Individuals among palimpsest data: fluvial landscapes in Southern England

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Individuals among palimpsest data: fluvial landscapes in southern England

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"One important lesson is that one should be extremely wary on any generalization concerning the conduct of individuals."

(A. Beevor, Berlin: The Downfall 1945, 2002: xxxv)

Introduction

This paper seeks to address a critical question: can Palaeolithic archaeologists consider the role of individual hominins in the Pleistocene, through the examination of palimpsest data sets? I will not concern myself with the question of whether individual hominins can be detected in palimpsest data sets, since in my opinion the answer here is a simple one: no, save for the odd fossil. The answer to the question of their role however, is not so simple. In addressing it, it is necessary to consider how individuals influence and contribute to wider hominin society and long-term behavioural evolution. At the same time, we also need to demonstrate which elements of evolving hominin behaviour are evident in a palimpsest record, and the different chronological scales associated with that type of archaeological data.

Mithen (1993: 393) provides a valuable distinction between specific and generic individuals. Mithen's specific individual is viewed here as a person whose presence and actions, whether tool-making or walking, can be demonstrated to have occurred at a specific time and place in the past. Following Mithen, it is proposed here that archaeology is predominantly unable to refer to or trace specific past individuals in the Palaeolithic record, although the physical residues of individual actions are occasionally recorded, as with the Boxgrove knapping scatters (Roberts & Parfitt 1998) and the Laetoli footprints (Leakey & Harris 1987). By way of contrast, Mithen also proposes that past, generic individuals may be referred to in terms of people of particular age and sex, in a range of social, economic and historic contexts. The behaviour of these generic individuals in particular situations can then be suggested on the basis of evolutionary theory and psychology. This approach therefore stresses the concept and the idea of individual action and behaviour, rather than its physical demonstration. From the perspective of the Palaeolithic and palimpsest data sets, I suggest that it is the behaviour of generic individuals with which we should be concerned, in particular their contributions to social processes (e.g. food getting, learning, behavioural changes) that occur at a range of different timescales. Yet such approaches clash markedly with the majority of extant research. Numerous authors (e.g. Clark 1992; Mithen 1996; White & Schreve 2000; Binford 2001; Ashton & Lewis 2002) have emphasised the group when discussing behavioural evolution and cultural change. As Mithen (1993) observed ten years ago, the focus upon groups has provided valuable models for Palaeolithic society, stressing adaptation at different time intervals. However, these models have only made limited contributions to our understanding of adaptation and change through time. Mithen concluded that our ability to identify and monitor groups and group actions is arguably worse than when the focus is placed upon individuals. He therefore stressed the extremely rare 'moments in time' and the very long time scales of millennia – the latter of which are the focus of this paper. However, the exploration of individuals through palimpsest data requires frameworks that draw links and connections between individual action and coarse-grained patterning in the archaeological record.

This paper presents recent research inspired by Shennan (2001) as an example of the type of connecting framework outlined above. Shennan emphasised the role of group size with respect to the processes of knowledge transmission and cultural change. His model of cultural evolution focuses upon the mechanisms involved in the transmission and change of craft traditions (e.g. stone tool production). He suggests that rates of successful technological innovation may have been correlated with population sizes and densities, from the earliest periods of hominin culture to the present:

"When cultural innovation processes take place and the results are passed on by a combination of vertical and oblique transmission, larger populations have a very major advantage over smaller ones. Quite simply, members of larger populations are on average both biologically fitter and more attractive as models for imitation, by virtue of the fact that the deleterious sampling effects present in small populations decline as population sizes increase. When populations are small, innovations which are less beneficial reproductively and less attractive to imitate are more likely to be maintained within them."

(Shennan 2001: 12)

By stressing the roles of parent/offspring and child/adult links within the processes of knowledge transmission, Shennan's model highlights the premise that individual actions (in this case technological innovations and their subsequent transmission through social learning) can be detected in the archaeological record. He subsequently presents the Middle to Upper Palaeolithic transition and aspects of the accompanying changes in material culture as a supporting case study (2001: 12–15). However, the chronological resolution of the assemblages associated with the Middle to Upper Palaeolithic transition are in marked contrast to the palimpsest assemblages of the earlier Palaeolithic. The remainder of this paper therefore presents two case studies which explore patterns in technological innovation and hominin demography (two fundamental elements of the Shennan model), and analyse the variable chronological resolution of these patterns within archaeological palimpsests. These palimpsest archaeological assemblages occur within fragmented Middle Pleistocene fluvial landscapes from southern Britain: the Solent River (Hampshire, West Sussex and East Dorset) and the River Axe (West Dorset and East Devon).

Palimpsest archaeology

In the introduction to this volume, Gamble & Porr emphasise the frequent presence of well-preserved, high-resolution sites in the Palaeolithic archaeological record. Yet the data that form the basis of my contribution could hardly lie further away from those types of sites.

Palimpsest archaeological deposits (Isaac 1981, 1989; Foley 1981a, 1981b; Stern 1993, 1994) can be described as forming through the deposition over time of artefacts and ecofacts within an episodically accreting sedimentary context. While the period of time associated with the formation of a palimpsest deposit may be known, the internal chronology of the sedimentary deposit remains unknown. Stern (1993) has usefully described the Lower Okote Member (LOM) of the Koobi Fora Formation (northwestern Kenya) as the minimum archaeological-stratigraphic unit in her study area. The LOM consists of a wedge of sands, silts and tuffs that represent interlocking channel and floodplain deposits, up to 8m in thickness, and comprises a set of time-transgressive fluvial subfacies (Stern *ibid*: 205). Although single flood event tuffs punctuate the LOM, they outcrop over too small an area and/or contain negligible quantities of material remains to be used to document the differential distribution of archaeological debris across the ancient landscape. Instead, the LOM is defined by the presence of widespread, datable tuffs at its lower and upper boundaries:

"Thus the LOM is the smallest wedge of sediment*, and hence* the smallest unit of time*, that can be used to study the distribution of archaeological debris across the ancient landscape in this portion of the Koobi Fora Formation."*

(Stern 1993: 205)

To continue with Stern's example, within the LOM it is impossible to demonstrate whether all the archaeology originates from a single behavioural event and/or accumulated during a single depositional episode, or whether it was produced over a time period of *n* years duration and/or deposited throughout the sedimentary history of the LOM. It can only be assumed therefore that the archaeology is a palimpsest which accumulated at different times, resulting in the mixing and overprinting of unassociated artefacts and ecofacts:

"Archaeological debris occurs at a number of stratigraphic levels within the LOM and in most but not all of the depositional environments represented in it. The distribution of this debris, both through the sequence and across depositional environments, is non-random. Most of it occurs in sediments representing proximal floodplain settings and lies towards the base of the LOM. This does not mean, however, that most of it was deposited at about the same time or over a relatively short span of time. The archaeological materials can only be considered contemporaneous within the boundaries of the LOM itself."

