), they represent an important ‘cultural phenomenon’ within the Virginia woodland. This ‘phenomenon’ was significant for several reasons – among them, location:

‘… the mounds are located at a compelling, albeit challenging, geographic nexus – that area of the Eastern Woodlands immediately beyond the northeastern extent of Mississippian mound distributions and just west of the coastal distribution of late prehistoric Woodland ossuaries. At a broad level of abstraction, the Virginia mounds contain structural elements of both but can be classified as neither…’

(Dunham et al. 2003, 110-11)

In this case, the relationship (both economically and socio-politically) between the ‘users’ of the Virginia mound sites and those from further afield remains uncertain, although it is ‘clear that the local societies of the Middle Atlantic region were never isolated from neighbouring regions… during the Woodland period’ (Hantman and Gold 2002, 287). This is important as it opens up the possibility of intra- and inter-regional relations, and the sharing (or rejecting) of various materials and ideas associated with cultural (and technological) change. As Dunham et al. (2003, 124) suggest, ‘the collective secondary burial features

Table 15: Information pertaining to type, size, and population estimates for the Virginia burial mounds (Dunham et al. 2003, 111). Linville and John East are highlighted accordingly.

<table>
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<th>Mound Name</th>
<th>Other Names</th>
<th>Base (ft.)</th>
<th>Hgt (ft.)</th>
<th>Volume (ft³)</th>
<th>Estimated Population</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Sub Mound</td>
<td>Mound</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I. Earth and Stone Mounds</td>
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<td>Bell Mound #1</td>
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<td>4</td>
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<td>6</td>
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<td>Clover Creek</td>
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<td>36</td>
<td>10</td>
<td>4946</td>
<td>?</td>
</tr>
<tr>
<td>Hirsch</td>
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<td>40</td>
<td>5</td>
<td>3206</td>
<td>46</td>
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<td>II. Earthen Mounds</td>
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<td>5562</td>
<td>—</td>
</tr>
<tr>
<td>Rappidin</td>
<td>none</td>
<td>40</td>
<td>15</td>
<td>9089</td>
<td>168</td>
</tr>
</tbody>
</table>

Note: The population columns are estimations based on extrapolation from observed numbers of individuals in each mound. Differential preservation and excavation strategy make these estimates the best estimate possible with the available data.
in the accretional mounds indicate a dramatic change in the ritual life of the native peoples of Virginia,' whereby ‘the ritual associated with the death of many individuals was completed only intermittently and only in a collective manner,’ so that ‘burial at a mound assumed the scale and impact of a public ceremony, a community-wide event.’ So too, ‘the mounds may also have marked territory and local control of land and resources,’ while ‘the striking regional similarity in the mounds… speaks to an inclusive nature of the ancestral cult, which united the region, marking above all the shared identity of those who lived where the mounds stood’ (ibid, 125). Any changes or differences in technology, thus, should be considered in light of accompanying socio-political developments, both locally and further afield, and interpretations regarding the pace, prominence, and nature of this change adjusted accordingly.

Although typically dated to the Late Woodland, several of the mounds – including Linville – ‘are increasingly understood to have an earlier component’ (Hantman and Gold 2002, 286), to be borne in mind when accounting for the presence (or absence) of technological diversity within the assemblage. Linville Mound (also known as Bowman Mound) was excavated by Gerard Fowke during the late nineteenth century (around 1891-1892), at which point the site had already been looted for many years. ‘Located on the floodplain of Linville Creek, approximately six miles upstream from its confluence with the north fork of the Shenandoah River’ (Hantman and Gold 2002, 286), the mound lay on northern edge of the group (Figure 229), and originally stood at an estimated 10 to 12 feet high. Although ‘there was no village or camp in the immediate vicinity’ of the site (Fowke 1893, 419), Fowke’s excavation of the remaining structure uncovered ‘many collective secondary burial features, as well as a variety of other interment types, including single and small multiple interments (primary and secondary) and cremations,' along with a variety of artefacts including ‘gorgets, red ochre, shell, bone needles, stone tools of quartzite and chert, clay pipes, ceramic vessels, a panther claw, and two distinctive bone/antler combs’ (ibid). According to Hantman and Gold (2002, 286), ‘Fowke’s narrative does not allow precise determination of the placement of these various objects, but he does indicate that many of the more elaborate grave goods were concentrated in one area,’ providing a vague indication of status and hierarchy (similarly implied by Carpenter 1950, 308). The presence of circular depressed healed
traumatic lesions on three of the 16 intact crania he recovered, too, provides useful insight into the (violent) experiences endured by some of the Linville burial population (Gold 2004, 112), which may have constituted as many of eight hundred individuals (Fowke 1893, 419).

John East Mound, smaller and to the south of Linville (Figure 229), was excavated in 1952 (although the owners of the site had explored the area previously, encountering various burials but recovering only two artefacts, both of them pipes) (Holland et al. 1953, 2), and, with a radiocarbon date of c.AD1010-1160 (Gold 2004, 33), falls neatly within the Late Woodland for the

Figure 230: A map of John East Mound (top) with reference to the various test cuts, and a profile of Test Cut 3 (bottom), describing the succession of burials within the mound centre (Holland et al. 1953, 6; 8).
area (potentially associated with a contemporary site village site upstream, based on surface collections). Located on a river flat two miles long and approximately thirty yards from the left bank of the Shenandoah River, the mound measures around 45 feet wide and 55 feet long, and, upon excavation (Test Cut 3) revealed a succession of burials, placed in the ground and covered with rocks, building the height of the structure over time (Holland et al. 1953, 2-4) (Figure 230). According to Holland et al. (1953, 4), ‘the burials encountered were flexed and the head often rested on a rock. Charred finger, toe and skull bones indicate some exposure to fire, but there was no evidence of conscious cremation, and although ‘offerings… were placed with the burials… these do not appear to be numerous.’ The first burial group, for example, comprised two male individuals, a piece of turtle carapace, and a small stone pipe, and the second, a badly decomposed individual and a pitted hammerstone (which may or may not have been associated with the individual) (ibid, 3). The third burial group – including two individuals, a likely female aged 20-30 and a male aged 35-50 – is, however, of special interest to this study. This is because it contained three (perhaps four) large triangular ‘arrow’ points (recovered alongside a rectanguloid stone pendant and copper fragment associated with the male individual) (ibid, 3-4), the only points recovered from the site (thus far). In this respect, John East provides valuable insight into ‘special’ pieces associated with a non-utilitarian recovery context.

Analysis

Linville Mound 44RM281 (N = 14)

Table 16 reveals a fairly broad range in variation among the Linville sample (with only two outlier values recorded; one for weight, one for basal width), characterised by the separation of several larger, more dispersed values, and what appears to be a more consistent, dominant type cluster (Figure 231). This cluster, typically based towards the lower (i.e. smaller) end of the scale, represents the triangular unnotched ‘arrow’ point type most commonly associated with the Late Woodland period, whilst the others describe what could be larger versions of a roughly triangular/reworked triangular form (perhaps associated with an earlier, Middle Woodland component), or else other tool types (flaked stone knives/drills) (Figure 232).
Little precise information regarding recovery context exists for the triangular type cluster, although two of the larger pieces were, interestingly, found associated with a skeleton. It might be suggested, then – albeit only tentatively – that these larger (potentially ‘dart’) types enjoyed an ‘elevated’ function above the more typical ‘arrow’ recovered from the Linville Mound, although, considering their fine flaking, consistency in manufacture and material type, all of the stone ‘points’ in the sample were – perhaps unsurprisingly given their location – designed and utilised with a ‘special’ use-context in mind.

Table 16: Summary of attribute averages, range, and outlier values for Linville Mound.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Mean</th>
<th>Median</th>
<th>Lowest Value</th>
<th>Highest Value</th>
<th>Range</th>
<th>% Outlier Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (g)</td>
<td>8.82</td>
<td>3.46</td>
<td>1.57</td>
<td>29.43</td>
<td>27.86</td>
<td>8.33</td>
</tr>
<tr>
<td>Length (mm)</td>
<td>48.67</td>
<td>36.90</td>
<td>28.77</td>
<td>93.16</td>
<td>64.39</td>
<td>0.00</td>
</tr>
<tr>
<td>Width (mm)</td>
<td>26.19</td>
<td>25.05</td>
<td>18.46</td>
<td>35.71</td>
<td>17.25</td>
<td>0.00</td>
</tr>
<tr>
<td>Thickness (mm)</td>
<td>6.00</td>
<td>5.23</td>
<td>3.67</td>
<td>9.23</td>
<td>5.56</td>
<td>0.00</td>
</tr>
<tr>
<td>Basal Width (mm)</td>
<td>25.38</td>
<td>24.06</td>
<td>18.46</td>
<td>35.28</td>
<td>16.82</td>
<td>8.33</td>
</tr>
<tr>
<td>Neck Width (mm)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Figure 231: Simple combination analyses applied to the Linville Mound specimens.
Base type fits predominantly within the range of straight to concave, the latter restricted to the triangular unnotched cluster, whilst blade type – a little more mixed – includes both straight forms, mostly attributed to the dominant cluster, and incurvate/excurvate variations, typically reserved for the larger, more varied pieces among the collection (Figure 233).

Figure 232: The larger, more varied specimens from the Linville site (top row), perhaps knives (and/or a drill) rather than points, and the triangular unnotched types represented by the dominant ‘cluster’ in the combination analyses (middle and bottom rows).
Attribute visibility was especially good at Linville (with all categories scoring at least 85 percent), excepting neck width, which was entirely absent among the unnotched sample (Figure 234). As a result, Hildebrandt and King’s (2012) dart-arrow index (which requires neck width values in its function) had to be omitted for this site, although Shott (1997) and Hughes’ (1998) approaches went on to represent a large proportion of the collection (Figure 235).

As Shott’s (1997) three- and four-variable solutions required neck width measures to function, only the one- and two-variable solutions could be used here, although both agreed upon a predominantly dart-based system at the site, with only very limited presence of ‘arrow’ points (Figure 236). A similar pattern

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**Figure 233:** Basic qualitative attribute values for the Linville Mound specimens.

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**Figure 234:** Comparable visibility of quantitative and qualitative attributes among the Linville Mound specimens.
was reflected in the results derived from Hughes’ (1998) TSA, TP and mass values, with the majority falling well beyond the proposed arrow thresholds (Figure 237); an interesting outcome for a site represented by a predominantly triangular unnotched point type typically associated with Late Woodland contexts and the bow and arrow.

Figure 235: Percentage of total specimens used in each classification approach for the Linville Mound site.

Figure 236: Shott’s multiple and single variable solutions for the Linville Mound specimens.

Figure 237: Hughes’ TSA, TP, and mass values for the Linville Mound specimens. The blue dashed lines for TSA and TP represent the threshold value for dart-based systems, the red lines arrow-based systems.
John East Mound AU35M \((N=4)\)

Table 17 describes a relatively narrow range in variation for John East Mound (limited to only four specimens), documenting only a single outlier value (in this case, width and basal width are equal). As the combination analyses attest to, two of the points were especially similar (i.e. closely placed), evidencing adherence to what appears to be a fairly strict ‘mental template’ and manufacturing process, although variations in size persisted at both ends of the scale (Figure 238). In this case, it was shape – rather than size – that was most tightly controlled, supported by the closeness of the values to the trend line and by qualitative observations of base and blade type, exclusively concave and straight, respectively (Figure 239).

**Table 17:** Summary of attribute averages, range, and outlier values for John East Mound.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Mean</th>
<th>Median</th>
<th>Lowest Value</th>
<th>Highest Value</th>
<th>Range</th>
<th>% Outlier Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (g)</td>
<td>3.43</td>
<td>3.13</td>
<td>1.58</td>
<td>5.86</td>
<td>4.28</td>
<td>0.00</td>
</tr>
<tr>
<td>Length (mm)</td>
<td>40.17</td>
<td>41.11</td>
<td>24.93</td>
<td>53.52</td>
<td>28.59</td>
<td>0.00</td>
</tr>
<tr>
<td>Width (mm)</td>
<td>25.58</td>
<td>24.68</td>
<td>21.20</td>
<td>31.75</td>
<td>10.55</td>
<td>25.00</td>
</tr>
<tr>
<td>Thickness (mm)</td>
<td>4.79</td>
<td>4.71</td>
<td>3.89</td>
<td>5.87</td>
<td>1.98</td>
<td>0.00</td>
</tr>
<tr>
<td>Basal Width (mm)</td>
<td>25.58</td>
<td>24.68</td>
<td>21.20</td>
<td>31.75</td>
<td>10.55</td>
<td>25.00</td>
</tr>
<tr>
<td>Neck Width (mm)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Figure 238:** Simple combination analyses applied to the John East Mound specimens.
As in Figure 240, all four specimens were of the triangular unnotched point type, traditionally associated with the bow and arrow and the site’s Late Woodland temporal-cultural assignment, and all were manufactured from the same material type, a blackish grey chert. Interestingly, only the larger three were documented in Holland et al.’s (1953) report, associated with the remains of an adult male, leaving the context – and associated meaning – of the fourth, somewhat smaller point, open to debate. One suggestion might be that the larger points were considered more ‘special’, thus elevating their function and, in effect, their association with the deceased. In the absence of more detailed information regarding context, however, the nature of such differences can only be surmised.
The relative completeness of the points from John East meant that attribute visibility was especially good, scoring 100 percent for all categories except neck width, which was entirely absent among the unnotched sample (Figure 241). As was the case for the Linville collection, Hildebrandt and King’s (2012) dart-arrow index (which requires neck width values in its function) had to be omitted for this site, whilst Shott (1997) and Hughes’ (1998) approaches went on the represent all points in the sample (Figure 242).

Shott’s (1997) one- and two-variable solutions agreed upon an exclusively dart-based classification (Figure 243), whilst Hughes’ (1998) TP, TSA, and mass values fell mostly beyond the proposed arrow threshold, with only very limited extension into arrow territory for the latter two (Figure 244). Again, this was an interesting outcome for a site represented exclusively by points attributed to the Late Woodland period and the use of bow and arrow, providing further evidence

![Attribute Visibility](image1)

**Figure 241**: Comparable visibility of quantitative and qualitative attributes among the John East Mound specimens.

![Classification Application](image2)

**Figure 242**: Percentage of total specimens used in each classification approach for the John East Mound site.
for the limitations associated with using size to determine represented function (dart or arrow), particularly among samples recovered from ‘alternative’ use-contexts.

![Multiple and Single Variable Solutions](image)

**Figure 243:** Shott’s multiple and single variable solutions for the John East Mound specimens.

![Figure 244](image)

**Figure 244:** Hughes’ TSA, TP, and mass values for the John East Mound specimens. The blue dashed lines for TSA and TP represent the threshold value for dart-based systems, the red lines arrow-based systems.