(Stern 1993: 207)

Stern's discussion of the Lower Okote Member and its chronological structure provides a valuable parallel with the fragmented fluvial landscapes of southern Britain. These landscapes consist of a series of terrace landforms, associated with major and minor river valleys, both extant (e.g. the post-diversion Thames, the Wash drainage (including the Welland, Nene, Ouse and Cam), and the Worcestershire/Warwickshire Avon) and extinct (e.g. the Solent River, the pre-diversion Thames, and the Bytham (Figure 1)). The fluvial deposits associated with these terrace landforms (primarily coarse-grained gravels, but also including finer-grained sands, silts, clays and loams) have yielded the majority of the Middle and Lower Palaeolithic core and flake stone tools recovered in Britain[i]. These deposits accumulated through fluvial processes, including high energy flooding and lower energy sedimentation events, and are therefore secondary archaeological contexts. The key concern however regards the issue of absolute dating for fluvial sediments, which has resulted in considerable difficulties for the establishment of both high and low resolution geochronologies.

Numerous attempts have been made to establish the geochronology of fluvial terrace landforms and their associated deposits, primarily through the links between terrace formation and climatic variations (e.g. Zeuner 1958; Wymer 1968; Clayton 1977; Rose 1979; Green & McGregor 1980, 1987; Gibbard 1985; Bridgland 1994, 1995, 1996, 1998, 2000, 2001). These models have stressed climatic factors (e.g. Green & McGregor 1980, 1987; Gibbard 1985; Bridgland 1994, 1995, 1996, 1998, 2000, 2001), sea-levels and the differential response of rivers in their lower and upper reaches (e.g. Zeuner 1958). These attempts have been facilitated by the widespread acceptance of the marine isotope curve in the late 1980's (Shackleton 1987), which resulted in a major re-evaluation of the number of glacials and interglacials in the late Middle Pleistocene. However, despite the archaeological value of Bridgland's climatically-driven, cyclical model of terrace formation (Bridgland 1994, 1995, 1996, 1998, 2000, 2001; & Allen 1996), it is clear that this model only provides a coarse-resolution geochronology — in other words, terrace deposits can only be dated at the level of individual marine isotope stages, which may be greater than the Lower Okote Member in duration (as discussed above). Even where an aggradation event is linked to a cold/warm stage transition, the geochronological resolution is limited to tens of millennia. This coarse level of geochronological resolution also applies to models grounded in biological data, including mammal assemblage zones (Schreve 1997, 2001a, 2001b), shell amino-acid ratios (Bowen *et al*. 1989), molluscs (e.g. Keen 2001; Preece 2001) and coleoptera (e.g. Coope 2001), although Schreve (2001a) has recently suggested that mammal assemblage zones can be used to detect isotopic sub-stages.

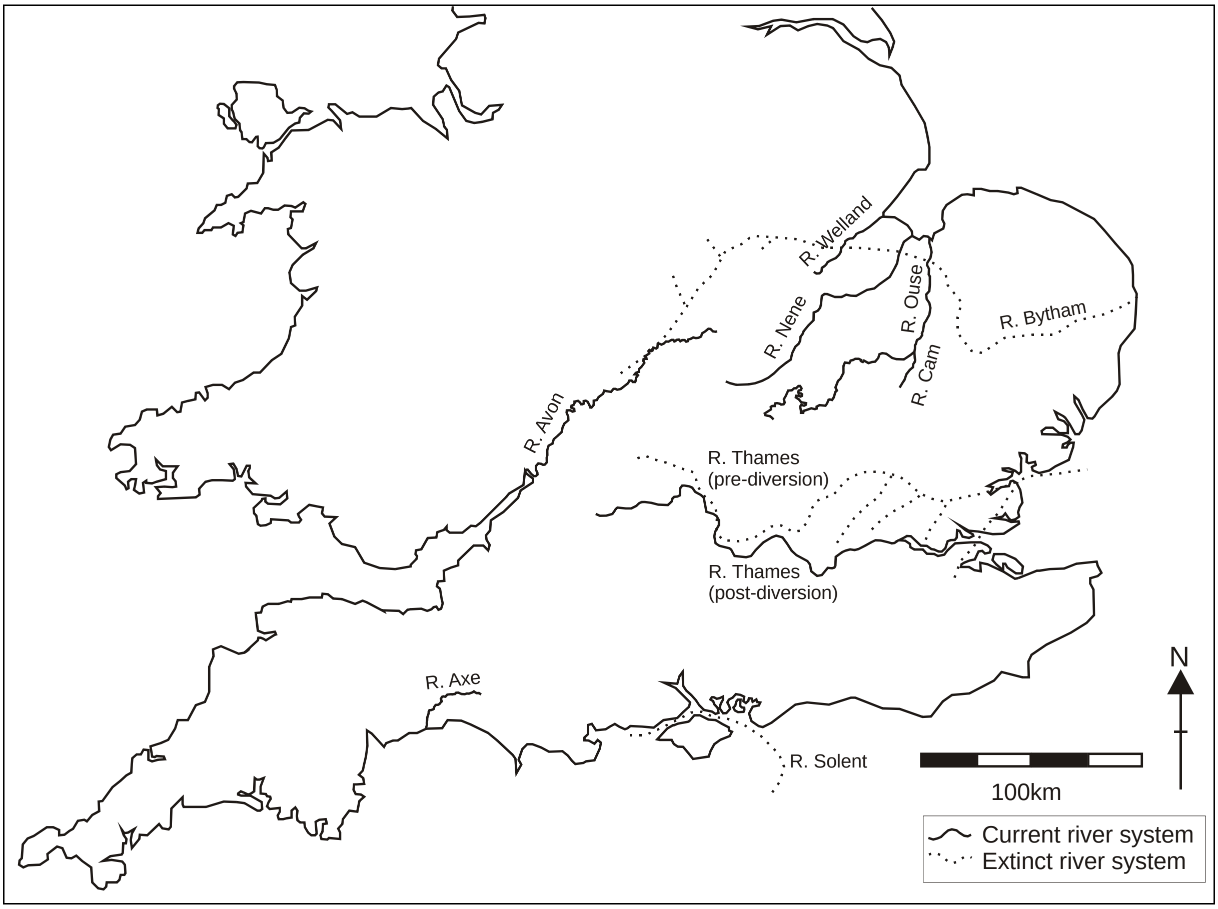

Figure 1: selected river systems of Southern Britain (after Bridgland & Schreve 2001: Figure 1; Roberts *et al*. 1995: Figure 1)