**Summary**

That the Linville and John East mound sites were primarily (if not, exclusively) used for mortuary purposes made them an excellent case study for determining the effects of ‘special’ attributed function (and meaning) upon artefact design – in this case, flaked stone points. Despite a few larger pieces among the Linville collection – which may or may not represent knives or drills, rather than projectile points – all recovered pieces were of the triangular unnotched variety.
commonly attributed to the Late Woodland (and Mississippian) period and, according to traditional accounts, the use of the bow and arrow. Finely flaked, relatively complete, and morphologically consistent (basal type within the straight to concave range, and blade type typically straight), they evidenced strict adherence to a dominant tool design (or ‘mental template’), the appropriation of time and attention to detail, and, in effect, a ‘special’ (i.e. controlled, intended) function and ‘shared identity’ among sites within the wider mound ‘complex’ (and links with cultures from further afield, such as the Mississippian). Slight deviations in size – at both the large and small ends of the scale – attest to limited flexibility within the manufacturing process, and, perhaps more importantly, highlight the problem of using strict size parameters when classifying even the most consistent of point types.

For the most part, however, these samples displayed a great deal of homogeneity and were awarded, where possible, the same functional classification. In this case, only Shott (1997) and Hughes’ (1998) solutions could be used, for Hildebrandt and King’s (2012) index required an attribute missing from these unnotched samples (neck width), signalling two of many subjectivities within the classification process – applicability and context. Remarkably, despite (traditionally) having been associated with the bow and arrow, both Shott and Hughes’ approaches classified these points as darts. One possible explanation might be that points designed for special, ‘elevated’ contexts (such as burial mounds) were made larger for symbolic-aesthetic reasons, causing them to overlap in size with the (traditionally) larger dart point. Alternatively, this point type might have been awarded interchangeable dart-arrow functions, or lacked a specific attributed function altogether, intended only as a broader symbol of identity, skill or bravery etc. Considering the dart-dominant ratios of other, largely post-introduction (of the bow and arrow) sites in the study area, however, it is likely that Woodlands ‘arrow’ types were typically larger than those for which Shott and Hughes’ methods were originally intended/derived from (i.e. Southwestern collections). In this respect, classification values ought to be realigned according to a more specific context, rather than universally applied.

Presumably, more information regarding the comparability (size, prominence of basal and edge features, fineness of flaking, material type, etc.,) of points recovered from burial mounds and those included in the more ‘typical’
associated site assemblage for the area would help clarify the prominence of a ‘true’ difference in size, and should be borne in mind for the future. For the time being, though, Linville and John East remain important contributors to the study, providing valuable insight into the relationship between ‘alternative’ use-contexts and ‘specially-made’ versions of a given point type, evidencing several key issues regarding the process of classification (whether dart, arrow, both, or neither) and subsequent interpretation (relative to other, more ‘typical’ site contexts).
6.3.5. Study Area Three: A Summary of the Woodlands

Of the many insights gained from the Woodlands data, perhaps the most significant was the admission that physical expressions of technological change are not necessarily (nor exclusively) derived from an explicit difference in point size. Generally speaking, sites with longer and/or multiple occupations spanning pre- and post-introduction (of the bow and arrow) periods (refer to Figure 245) displayed, as expected, the broadest range in attribute values studied (including Hidden Valley Rockshelter, Winslow, and Clarksville) (Figures 246-251). By contrast, the consistently narrowest range in variation occurred at John East Mound, a Late Woodland (post-introduction) site with a much shorter period of use (a pattern similarly reflected at its counterpart – Linville Mound – if the larger, potentially knife/drill pieces in the assemblage omitted and the weight/length categories duly adjusted), so that – broadly speaking – the data supports conventional interpretation of a move towards a more consistent (i.e. dominant) projectile system by the Middle-Late Woodland periods (after c. AD500). Any clearly-defined decrease in average values through time (according to traditional accounts of a shift from larger ‘dart’ to smaller ‘arrow’ points), however, is lacking, as are distinctly separable large/small, dart/arrow type clusters. In fact, two of the exclusively late, post-introduction sites – Linville

![Temporal-cultural assignments of each site relative to the others within the Woodlands study area.](image)

*Figure 245: Temporal-cultural assignments of each site relative to the others within the Woodlands study area.*
Figure 246: Weight data (with and without outliers) for the Woodlands sites.

Figure 247: Length data (with and without outliers) for the Woodlands sites.
Figure 248: Width data (with and without outliers) for the Woodlands sites.

Figure 249: Thickness data (with and without outliers) for the Woodlands sites.
Figure 250: Basal width data (with and without outliers) for the Woodlands sites.

Figure 251: Neck width data (with and without outliers) for the Woodlands sites.
and John East – bore witness to some of the highest averages calculated (except for thickness), a clear contradiction of traditional assumptions regarding the relationship between point size and antiquity.

As closer observations of each site collection revealed, it is point shape (largely defined by qualitative traits, such as blade type, base type, the presence or absence of notching, etc.) rather than size (described in quantitative terms), which best characterises the difference between presumably earlier ‘dart’ and later ‘arrow’ types. As Hidden Valley, Winslow, and Clarksville each attest to, there exists a broad level of separation between larger stemmed/notched points attributed to earlier, predominantly ‘dart-based’ contexts, and various manifestations of the later unnotched triangular ‘arrow’ point, each with their own distinctive type features. At the extreme ends of the scale, this division also appears to correspond with traditional interpretations of a large dart/small arrow point divide, although intra-type variability and inter-type comparability among the ‘core’ sample limits the viability of a clear and consistent size difference between the two.

Of particular interest are especially large manifestations of the unnotched triangular ‘arrow’ type, which was often much larger than traditional classification schemes tend to permit, especially (although, not exclusively) among the ‘alternative’ recovery contexts of the two burial mound sites. In this case, despite maintaining ‘atypically’ large attribute values in all other categories, the Linville and John East specimens demonstrated comparably low thickness values (refer to Figure 249), providing evidence, perhaps, that these pieces were more finely worked and, in effect, awarded an ‘elevated’ (i.e. otherwise enlarged) status compared to the more typical, practical tool type. That similarly large examples of this type were recovered elsewhere in the study area, however, negates their restriction to ‘special’ contexts, and provides sound argument against the use of strict, exclusively size-based classification parameters for sites from such a diverse and distant set of sites and study areas.

The relative absence of neck width among the unnotched triangular type, too (as in Figure 251), presented another stumbling block within the classification process, demonstrating clear implications for the comparative applicability of (and subsequent interpretations derived from) each of the three schemes tested here. Hildebrandt and King’s (2012) dart-arrow index, for
example – which required neck width values in order to function – became increasingly less viable among sites with a predominantly Late Woodland (i.e. unnotched triangular) component, whereas Shott (1997) and Hughes’ (1998) approaches – which functioned without neck width – were able to maintain equally high (>75 percent) scores throughout (Figure 252).

It was hardly surprising, then, that Hildebrandt and King’s (2012) approach, where applicable, produced exclusively dart-based results, biased towards the classification of earlier, stemmed/notched varieties, compared to the more varied outcomes of Shott (1997) and Hughes’ solutions (Figures 253-255). However, although arrow types were better represented among the latter, the proportion of ‘dart’ values remained unexpectedly high for a series of sites characterised by Late Woodland occupations and an associated point type traditionally thought to represent the use of the bow and arrow. In this case, the data was subject to the biases of classification schemes originally designed for/derived from collections in the Southwest (where the size and shape of ‘dart’ and ‘arrow’ points was somewhat different – i.e. smaller), the parameters of which were inappropriate for the Woodland types. Combined with the problems posed by intra-type variability and inter-type comparability, thus, the distinction between supposedly larger ‘darts’ and smaller ‘arrows’ is far from simple or objective. Rather, it requires an integrated approach combining the study of both quantitative and qualitative point features, an acceptance of flexibility in type
design, manufacture, and associated use-context, and an appreciation of the relationship between more broadly based trends and their local variations.