Recent research has also highlighted the link between phases of fluvial activity (erosion and aggradation) and periods of climatic instability and transition (e.g. Rose *et al*. 1980; Vandenberghe 1993, 1995, 2002; Collins *et al*. 1996). However, all of this research has focused upon the Devensian and Lateglacial periods, for which higher resolution geochronological and climatic data is available. Moreover, despite the high resolution climatic records now becoming available through ice core research (e.g. Anklin *et al*. 1993; Petit *et al*. 1999), the typically partial preservation of fluvial sequences severely restricts the potential for linking individual terrace sedimentary sequences with portions of the high-resolution, ice-core climatic record.

The partial preservation and localised erosion and re-working of fluvial terrace sequences also mirrors Stern's (1993) LOM situation in that sediments representing high resolution events (e.g. fine-grained channel deposits) are typically not continuously preserved over large enough areas to support regional-scale sub-divisions of the terrace sediments into finer geo-chronological units. Finally, the errors of magnitude associated with optically stimulated luminescence do not enable correlation of spatially distinct sediments with either each other or the high resolution climatic record.

In other words, and comparable to Stern's (1993) minimum archaeological-stratigraphic unit, each of the artefact-bearing fluvial terrace deposits of southern Britain represent the smallest time unit that can be employed for analytical comparisons *between* individual sedimentary exposures. Yet within these deposits (whether coarse or fine-grained), archaeological debris (both re-worked and *in situ*) can occur at a number of stratigraphic heights, and therefore cannot be assumed to have been deposited at the same time or even over a short period of time. These deposits are therefore clearly archaeological palimpsests, with the inherent problems of time averaging and the over-printing and blurring of patterns in material culture. The following case studies investigate whether the archaeological content of these palimpsests permit the discussion of individuals and individual actions, through demographic patterns and technological change.

Fluvial landscapes and hominin demography: the Solent River

The sedimentary relics of the Solent River and its tributaries have been studied for over 150 years. Pleistocene gravels and sands occur extensively throughout the Solent Basin, overlying the bedrock at a wide range of altitudes and distributed both on- and off-shore. The first integrated interpretation of the deposits was made by Darwin-Fox (1862), who suggested the existence of a Solent River system. Darwin-Fox viewed the rivers Frome, Piddle, Stour, and Avon as parts of a single river system draining west Dorset and east Hampshire. The Solent River was argued to have flowed eastwards across the land now occupied by Christchurch Bay and the East and West Solent, entering the sea at Spithead. A chalk ridge of high ground connected the Isle of Wight and the Isle of Purbeck, and formed the southern side of the ancient river valley. The Solent River was therefore seen as the major axial stream of the Hampshire Basin and the partial or complete existence of the system was recognised by the majority of subsequent workers (e.g. Evans 1864; Coddrington 1870; Bury 1926; Hooley 1922). Since Darwin-Fox, various modified models have been proposed for a Solent River system (see Hosfield 1999 for a summary; also Velegrakis *et al*. 1999; Bridgland 2001; Dix 2001). Recently however, the view of the Solent River as a single system has been challenged, most notably by Velegrakis (1994; *et al*. 1999), whose work in Christchurch Bay and Poole Harbour has suggested that separate 'eastern' and 'western' Solent Rivers may have existed, following contrasting drainage routes to the Channel River (Figure 2).

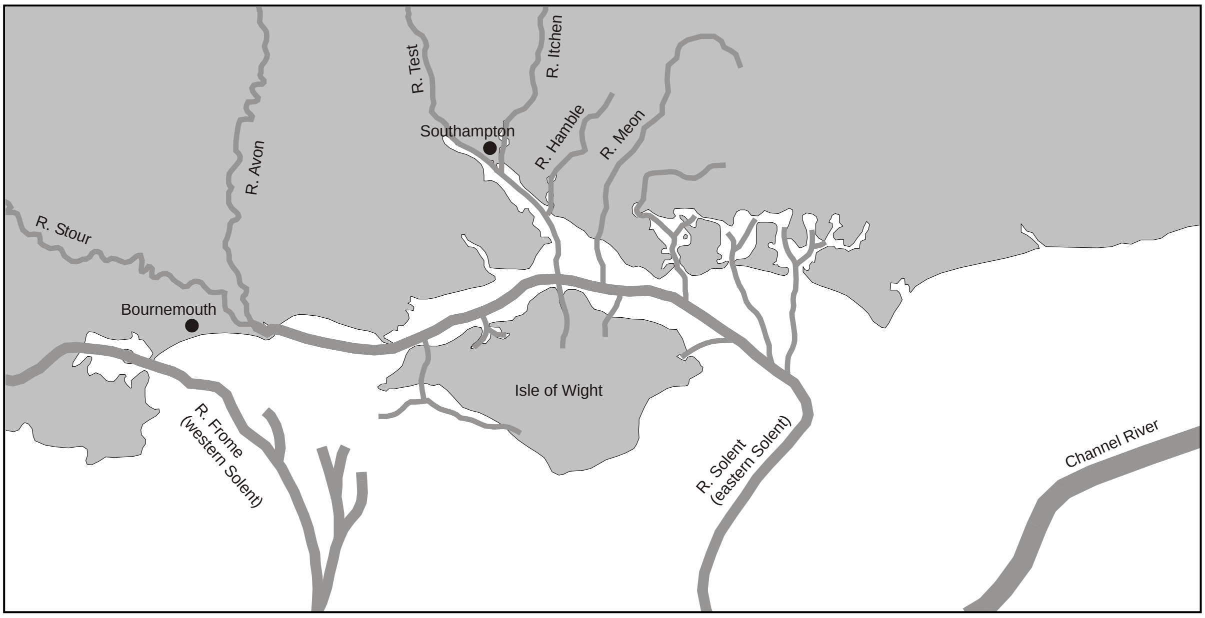

Figure 2: current model of the Solent River (after Bridgland 2001: Figure 1)

Early interpretations of the Solent system sands and gravels tended to agree upon their fluviatile origin (Reid 1893; White 1915; Bury 1923). Contemporary to, and following, this debate came a series of classifications for the coarse-grained deposits: plateau and valley gravels (Reid 1898, 1902a, 1902b; White 1912, 1915, 1917, 1921); numbered gravel terraces, based upon the morphology and altitude of the deposit surfaces (e.g. Chatwin 1936; Green 1946; Everard 1954; Swanson 1970); and the 25 terrace levels identified by the British Geological Survey during the 1970s and 1980s in the areas between Bournemouth and Southampton (16 terraces) and Dorchester and Wareham (9 terraces).

The most widely currently accepted classification was undertaken by Allen & Gibbard (1993), which established a series of aggradation units on the basis of lithological characteristics, sedimentary structures and altitude from a type section. While acknowledging the limitations of this work (the problem of the Poole Harbour gap and the presence of just two pre-Flandrian organic deposits, both currently argued to be younger than 200,000 years

BP), it has provided the basis for recent attempts at establishing the geochronology of the fluvial deposits (Bridgland 1996; 2001; Hosfield 1999). The most recent model proposed by Bridgland (2001) is supported here as a framework for the archaeological interpretation of these data (Table 1).

Terrace	Terrace pair	Downcutting event	MIS-assignment	Ages (kya BP)
Setley Plain	Setley Plain/		13?	478–524
	Mount Pleasant	Cooling limb	13/12 transition?	
Mount Pleasant			12?	423–478
		Warming limb	12/11 transition	
Old Milton	Old Milton/		11	362–423
	Tom's Down	Cooling limb	11/10 transition	
Tom's Down			10	339–362
		Warming limb	10/9 transition	
Taddiford Farm	Taddiford Farm/		9	303–339
	Stanswood Bay	Cooling limb	9/8 transition	
Stanswood Bay			8	245–303

Table 1: proposed chronology for selected fluvial terrace units associated with the Solent River complex (Bridgland 2001). MIS = marine isotope stage. 'Limb' = the cooling and warming limbs represent the cold–warm and warm–cold climatic transitions within the glacial/interglacial climatic cycles.

Although the Pennington and Lepe deposits consist of 'upper' and 'lower' gravels encompassing fine-grained organic sediments (following Bridgland's (1996) 'sandwich' model of fluvial terrace deposits), the majority of fluvial deposits associated with the Solent River complex consist of undifferentiated coarse-grained gravels. These deposits can only be classified as archaeological palimpsests (as described above), since they cannot be sub-divided on the basis of current stratigraphic understanding and absolute dating resolution, although it is likely that that fluvial sedimentation occurred episodically, in response to short-lived phases of climatic change (Rose *et al*. 1980; Vandenberghe 1993, 1995, 2002; Collins *et al*. 1996; Maddy *et al*. 2001). The minimum archaeological-stratigraphic unit therefore ranges in duration between *c*. 20,000 years (the Tom's Down gravel, assigned to MIS (marine isotope stage) 10) and *c*. 60,000 years (the Stanswood Bay gravel, assigned to MIS-8), following the Bridgland model (2001; Table 1).

The archaeology within these palimpsest sand and gravel deposits consists of predominantly derived artefacts (based on their physical condition – Hosfield (1999)), of which over 50% are bifaces (Table 2). These artefacts have been recovered both as individual finds and larger assemblages numbering tens and hundreds (Wessex Archaeology 1993).

The Solent River therefore provides a "deep time" data set, of a minimum 400,000 years duration (assuming a MIS-13 age for the Setley Plain gravels (Bridgland 2001) and an MIS-4 age for the Pennington upper gravels (Nicholls 1987)), sub-divided into a series of *c*. 20-60,000 year archaeological palimpsests. These palimpsests take the form of individual terrace deposits, containing derived stone tools. Yet interpretation of these palimpsest data has traditionally been restricted to the discussion of regional presence/absence and the identification of morphological patterning within a typological framework (e.g. Wymer 1968; Roe 1981, 2001). One of the key reasons for these limited approaches concerns the unsystematic 'construction' of the archaeological record during the 19th and 20th centuries. The collecting activities of amateur archaeologists and antiquarians, and the localised distribution of aggregates extraction and economic development resulted in a regional archaeological record that is spatially and typologically biased (Hosfield 1999). Comparisons of sub-regional data sets must therefore acknowledge the different socio-economic conditions that influenced the extant archaeological data.

Artefact Type	No.	Artefact Type	No.
Bifaces	8584	Miscellaneous	156
Flakes	6240	Rough-outs	106
Retouched Flakes	235	Cores	174
Scrapers	9	Cleavers	1
Levallois Flakes	113	Chopper Cores	2
Levallois Cores	14	Flaked Nodules	1
Tortoise Cores	2	Total	15637

Table 2: Lower and Middle Palaeolithic artefacts in the Hampshire Basin (Wessex Archaeology 1993)

Population Models

Hosfield (1999) and Ashton & Lewis (2002) have recently developed new applications for palimpsest data sets, focusing upon long-term demographic patterning. These population models acknowledge both the chronological structure of the palimpsest record, and the spatial and typological bias within the data. A specific case study is presented here, to illustrate these models. The analysis utilises palimpsest data sets in the modern region of Bournemouth to model hominin population histories within the wider Solent River system (Figure 2). The selection of the Bournemouth region reflected its history of antiquarian fieldwork, the presence of several findspots associated with the River Stour and the now-extinct River Solent (e.g. King's Park and Queen's Park in Boscombe (Bury 1923; Calkin and Green 1949; Wessex Archaeology 1993)), the recent mapping of the terraces by Allen (1991; & Gibbard 1993), and the recent publication of a relatively robust geochronological model (Bridgland 2001).