As aforementioned, the people who occupied the sites in this area were far from isolated. Based on the northeastern periphery of the influential Mississippian culture, it is hardly surprising that – among other traits – the unnotched triangular point type became increasingly popular during the late prehistoric period. As Fagan (1991, 335) suggests, these connections, often rooted in trade and exchange, ‘assumed ever greater importance in the yearly round’ and ‘became a source not only of valued possessions and raw materials

![Graph 1](image1.png)

**Figure 253:** The results derived from Hildebrandt and King’s (2012) dart-arrow classification index for the Woodlands sites.

![Graph 2](image2.png)

**Figure 254:** The results derived from Shott’s (1997) single variable classification solution for the Woodlands sites.
traded for food or other commodities, but of social connections and prestige – a way of maintaining diplomatic relations with the outside world.’ Inevitably, some sites were more integrated than others, but for the most part, it seems there was an increasing pressure – or a desire – among the area’s inhabitants to

**Figure 255:** The results derived from Hughes’ (1998) TSA, TP, and mass values for the Woodlands sites, relative to the proposed dart (blue) and arrow (red) thresholds.
conform to this popular ‘mental template’ and adopt what had become the common point form (and associated tool type). That being said, the presence of earlier stemmed/notched varieties among some of the later site levels (as at Hidden Valley Rockshelter) – albeit in smaller quantities – attests to the value people placed upon maintaining an awareness (if not active use) of traditional (local) tools and technologies. At this point it seems appropriate to suggest that only by including these ‘anomalies’ and accounting for flexibility in point design and use strategies – elements far too often overlooked in traditional classification approaches – can any meaningful conclusions be drawn from the data. Although well-defined, distinctly-different, and clearly-separable functional tool types might be the classifier’s dream, it seems they rarely feature in practical reality.
7. Inter-Study Area Trends

Featured among the various intra-area patterns described in Chapter 6 (each contextualised by economic necessity – or lack thereof – and associated temporal-cultural developments) is technological diversity. This diversity (i.e. variation) – in tool design, manufacture, and use – provides strong support for the value of individual context, attributed meaning, and the need to revaluate approaches to artefact classification. Naturally, similarities between sites within a given study area do exist, although they are not always as explicit or consistent as traditional accounts would have us believe. This is justified, for example, by some of the inconsistencies witnessed among the classification results, evidence of different tool preferences among contemporary sites, and the presence (or lack thereof) of traditional forms alongside newer ones. As the focus now shifts from trends at the intra- to inter-study area level, therefore, it seems only sensible to predict an increase in assemblage variability, and, in effect, an exacerbation of associated implications regarding classification practices and archaeological interpretation. Evidence in support of this assumption will be discussed according to a basic review of attribute values and visibility, followed by a note on the comparative applicability and subsequent results of each of the three classification schemes tested, as below.

**Attribute values**

Based on the inter-area comparisons described in Figures 256-261, it appears that – among these samples, at least – Woodlands points were typically heavier, longer, wider and thicker than those of the Plains and the Southwest, with larger basal and, where present, neck widths (with similar trends reflected in both modified and unmodified datasets). At the opposite end of the scale, the Plains points were, on average, lighter, shorter, narrower, and thinner than the rest, with a comparably narrow (inter-quartile) range in variation that might be used to infer greater consistency and control in design and manufacture, compared to those recovered from the Southwest and Woodlands sites studied here. That the main component of the Plains sites belonged to post-introduction (post AD1000) contexts, compared to the broader pre- to post-introduction timeframes encountered among several Southwest and Woodlands sites, likely accounts for some of this difference, although the contrast between the Plains
Figure 256: Weight data (with and without outliers) for each of the sites within the three study areas – the Southwest, Plains, and Woodlands, from left to right.
Figure 257: Length data (with and without outliers) for each of the sites within the three study areas – the Southwest, Plains, and Woodlands, from left to right.
Figure 258: Width data (with and without outliers) for each of the sites within the three study areas – the Southwest, Plains, and Woodlands, from left to right.
Figure 259: Thickness data (with and without outliers) for each of the sites within the three study areas – the Southwest, Plains, and Woodlands, from left to right.
Figure 260: Basal width data (with and without outliers) for each of the sites within the three study areas – the Southwest, Plains, and Woodlands, from left to right.
Figure 261: Neck width data (with and without outliers) for each of the sites within the three study areas – the Southwest, Plains, and Woodlands, from left to right.
samples and contemporary (or later) sites elsewhere (such as Marshview Hamlet in the Southwest, and John East Mound in the Woodlands) ensures that, to a certain extent, differences in attribute values (i.e. point size and shape) did exist, and serve as important indicators regarding inter-area variation.

**Attribute visibility**

Based on the samples studied here, qualitative attributes (including base and blade type) were, on average, consistently more visible than their quantitative counterparts (including weight, length, width, thickness, basal width, and neck width) by at least 10 percent (Figure 262), an interesting observation considering the primarily quantitative focus of classification functions. According to individual study area, it appears that all attributes – both quantitative and qualitative – were less visible in the Southwest, except for neck width, for which it scored highest (Figures 263-264). Upon the removal of neck width from the list, the visibility ranking of quantitative attribute values remains stable, with thickness at the top and weight at the bottom (Figure 265), providing a useful indication of which attributes were most likely to be present for study, and, in effect, most likely to provide a representative classification result. A concept further developed in the discussion below, the relative visibility of attributes had a direct effect upon the applicability of different classification schemes, especially when applied to sites from different study areas.

![Attribute Visibility](image)

*Figure 262: Quantitative and qualitative attribute visibility specific to each area (left), and more generally (right).*
While Shott (1997) and Hughes’ (1998) approaches retained equal applicability scores throughout (based on the highest ranking one variable solution and TSA/TP scores, respectively), Hildebrandt and King’s (2012) dart-arrow index produced a more varied set of results (Figure 266). In this case, sample representation for the Plains and Woodlands sites was at least 77 percent.
according to Shott and Hughes’ methods, and despite increased variability in the Southwest, never fell below 50 percent for either scheme. Hildebrandt and King’s approach, on the other hand, although highest for all sites in the Southwest (except Marshview Hamlet), scored lowest elsewhere, and was the only method that failed to classify any points for a given site (in this case, John East and Linville among the Woodlands sites). That being said, it also produced the joint highest score of all sites and methods (100 percent at Payne, relative to 100 percent at John East by the other methods), revealing a broad range of inter-site/area variability that suggests it was the most context-specific of the three methods tested. Regardless of associated outcomes, then, it appears that Shott and Hughes’ methods – which used the more consistently available width and thickness values – were more widely (and consistently) applicable on an inter-area scale, compared to Hildebrandt and King’s index, which, by contrast, required the more variable neck width marker in order to function (refer to discussion regarding attribute visibility, above).

With this borne in mind, it appears that both the type and number of attributes selected played a significant role in the applicability of each classification scheme (relative to a given study area). Of particular interest was that certain attributes (or attribute types) were notably more visible in one area

Figure 266: Comparative applicability of the three classification schemes, relative to each site and study area.
than another, so that what successfully represented a sample in one location, was comparably unsuccessful elsewhere. Hildebrandt and King’s (2012) dart-arrow index, for example, was derived from samples in the Southwest, where useable neck width values were usually available. By comparison, these values were substantially less visible among Plains and Woodlands assemblages with an increasingly unnotched type component. In this respect, the applicability of the index was heavily determined by recovery context (the specific morphological preferences of a given study area), so that its effectiveness in broader, inter-area studies remained limited.