As with the Middle Thames area of Ashton & Lewis (2002), the majority of artefacts from the Bournemouth area were collected by individuals rather than systematically excavated. In light of this rather unsystematic sampling history, a restricted study area was preferable, as it minimised the potential bias that could be introduced through localised collecting (Ashton & Lewis 2002: 388). These individual antiquarians included C.H.O. Curtis of Bournemouth, who collected artefacts from Barton during the late 19th century, while J. Druitt collected artefacts from his home town of Bournemouth in the late 19th and early 20th centuries (Hosfield 1999: Table 3.13). The work of A.H. Stevens, Dr H.P. Blackmore and Albert Way (and his son Norman) has also been documented (Wessex Archaeology 1993: 123).

Ashton & Lewis (2002) dealt with the problem of selective artefact collection (e.g. the sporadic collecting of flakes and cores), by utilising the numbers of bifaces, Levallois flakes and cores as a proxy for artefact discard rates and population. In my model, bifaces alone were utilised as a proxy, since the terrace deposits analysed were laid down prior to the first recognition of Levallois technique in the British Palaeolithic during marine isotope stage 8 (Bridgland 1996). Three terrace units were selected (Figure 3): the Setley Plain (stratotype SZ 305994: 42m), Old Milton (stratotype SZ 242929: 31m), and Taddiford Farm (SZ 259924: 26m) gravels (Allen & Gibbard 1993). The Mount Pleasant (stratotype SZ 296981: 36m) and Tom's Down (stratotype SU 450016: 28m) gravels (which stratigraphically lie between the other three terrace units) were excluded from this analysis as they are not preserved in the Bournemouth study area. Following the methodology of Ashton & Lewis (2002) therefore, an index of population density was constructed for the Setley Plain, Old Milton, and Taddiford Farm terrace units.

The results (Table 3) were generated from the sites and artefact data presented in the Southern Rivers Palaeolithic Project (Wessex Archaeology 1993), and the methodology follows that of Ashton & Lewis (2002). Artefact densities are plotted in Figure 4–Figure 7. The basic density values (Figure 4) were initially adjusted to account for the differential time-spans associated with the formation of each gravel unit (Figure 5), although it is recognised that gravel accumulation would not have been continuous during those periods. These densities were also re-calculated to account for local variations in urbanisation (Figure 6), based on the Ordnance Survey 1" mapping, and quarrying (Figure 7), derived from the Southern Rivers Palaeolithic Project mapping (Wessex Archaeology 1993). The plots all indicate the same general pattern however, with relatively small numbers of artefacts associated with the Setley Plain and Old Milton gravel, and relatively large quantities of material in the Taddiford Farm gravel. It is of course documented that much older artefacts can be re-worked into younger and lower terrace aggradations. The observed pattern (low densities in the two oldest deposits and high densities in the youngest deposit) may therefore be partially exaggerated as a result of re-working. Nonetheless, the marked contrasts in densities between the three terrace units suggest that there is a genuine pattern, with a relatively dense phase (or phases) of artefact production and discard during the period associated with the deposition of the Taddiford Farm gravels (MIS-9).

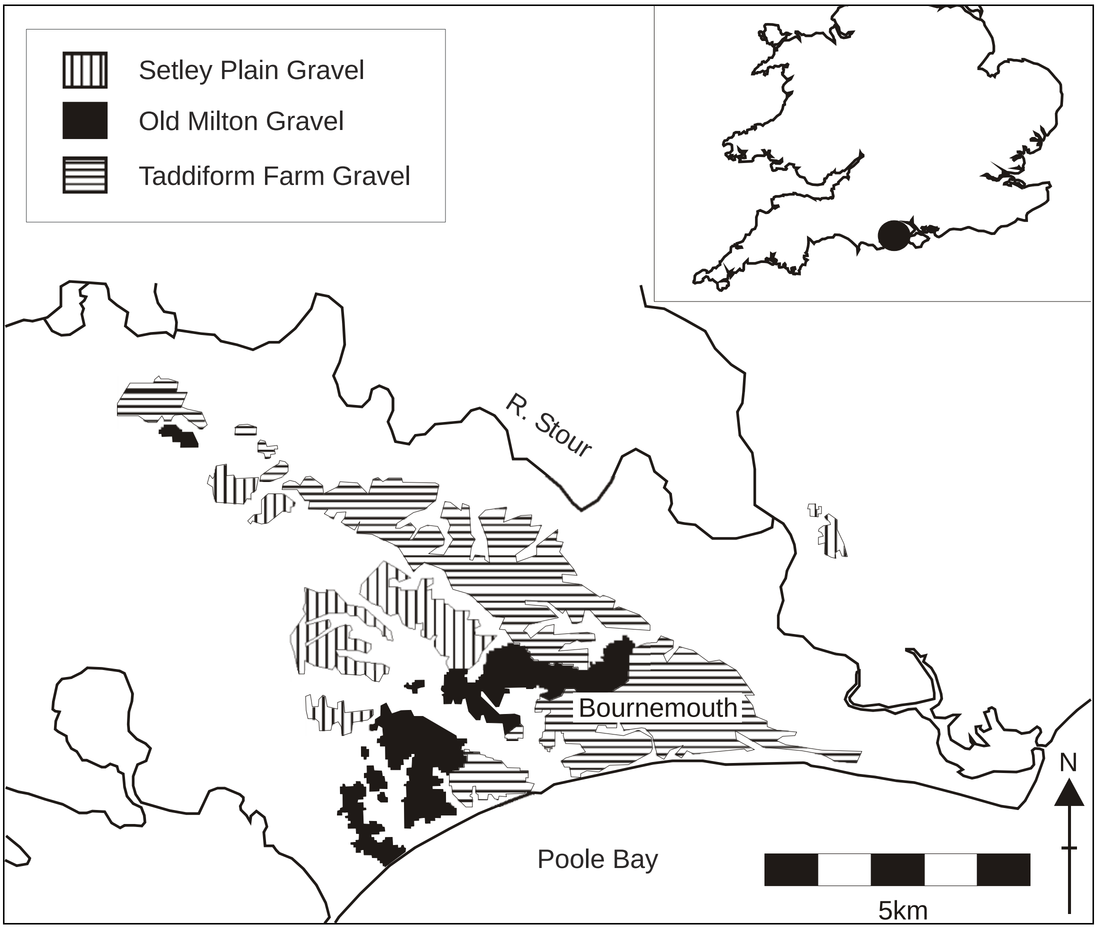

Figure 3: distribution of the Setley Plain, Old Milton and Taddiford Farm Gravels in the Bournemouth area (after Allen & Gibbard 1993)

Following Ashton & Lewis (2002), this model adopts artefact densities as a proxy for population sizes. The data therefore suggests relatively small populations during MIS-13 and MIS-11, followed by a significant increase in population during MIS-9, with all of these data relating to the area of the Solent River/River Stour confluence. The Shennan model (2001) would suggest that these population increases may be associated with successful technological innovation, and the first occurrence of Levallois technology in the deposits of the Solent River is associated with the MIS-9 Taddiford Farm gravels (Wessex Archaeology 1993; Bridgland 1996; Hosfield 1999). The link is not one of cause and effect between technological innovation and population increase, and it is stressed that these data alone do not explain the cause(s) of the apparent population increase. However, the larger populations present during MIS-9 may have provided the social framework and larger group sizes within which technological innovations and their successful transmission flourished. At the same time, Bridgland (1994, 1996) has demonstrated that the first appearance of Levallois technology

Terrace Unit	MIS stage (after Bridgland 2001)	MIS Duration	No. of bifaces	Terrace area (km^2)	Biface density/km^2	Biface density/ 100,000 years	Urban expansion until 1993 (km^2)	Biface density over area of urban growth / 100,000 years	Quarrying until 1993 (km^2)	Biface density over area of quarrying / 100,000 years
Setley Plain Gravel	13	50,000	14	3.97	3.53	7.06	3.97	7.06	0.02	1,400.00
Old Milton Gravel	11	63,000	13	5.62	2.31	3.67	5.57	3.70	0.04	515.87
Taddiford Farm Gravel	9	33,000	817	17.30	47.23	143.12	15.61	158.60	0.23	10,764.16

Table 3: index of population variation in the Solent River/River Stour region during the late Middle Pleistocene

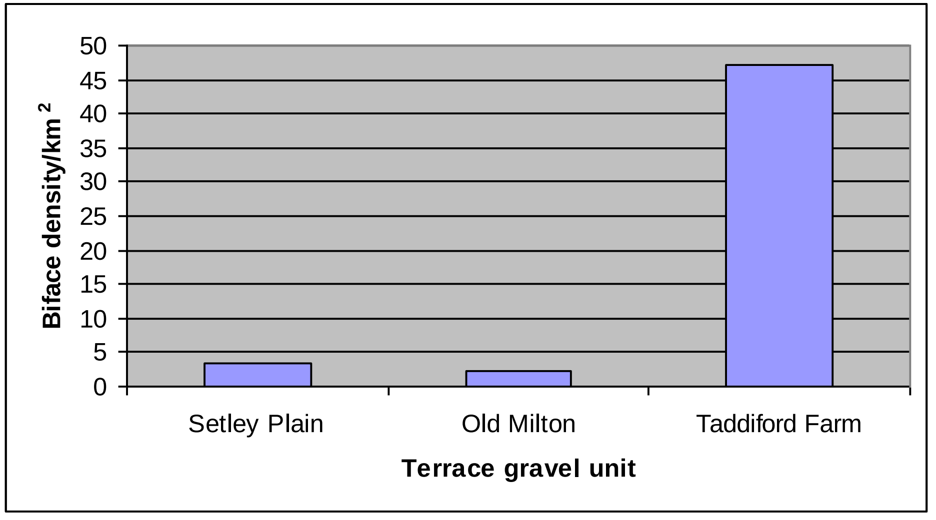

Figure 4: biface densities on terrace gravel units

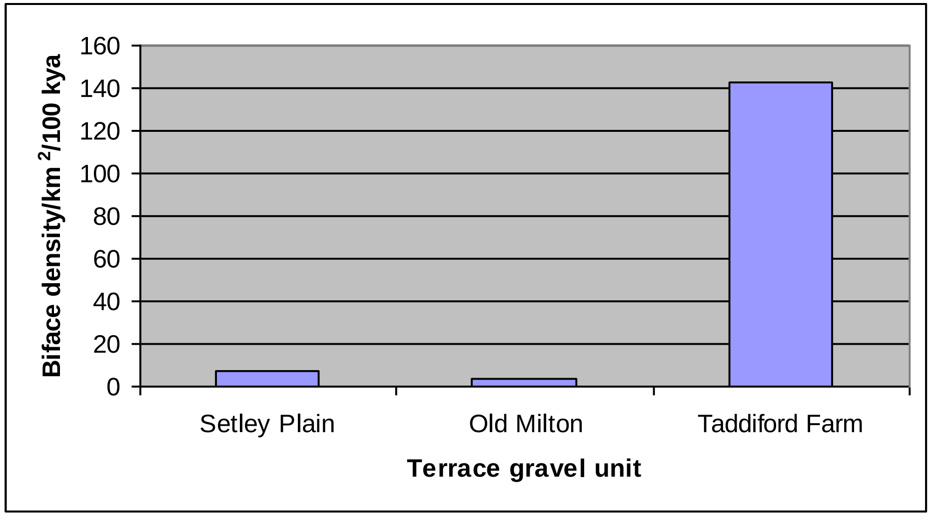

Figure 5: biface densities on terrace gravel units, per 100,000 years

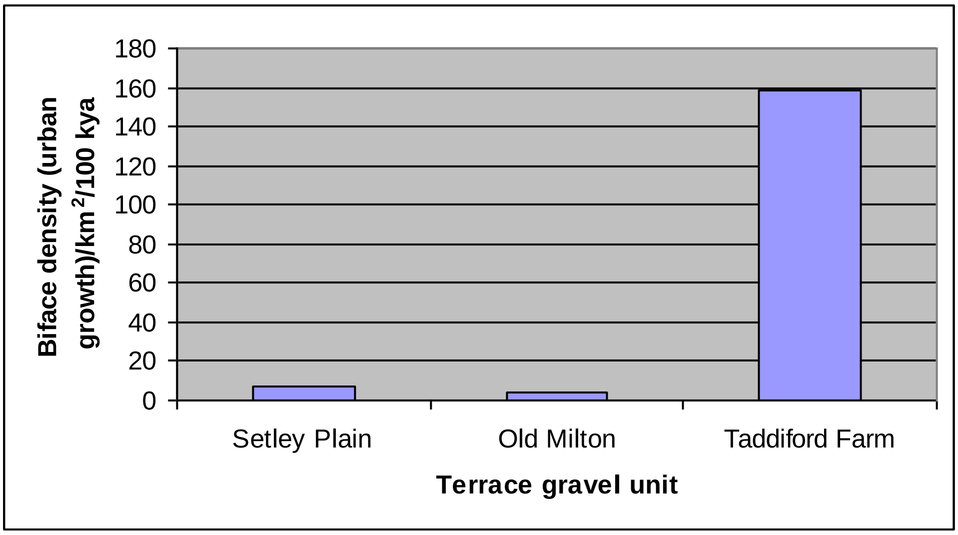

Figure 6: biface densities on terrace gravel units subject to urbanisation since 1861, per 100,000 years