On another occasion, the number of attributes selected for use was the limiting factor. As was the case for Shott’s (1997) single and multiple variable solutions, sample representation increased as the number of required attribute values decreased (Figure 267), so that the four variable solution was the least applicable, followed by the three variable solution, and then jointly by the two and one variable solutions. Interlinked with the type issue described above, the biggest increase in applicability for the Plains and Woodlands sites lay between the two and three variable solutions – based on the elimination of the problematic neck width value – whereas the trend in the Southwest – for which neck width visibility was less of a problem – reflected a more subtle curve. Inevitably, there was no simple ‘one size fits all’ solution to the classification (and comparison) of stone points recovered from such a distant and diverse set of study areas. More or less subtle differences among the assemblages ensure

![Percentage of total specimens for Shott's solutions](image)

**Figure 267:** The relative applicability of Shott’s (1997) single and multiple variable classification solutions, calculated according to the averages derived from each of the three study areas.
that the selection of attributes for inter-area, comparative studies is far more complex. As evidenced in this study, certain attributes demonstrate higher, cross-area visibility scores than others, and, in effect, a higher level of applicability among the classification schemes that use them. Thus, for the sake of broader, inter-area studies, at least, attempts should be made to utilise attributes with the highest visibility scores averaged across all areas, so that the classification process becomes as widely and consistently applicable as possible, and the most representative results produced for fair and meaningful large-scale interpretation.

Classification results
Perhaps unsurprisingly, the results derived from each of the three classification schemes (Figures 268-270) revealed a similar pattern of comparability to that of the applicability scores. Shott (1997) and Hughes’ (1998) approaches, for example, expressed similar findings throughout, often (though not always) in contrast to those produced by Hildebrandt and King’s (2012) dart-arrow index. In this sense, they provide an interesting case in support of the subjective nature of the classification process and its relationship with subsequent interpretation. Moreover, they comprise an important part of the interpretive

<table>
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<th>Southwest</th>
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<td>Bower’s La Roche Hidden Valley Rockshelter</td>
<td>Winslow Clarksville</td>
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Figure 268: The results derived from Shott’s (1997) single variable classification solution, relative to each site and study area.
Figure 269: The results derived from Hughes’ (1998) TSA, TP, and mass values for each site and study area, relative to the proposed dart (blue) and arrow (red) thresholds.
process by contextualising trends described in the basic level attribute analyses (above), and developing our definitions of various tool types (and their presumed functions) – in this case, the more or less subtle distinctions made between earlier, larger ‘dart’ points, and later, smaller ‘arrow’ points.

On the whole, the results produced by Shott (1997) and Hughes’ (1998) classification methods were more evenly matched, and – for the most part – more closely aligned with the basic separation of different ‘dart’ and ‘arrow’ point types (i.e. observable type traits, characteristics, or ‘styles’) among the collection, compared to those produced by Hildebrandt and King’s (2012) index. The Woodlands results were the most comparable, producing, on average, the largest values and, thus, the highest proportion of dart-dominant sites of the three areas studied, irrespective of the method selected. Whilst Hildebrandt and King’s (2012) index recorded (where applicable) exclusively dart-based results, however, Shott (1997) and Hughes’ (1998) approaches included (albeit to varying degrees) a number of smaller ‘arrow’ values at each of the relevant sites. On a smaller scale, thus, subtle variations between the three classification schemes were evident, although more generally, they all stood in stark contrast to traditional interpretations regarding point size and antiquity, and the use of

Figure 270: The results derived from Hildebrandt and King’s (2012) dart-arrow classification index, relative to each site and study area.
smaller, arrow-dominant systems among sites with predominantly post-introduction components. In this respect, the Woodlands data raised two key issues regarding (in)consistency within the classification process; the first between different schemes applied to the same datasets, and the second between the results produced and the validity of traditional assumption. Key themes that are central to this study, they are far from limited to the Woodlands case study; as below, the datasets for the Southwest and the Plains revealed similarly intriguing patterns of variability.

The Plains sites, for example, although predominantly arrow-based according to Shott (1997) and Hughes’s (1998) approaches – and, therefore, suitably aligned with traditional interpretations regarding the adoption of smaller point types alongside the introduction and standardisation of the bow and arrow – were, by contrast, labelled dart-dominant (or lacked a dominant technology, as at Bower’s La Roche) by Hildebrandt and King’s (2012) index. In a similar fashion to the Woodlands data, this difference between schemes – and, thus, the relative misalignment of traditional assumption/interpretation – can (in part, at least) be attributed to the issue of applicability (i.e. the limitations associated with applying schemes designed for/derived from one study area to sites from another – see discussion on Classification applicability, above). Any difference among the results for the Southwest – the area for which each of these three schemes were designed for – however, requires another explanation, for in this case, applicability was more evenly apportioned.

Broadly speaking, Shott (1997) and Hughes’ (1998) approaches described an increase in arrow values (and relative decrease in dart values) that roughly aligned with conventional interpretation regarding point size and antiquity, although the arrow:dart ratio among post-introduction sites (around 3:1) was considerably higher than traditional assumptions – which infer a clearer, more abrupt change from dart to arrow point technology – have tended to suggest. It is of special interest, therefore, that the results produced using Hildebrandt and King’s (2012) dart-arrow index happened to lower this ratio even further, and in two cases, reversed the results to reveal an ‘unlikely’ use of dart-dominant systems at the two sites with the latest (post-introduction) occupations. In this case, discrepancies among the results produced by different classification schemes had a direct effect upon the ability to effectively and consistently recognise, define, and explain technological change in the
archaeological record, even where attribute visibility and applicability were equal.

This borne in mind, it is clear to see that the supposedly simple, consistent, and accurate division of ‘dart’ and ‘arrow’ point technologies – and the process and recognition of technological changes more generally – is, in reality, far more complicated than traditional ‘either/or’ classification categories have typically allowed for, especially when interpreted on an inter-area scale. In some cases, the presence of unusually large ‘arrow’ points (such as those among the Woodlands mound sites), exotic or finely-worked pieces (including those at Mitchell and Cattle Oiler on the Plains), and relatively abundant ‘dart’ types during later periods (as in the Southwest) can – and have been – attributed to ‘special’ recovery or use contexts, yet, their persistence more generally (i.e. at more ‘typical’ sites and among more ‘practical’ use-contexts) – evidenced throughout this work – provides strong support in favour of a more sophisticated account of human adaptive change and associated technological diversity.

Given the broad scope of inter-area trends revealed is this study, thus, several statements regarding the dart-arrow dichotomy in American archaeology – and the process of artefact classification more broadly – can be made. Firstly, it appears that differences in point size – presumably associated with differences in associated projectile technologies (the dart and atlatl, and the bow and arrow) – are clearer in some areas (and at some sites) than others. Generally speaking, at the extreme ends of the scale the large ‘dart’, small ‘arrow’ point divide appears to hold true, yet, as archaeologists rarely work with ‘extreme’ cases, the wider, more practical use of this rather simplistic distinction remains unclear. In each study area there were numerous examples of smaller ‘dart’ types and larger ‘arrow’ types, with distinctions between the two clouded by cases of intra-type variability and inter-type comparability. Size, thus, is a relative term that varies according to time (whether early, late, or transitionary) and place (‘special’ or otherwise), and cannot be used (via strictly-defined, universally applied classification parameters) as a stand-alone distinction between the two point types and projectile technologies under scrutiny.