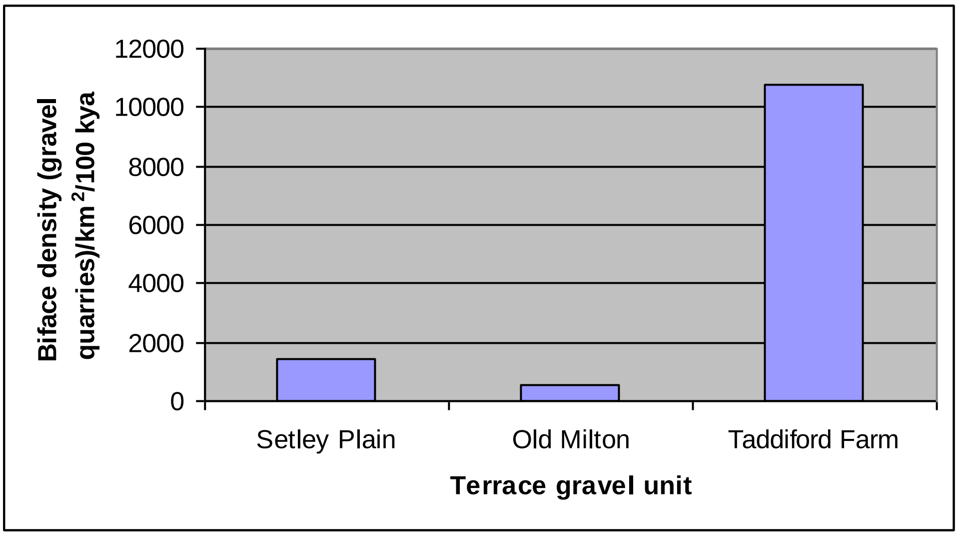

Figure 7: biface densities on terrace gravel units subject to quarrying (1861–1990), per 100,000 years

during late MIS-9 and early MIS-8 is a robust pattern, occurring throughout the River Thames system and apparently in the Solent River system as well[ii]. It might therefore be expected that a similar demographic pattern (a high peak during late MIS-9/early MIS-8) would occur in both the Solent River and Thames systems. Yet Ashton & Lewis (2002) have demonstrated that the population signature for the Middle Thames decreased markedly from MIS-11 onwards.

Overall therefore, the demographic patterns in the Solent River are interesting and *may* reflect trends in knowledge transmission and technological innovation. This is based on the apparent association between a notable peak in the demographic data during MIS-9 and the first appearance of Levallois technology, which has long been recognised as a highly significant technological change during the pre-Upper Palaeolithic of north-western Europe (e.g. Roe 1981). Following the Shennan (2001) model, it is suggested that the Levallois technological innovation was highly successful during MIS-9, and that its widespread adoption during this period is a reflection of the relatively large populations (and therefore efficient knowledge transmission mechanisms) of the time. It is noted that this model permits the possibility of numerous Levallois-type technological innovations prior to MIS-9, which were unsuccessful and short-lived as a result of small populations and therefore inefficient transmission mechanisms.

Yet it is clear that further testing of regional and sub-regional patterns in hominin demography (utilising artefact density as a proxy) are necessary. Moreover, this approach must consider three cautionary notes. Firstly, improved understanding and modelling of vertical artefact derivation from older to younger terrace deposits is required, in order to improve the robusticity of these approaches. Secondly, the approach assumes that biface 'function' or 'functions' were consistent over long periods of Pleistocene time and/or that the frequency of biface production remained stable, irrespective of 'function'. This is possible, but recent evidence for biface use in butchery (Pitts & Roberts 1997) and wood-working (Dominguez-Rodrigo *et al*. 2001), use wear studies and experimental archaeology (Keeley 1980; Jones 1980, 1981; Schick & Toth 1993; Pitts & Roberts 1997), variable patterns of immediate discard and re-use (Pitts & Roberts 1997) and social theories of biface use (Kohn & Mithen 1999; Gamble 1999) all suggest that the assumption may be an over-simplification. Thirdly, the geochronological models for the Solent River lack absolute dates and are primarily based on the Bridgland (2001) model of terrace formation and the use of a diagnostic industry as a chronological marker. While the absence of biological data and biostratigraphical markers is a persistent problem (due to soil and sediment chemistry in the Solent River region), current developments in optically stimulated luminescence dating may result in more robust models in the near future.

I have shown therefore that regional palimpsest data sets (as represented by the fluvial deposits and derived artefact assemblages of the Solent River) can be employed to model hominin demography. Yet where does that leave us with respect to the individual's contribution to social processes? We are obviously dealing with generic rather than specific individuals, but testable mechanisms such as that of Shennan (2001) provide a framework through which to highlight the role of the generic individual. In linking population sizes and successful technological innovation, Shennan stresses the social processes of behavioural (tool-making) change and learning. Long-term fluctuations in demographic data can therefore be tracked and tested against the material record, potentially supporting propositions of changing social organisation and generic individual action. For example, the larger populations of the Solent River landscape in MIS-9 may be associated with distinctive social structures in which adults and children were involved in both parent/offspring- and adult/child-based processes of social learning and knowledge transmission.