This ties in nicely with the second observation, that quantitative distinctions (related to presumably ‘dart’ and ‘arrow’ point size parameters)
appear more clearly-defined – and tightly controlled – in some areas than others, and typically require the supporting context supplied by associated qualitative type features (such as base and blade modifications, the presence or absence of notching, etc.). For the most part, this combined approach allowed for the basic division of (typically larger) dart and (typically smaller) arrow point styles within the archaeological record, although – once again – variability and comparability within and between types distorted this supposedly ‘simplistic’ divide, often hinting at a more subtle gradation of technological change (associated with the introduction and standardisation of the bow and arrow) than traditional interpretations have tended to permit.

Finally, with this diversity (i.e. variability) borne in mind, it is evident that technological change (in this case, from the dart and atlatl to the bow and arrow) – and the processes used to recognise it (various classification schemes and rigidly-defined type definitions) – are heavily influenced by the subjectivities of individual context. No one site or study area (with its specific associated environmental and cultural context) is precisely comparable to another, nor are the classification approaches applied to them. Similar areas may be more likely to reveal similar trends, but on a broader, inter-area level, interpretation of change – if it is to be meaningful – must seek to identify and account for subjectivity (and the validity of observable differences), and, in so doing, realign the classificatory ideal with practical reality.
PART THREE: OLD IDEAS AND NEW INSIGHTS

8. Discussion

8.1. A Reassessment of Technological Change

That many of the concerns expressed in Part One were evidenced in the analyses conducted in Part Two serves as strong evidence that reassessments in this field of study are both warranted and necessary. As long as classification schemes can be shown to both reveal and conceal elements of technological change within the archaeological record, and a broad range of interpretive variation persists, the topic remains an important one to be revisited — and reinvigorated — again and again, as new theories, methods, and evidence become available. To be sure, our assumptions about past peoples and systems provide an invaluable foundation for interpretation, but are almost always based upon strict parameters, lines of division, and a classificatory ‘ideal’ — in this case, a presumed bimodality between stone points used with the dart and atlatl and those used with the bow and arrow. In reality, however, the situation is far more complex, and, in this respect, associated theory, process, and interpretation should be subject to regular testing and revaluation.

Traditionally, archaeologists have argued for a fairly late — and relatively abrupt — appearance of the bow and arrow in North America (reaching the Plains by c. AD200, the Southwest and Woodlands c. AD500, and becoming widespread no later than AD800), an assumption based primarily upon a supposedly clear shift towards smaller, triangular forms during the late Middle-Late Woodland periods. Increasingly, however, approaches to the topic have adopted a more inclusive standpoint, arguing for greater diversity in the archaeological record, and the potential for a much earlier (Archaic-Early Woodland) phase of introduction, experimentation and contemporary use, thus bringing into question the validity of a simple, unidirectional model of change. With these competing — and often, though not always — contradictory perspectives borne in mind, the analysis conducted in Part Two attempted to address the question of clarity within the identification process, focussing primarily upon differences in point size and, thus, the relative explicitness (i.e. the abruptness) of associated technological change.
From simple attribute summaries to the more complex classification analyses, the results were clear. Size is a subjective term and any differences (based on this marker alone) between the two tool types (dart and arrow) far from explicit. A product of several competing variables, its interpretation was prone to the subjectivities of individual researcher, research question, and recovery context, so that other indicators (including qualitative type characteristics) were required for further clarification of the division, particularly when attempting inter-study area comparisons. ‘Arrow’ points among the Plains sites, for example, tended towards the lower end of the scale, whereas those from the Woodlands – although similar shape-wise (i.e. triangular), were, on average, much larger than those gathered elsewhere. By the same merits, some samples were more variable than others, with differences ranging from subtle morphological gradation to separable type clusters. Inevitably, when analysed using the same classification scheme (or set of schemes) derived from/design for a specific locale (in this case, the Southwest, an area with better artefact preservation), these differences had a direct impact upon the applicability of the classification process, the comparability of the results produced, and, in effect, the validity of interpretations derived using associated dart:arrow point ratios. As Whittaker (2010a, 201) maintains, although most techniques ‘use more sophisticated arguments than point size alone… the basic difficulty of recognition remains,’ and, as evidenced in this study, the cross-area use of fixed parameters appears limited at best.

Even when a combined approach – using observations of both quantitative and qualitative point features – was taken, there remained in most cases (though to varying degrees) a number of indeterminate specimens that failed to ‘conform’ to traditional assumptions regarding a simple, clearly-defined dart-arrow distinction. Although typically divisible at the extreme ends of the scale, in this case, the data supported more recent recognition of the potential for technological continuity, complementarity, and functional variability, so that the development of/interrelationship between the two tool types in question reflects more than a single event in a linear sequence of change. Aptly demonstrated among the collections studied here, the adoption of a new technology, rather than simple and abrupt, typically involved a (more or less) extended period of experimentation, as tradition and innovation clashed, coexisted, and either converged or diverged upon the subsequent
standardisation of forms. To return to the issue of definition within measuring technological change (refer to Chapter 1.4), thus, it appears that the explicitness of any distinction depends largely upon the focus of the research being undertaken – be that of early manifestations of a new tool type, or of its widespread use.

It seems fair to suggest, then, that new forms developed out of – and alongside – earlier traditions, which, by all accounts, continued to feature among later, post-introduction adaptations (regardless of attributed function, utilitarian or otherwise), ‘as the makers of atlatl darts carried on their traditions of knapping as they shifted to smaller points for a different weapon’ (Whittaker 2012, 10). Hence, innovations in technology were designed according to a compromise between efficiency and culturally-determined stylistic preferences or ‘templates’, thereby accounting for diversity – via intra-type variability and inter-type comparability – within the archaeological record. In this respect, the possible and the practical represent two ends of a sliding scale of selected variables within the design process; a process in which want and need were closely intertwined. Just because people were capable of change, does not mean they were fully committed to it, and as Kirk and Daugherty (2007, 60) point out, ‘people kept older technologies while simultaneously diversifying.’

Thus, although a shift in the dominant (i.e. consistent) tool type, from dart-based to arrow-based projectile systems, appears to have taken place, the associated rate of change was rarely as consistent or abrupt as traditional accounts have tended to suggest. In fact, in some cases, maintaining tradition may have held equal (or even greater) value as the desire to remain ‘up-to-date,’ so that innovation and replacement do not necessarily go hand in hand.

The visibility and rediscovery of earlier traditions – whether by chance or deliberate curation – forms an important facet within human (and associated technological) development, for ‘material culture, in any situation or context, has the potential to influence and manipulate contemporary and future… behaviour’ (Warburton and Duke 1995, 226). As such, it seems sensible to surmise that earlier (typically larger) point types (and associated technologies) – often recovered alongside presumably later (typically smaller) ones, as in this study – had the power to influence the design (and function) of contemporary systems; a power that waxed and waned according to various other concurrent environmental and socio-cultural pressures. The point here, then, is that
changes – or preferences – in technology are rarely simple, unidirectional, or necessarily based upon modern perceptions of practicality.

As well as the interplay between tradition and innovation, situational purpose, too – whether single, multiple (versatile), or sequential (flexible) – would have played an important role in the relative indistinction of various point types (and associated projectile systems), which, it seems, were typically more changeable than conventionally allowed for. Intra-type variability and inter-type comparability, evidenced, more or less, in each of the three areas studied here, point towards an element of convenience in the design (the processes of learning and manufacturing relative to acquired skill) and function (based upon situational requirements) of any given tool type. In this respect, artefacts (and their associated functions) were rarely fixed in time and space, and – as continues to be the case today – were often reused and recycled, thus adding to the concealment of a potentially diverse (both morphologically and functionally) set of life histories. With this borne in mind, the limitations of using strictly-defined parameters as a measure of functionality (whether dart or arrow) and change becomes clear. Although – broadly speaking – the large/small, dart/arrow point divide holds true, at least at the extreme ends of the scale, as each of the case studies explored in this volume reveal, there lies a fair amount of ambiguity in between (relative to individual site and study area), so that no one single (traditionally, deterministic) definition of the adoption of the bow and arrow in prehistoric North America can ever truly exist.

8.2. The Significance of Individual Context and Meaning

Differences regarding the clarity of technological change – and its relative abruptness – exist and appear both environmentally and socio-culturally conditioned. Variations in point form (and associated function) cover a broad spectrum ranging from subtle to absolute and are manifest on several levels (local, regional, continental), so that the transition from one technology to another (in this case, from the dart and atlatl to the bow and arrow) was rarely as simple, rapid, or widespread as traditionally believed. Prone to the subjectivities of individual context, human behaviour – and, thus, the process of tool selection – was shaped by several competing factors, including a consideration of economic ‘efficiency’ relative to the surrounding environment,
the impact of local and nonlocal socio-cultural influences, the interplay between style (whether traditional or contemporary) and function (depending on the task(s) at hand), and a multiplicity of appropriated meaning (practical, symbolic, or a mixture of both). Although daunting, it is only by maintaining an awareness and acceptance of, and by attempting to account for such influences – varied but not mutually exclusive – that a valid and meaningful interpretation of human adaptation (including their role in/and response to technological innovations and change) can be achieved.

Debate regarding the superiority of one tool type (the bow and arrow) over another (the dart and atlatl), including reference to elements such as effective range, accuracy, accessibility, space, and relative acquisition of skill (as in *Chapter 1.2*), has traditionally been used to promote assumptions of a rapid and unrestricted change in projectile technology. Yu (2006, 209), for example, argues that the bow and arrow offers ‘a flexibility of use contexts that cannot be matched by the atlatl.’ Definitions regarding ‘superiority’ are, however, both highly subjective and largely dependent upon individual context, and it should be borne in mind that the most ‘efficient’ system (at least in modern, scientific terms) is not always or necessarily the one selected. As at many of the sites studied here, older – typically larger – ‘dart’ points (and associated projectile technologies) were evidenced well into later, supposedly arrow-dominant times, often recovered *alongside* the smaller ‘arrow’ types so as to suggest a similar, practical function. In other cases, these points were more clearly separable, implying a less utilitarian role, although the point remains that they were both *visible* and *utilised* in some way, and the question of ‘superiority’ or definite tool preferences far from explicit or universally consistent. Thus, although a smooth transition from one projectile technology to another, based on the development of an increasingly ‘efficient’ system, may *seem* logical, in reality, the selection process depended upon much more.

Successful adaptation to the socio-economic environment of a specific time and place required, for example, not only a thorough consideration of local ecological conditions (including landscape size, location, accessibility, and resource availability), the effects of population proximity, mobility, trade, and individual/group preferences or skill sets, but also of associated cultural (i.e. political and/or socio-religious) practices. At any given time and place these conditions were open to (non-linear) change, as were the tool types associated
with them, so that any assumptions regarding the nature and abruptness of technological development – including the dominance of dart- versus arrow-dominant projectile systems – should be abstracted on various levels (i.e. from small- to large-scale, local to regional analyses) for more meaningful (and comprehensive) interpretation.

Previous works on the topic have shown certain technologies to be more environmentally conditioned than others, and certain locations comparably more open to change. Yu’s (2006) study, for example, which sought to compare trends across three geographically distinct locations (central Japan, coastal Spain, and the North American Great Basin), revealed an earlier adoption of the bow and arrow in more densely vegetated locations, where a new hunting niche – presumably less accessible via earlier tool types (i.e. the dart and atlatl) – was subsequently exposed and taken advantage of. In this respect, landscape and associated cover structure – whether open or closed, even or uneven, vegetated or sparse – were closely linked to the selective and competitive advantage offered by a new tool type, providing a primarily environmentally-driven explanation for the pace of technological change. Considerable variability within – let alone between – some of the sites and study areas presented in this work, however, reveal that such patterning is far from universal, and that other (non-environmental, or combination) factors also played an important role, relative to individual context. To be clear, differences between the three main study areas – the Southwest, the Plains, and the Woodlands – did exist (refer to Chapter 7), but as internal variability and external comparability among the collections attest to, these were not always or necessarily environmentally-determined (and in this case, not consistent with Yu’s (2006) observations), but subject to many other socio-economic and/or cultural conditions.

Cross-area exchange in materials and ideas, for example, meant that technological traditions and innovations often transcended the boundaries of different habitats, each of which remained subject to local fluctuations and the effects of flexible adaptation. In this respect, the requirements of – and restrictions placed upon – tool design and functionality (whether reliable or maintainable, sacred or profane) were open to ever-changing interpretation, as were the ‘cultural patterns that maintained special guidelines for manufacture’ (Justice 1987, 6). Sometimes searched for, sometimes stumbled upon, innovations in technology maintained strong impetus for change. The desire to
remain ‘up-to-date’ and maintain external connections, however, was (as evidenced throughout this project) often met by concerns with connecting with the past (i.e. maintaining an awareness – if not active use – of traditions associated with a group’s cultural heritage), so that the interplay between past and present, tradition and innovation, the dart and atlatl and the bow and arrow, varied according to time and place, and accounted, thus, for the differences among each site’s dart:arrow ratios, and the common gradation (or morphological/functional overlap) between point types and associated hunting technologies. In this respect, technological innovation need not imply the effective replacement of one system by another (as has traditionally been the case), but serve instead as a more flexible definition pertaining to individual context. In this sense, it should cover a broad spectrum from subtle development to absolute change, and account for the contrast between native (emic) and modern (etic) perceptions of difference, attributed meaning, and the multivocality of material culture.

8.3. A Revaluation of Classification Practices

Aptly demonstrated throughout this study, human behaviour – and the physical manifestations thereof (in this case, flaked stone projectile points) – has a tendency to transcend the strictly-defined boundaries traditionally enforced by classification systems. Despite being ‘of necessity the foundation of data analysis in archaeology’ (Read 1974, 216), and providing, thus, a vital interpretative framework within which to work, the process of artefact categorisation is, by its very nature, in a constant state of change. It represents a fluid – rather than fixed – process, open to alterations and modifications as new materials and methodologies are proposed, and different variables awarded more or less attention. Variations, inconsistencies, and imprecisions are manifest in the presence of indeterminate specimens, intra-type variability, inter-type comparability, and contrasting classification results, and despite claims to the contrary, provide a valuable (and necessary) insight into both method (the classification process) and outcome (interpretations of technological change). Classification is, in this respect, far from a precise science; to deny this would be to rob past (and present) peoples of their
behavioural complexity, and remain ignorant of an important element within the identification and interpretation of human adaptive change.

Rather than focusing solely upon strict lines of division – commonly based upon deified ‘type fossils’ and an obsession with orderliness – thus, a successful, meaningful approach to artefact classification (and interpretation) should aim to provide greater scope for inclusivity and flexibility. As was the case here, more or less subtle differences among the results derived from each of the three classification schemes (further divisible according to individual site and study area) revealed two key dimensions of accuracy: ‘the correct placement of an artefact into a given category and... the definition of the categories themselves’ (Read 1974, 217). A brief review of each (as below), combined with an awareness of individual context and attributed meaning, provides an important perspective from which to consider cases of inconsistency – or, rather, technological diversity – among the archaeological record (and associated theory and practice).

First to be reviewed is the ‘accuracy’ of definition, prone to the subjectivities of observer bias and intended outcome. In this case, more or less subtle differences between classification schemes are often rooted in theoretical background (processualist, post-processualist, etc.) and associated research interests (whether temporal, spatial, functional, or stylistic), thereby limiting the potential for agreement upon a single, ‘accurate’ definition. Preservation, location, and demand (of the available material for study), too, play an important role in the development of approaches to classification and interpretation. Shott (1997) and Hughes (1998), for example, derived a large part of their approaches from the ethnographically-influenced dataset used by Thomas (1978), often criticised for its potential lack of comparability to the archaeological data, whilst all three of those tested in this study were founded in studies of the Southwest, where preservation has typically been better. Although working with what was available at the time, this inevitably had an impact upon the universal (or lack thereof) applicability of each classification scheme derived thereafter, as seen in the results of this study.

Analytically, some prefer the use of more tightly-regulated, closed type categories, others the more open type ‘cluster’ (as in Justice 1987; 2002), creating an interesting conflict between effective order and artificial division. By the same merits, different researchers and research questions may warrant the
use of different variables (or combinations of variables), each with their own interpretation of what constitutes an ‘accurate’ measure of difference. Closely linked to the premise that ‘clear types are rare and do not exhaust all archaeological material which in the majority of cases is in reality made without any moulds’ (Gorodzov 1933, 100-101), one of the biggest problems in awarding a suitable definition is, therefore, based on the difficulty of finding a ‘middle ground’ and, in effect, striking a suitable balance between the ‘norm’ and an ‘acceptable’ range in variation.

Personal judgement, then, forms an inescapable part of the classification process, encompassing both etic (scientific) and emic (native) perceptions of the material studied, the regulation of type categories, and the selection (and reselection) of certain attributes for analysis. Combined with the effects of non-conformity among the prehistoric makers of artefacts, discrepancies between the group and the individual maker, intention and execution, and conscious and unconscious action, the problem with constructing supposedly accurate definitions for an essentially inaccurate set of objects becomes clear, as do the limitations of their relative assignment. Both pertain to the bias inherent in decision-making and the difficulty of deciding what is important for study (i.e. what pieces/variables should be included in the study) and why. Aptly demonstrated among the analyses presented in Part Two, even despite attempts to objectify this process, the categorisation of artefacts is, by its very nature, a heavily subjective one based primarily upon people’s choices – both past and present.

Recognition of this problem is not to deny classification practices of their important role within the identification and interpretation of past objects, systems, and behaviours. Rather, the concerns expressed in this study are intended as a cautionary note regarding exclusivity and, thus, the value of maintaining an open mind. According to Adams and Adams (1991, 4), ‘we will never know, in many cases, how closely our type concepts correspond to some external reality, but we can discover and measure how closely the concepts of one person correspond to those of another.’ In this respect, measures of difference are more realistic (and helpful) than their impossible elimination, with valuable interpretive context provided by experience, experimentation, and use-wear studies (forming an important connection between theory- and practice-based interpretations). Approached in this way, artefact categories – and
observations of how well (or not) they function – provide valuable and necessary insight into the true complexities surrounding human technological action and response, the material expressions of which – in this study, at least – reveal broader scope for morphological-functional diversity than traditionally allowed for. Rather than shying away from the ‘problems’ associated with classificatory accuracy and allowing them to limit our abilities to effectively interpret past behaviour, a multi-faceted and reflexive approach – which both recognises and attempts to account for them – has the power to improve our understanding of what has proven itself a complex field of study.
9. Conclusion

Having opened with a statement comparing flaked stone tools – and the human thoughts and behaviours they represent – to a series of complex ‘languages’ (as in Stanford and Bradley 2012, 30), this volume now closes with a note regarding the subjectivity of the ‘decipherment’ process. In this case, the dart-arrow dichotomy in North American archaeology (and associated classification practices) serves as an excellent example of the all-too-often overlooked potential for diversity among intra- and inter-area expressions of technological change, and the interpretive variation derived from different approaches to analysis. With more or less different results produced according to individual site, study area, and classification technique, traditional accounts of a linear, fast-paced, widespread, and consistently-recognised sequence of change from one technology to another – an assumption based primarily upon differences in point size – simply do not hold true.

Size, it seems, is a relative term that varies according to time and place, and benefits from the context supplied by observations of point style (i.e. qualitative, shape-based markers of difference). Even then, a combined approach (quantitative measures and qualitative observations) can only go so far, with the separation of point types – and associated technologies – suffering regular cases of intra-type variability, inter-type comparability, and the inevitable effects of past and present – heavily subjective – human behaviour. A consideration of the role of people – as innovators, experimenters, and important agents whose behaviour, both directly and indirectly, affected alterations, fluctuations, and interpretations of tool preferences through time – has been particularly useful. In this respect, the re-acquaintance of people and points (a key intention of the project) provides valuable insight into the relationship between action and reaction, tradition and innovation, style and function, the practical and the impractical, and the various economically- and socio-culturally driven influences associated with the design and (multi)function of ancient artefacts.

At the extreme ends of the scale, a basic division between large dart and small arrow points typically holds true, but archaeologists rarely deal with ‘extremes’ alone and must attempt a more inclusive, reflexive approach to artefact classification if associated process and interpretation are to provide
meaningful insight into past systems and behaviours. Human adaptation – in this case, the adoption of a new projectile technology – rarely follows a strictly-ordered, linear sequence of change, but alternates back and forth as people accept, reject, experiment and standardise according to their local surroundings and the materials available at any given time. The presence – and, thus, the continued awareness, if not active use – of earlier tool forms and technologies among later, supposedly arrow-exclusive contexts (evidenced to varying degrees in this study) supports this ideal by demonstrating that, contrary to traditional accounts of a rapid and abrupt shift, innovation and replacement do not always or necessarily go hand in hand. In fact, there is a good case for technological continuity, complementarity, and functional variability, and, in this respect, a more diverse account of technological and human adaptive change in prehistoric North America.

Context, in particular, poses a major challenge to how we recognise change. As in this study, the archaeologist is rarely awarded the luxury of working with artefacts from tightly sealed (i.e. unmixed) contexts. In this case, stratigraphic mixing and site reuse make it difficult to distinguish between points attributed to different time periods and, in effect, the use of different projectile systems. This ambiguity has fuelled (and continues to fuel) vigorous debate regarding the dart and atlatl to bow and arrow transition in prehistoric North America (whether simple, late and abrupt, or complex, early, and gradual), and, in this study, is used to suggest a more open-minded approach to the interplay between tradition and innovation.

If consistently-recognisable artefact categories – separable according to strictly-defined quantitative (and qualitative) parameters – form the classificatory ‘ideal’, then this diversity represents the ‘nightmare’. Issues of consistency and comparability among the attributes (or combination of attributes) selected for study, combined with the subjectivities of individual researcher, research task, and study context (including a clear bias towards samples from the Southwest, often heavily influenced by ethnographic collections), make a single, widely-applicable classification approach – and a simple, generalised narrative regarding technological change – completely implausible. As in this study, the supposedly consistent division of ‘dart’ and ‘arrow’ point technologies is, in reality, far more complicated than traditional ‘either/or’ categories have tended to permit, especially when applied on a broader interregional scale. Rather than
dwelling on the lack of consensus, though, we can and must use it to our advantage. Only by comparing and contrasting different approaches to analysis via regular systems of review (as was the intention here) can their limitations be adequately exposed, addressed and accounted for, and a more meaningful interpretation of the archaeological record – and the people it represents – achieved.
APPENDIX

Original datasheets (Excel format)
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