Yet in using artefacts as a population proxy, the model presented above ignores a considerable body of potential information contained with the stone tool record that can be related to hominin behaviour and evolution. Unfortunately, the coarse resolution of regional and sub-regional terrace units dictates that only major technological innovations (such as the appearance of Levallois technique) can be modelled through long term patterns in hominin demography. Finer-scale trends, such as the transitions from Clactonian to Acheulean technology within MIS-11 and MIS-9 (White & Schreve 2000) are more difficult to model with regional, palimpsest data sets, since the derived artefacts within the terrace deposits cannot currently be divided between the earlier and later phases of the MIS-stages. Yet at the scale of individual palimpsest deposits, it may be possible to model the impact of individuals through high-resolution patterns of technological change. These approaches are explored in the following case study.

Fluvial landscapes: the River Axe

Although the Palaeolithic archaeology of south-west Britain is more renowned for its cave sites of Kent's Cavern (Campbell & Sampson 1971; Straw 1995, 1996) and Brixham Cave (Wymer 1999), the Middle Pleistocene fluvial deposits and associated lithic assemblage at Broom in the River Axe valley (Figure 1; Salter 1899, 1906; Ussher 1906; Woodward 1911; Reid Moir 1936; Green 1947; Green 1974, 1988; Stephens 1970a, 1970b, 1974, 1977; Shakesby & Stephens 1984; Campbell 1998; Marshall 2001) represent the most significant 'open site' in this region. The site is explored within this paper as the structure of the fluvial sediments and archaeology at Broom offer an opportunity to search for traces of individuals, as represented by long-term technological innovation (after Shennan 2001) and/or the short-term imposition of standardisation with respect to stone tool production.

The Broom 'site' was exposed during the commercial extraction of aggregates between the late 19th and mid 20th century, in three pits (the Railway Ballast Pit, Pratt's Old Pit and Pratt's New Pit). Approximately 1,800 artefacts were collected from these pits, of which the majority are bifaces, predominantly knapped from chert with a small number of flint examples. The majority of the assemblage shows evidence of fluvial modification and transportation, although the degree of damage suggests that the artefacts were probably moved over hundreds rather than thousands of metres. It is stressed however that the assessment of fluvial modification and transportation of chert artefacts is complicated by the quality of the raw material and the focus of previous authors (e.g. Wymer 1968; Shackley 1974, 1975; Harding *et al*. 1987) upon flint artefacts in their investigations of stone tool movement in fluvial systems.

The fluvial sediments at Broom consist of at least 15 metres of sands, gravels, silts and clays. These deposits have been traditionally divided into a tripartite sequence of lower gravels, the 'middle beds' (a mixture of gravels, sands, silts and clays), and upper gravels (Reid Moir 1936; Shakesby & Stephens 1984; Green 1988). Recent geomorphological research (e.g. Vandenberghe 1995, 2002; Maddy *et al*. 2001) has highlighted the apparent relationship between periods of fluvial activity (channel erosion and sedimentary aggradation) and periods of climatic instability. These phases appear to represent relatively short periods of the Middle Pleistocene climatic cycle, and are separated by long periods of relative quiescence and limited fluvial activity. The application of optically stimulated luminescence dating at Broom (Hosfield *et al*. in prep.) has indicated that the Broom sedimentary sequence may represent *at least* 20,000 years from top to bottom, and possibly rather more, up to 50,000–60,000 years. In this respect, the Broom terrace sediments represent a classic example of a relatively coarse minimum archaeological-stratigraphic unit and an archaeological palimpsest (Stern 1993). At a regional scale of analysis it is not possible to correlate units *within* the Broom sequence with deposits at other locations, since the absolute internal chronology of the deposits is unknown.

However, at the analytical scale of single exposures (in this case the deposits at Broom), it is possible to compare the three internal units, as their stratigraphical sequence can be demonstrated (Figure 8). Moreover, by adopting the current models of sporadic and episodic fluvial activity (e.g. Vandenberghe 1995, 2002; Maddy *et al*. 2001), it is suggested that the three sedimentary units (upper gravels, middle beds, and lower gravels) at Broom are separated by significant periods of time. By extension, it is argued that the archaeology within these sedimentary units are also separated by significant time periods, while the accumulation of their encompassing sediments was a relatively rapid phenomena. It was therefore proposed that the three sedimentary units could form the framework for a higher resolution examination of technological stability/change, based upon the archaeological content of each unit. It is stressed that the individual archaeological and sedimentary units are still archaeological palimpsests, since the distribution of the archaeological debris within each unit is unknown and cannot be assumed to have been deposited at a single moment.

Defining the archaeological content of each of the sedimentary units was based upon the archive of C.E. Bean (Green 1988), who documented the collection of over 1,000 stone tools from Pratt's Old Pit during the 1930s and early 1940s, and recorded valuable information concerning the stratigraphic provenance of many of the artefacts. Both Green (1988) and the current author (Hosfield & Chambers 2003) have since divided the Bean collection, where possible, into stratigraphic units that were defined by the location of Bean's site datum and first floor level (Figure 9). The current stratigraphic sub-division of the assemblage identified three sub-samples, which were associated with the three major sedimentary units at Broom:

1. 'Above datum' sample (20 bifaces) – associated with the Broom 'upper gravels'.

2. 'Datum' sample (62 bifaces) – associated with the Broom 'middle beds'.

3. 'Below datum' sample (34 bifaces) – associated with the Broom 'lower gravels'.

The structure of the sediments and archaeology at Broom therefore offer an opportunity to explore trends in long-term technological innovation (after Shennan 2001) and/or the short-term imposition of standardisation with respect to stone tool production. This sub-division of the Broom assemblage into stratigraphic units clearly makes a number of fundamental assumptions. These are identified here but dealt with in the following discussion of the evidence:

1. That the time-averaging associated with the individual archaeological samples is not of sufficient magnitude that any evidence for technological standardisation or innovation becomes invisible.

2. That the derived and re-worked lithic artefacts are broadly contemporary with the sedimentary units within which they were ultimately deposited, and that material from single behavioural episodes does not occur in different samples.

3. That the traces of individuals will be evident in lithic technology.

Biface manufacturing and standardisation

Examination of the overall biface assemblage from Broom indicated an absence of clear standardisation in the production of bifacial stone tools (Hosfield & Chambers 2003). A range of categories were recorded for the bifaces: type (using the Wymer (1968) system); raw materials; blank form; tip type; butt type; edge profiles; and size (employing a weight index). While the majority of these categories demonstrated evidence for a dominant type (e.g. cordate/ovate bifaces; medium-grained chert; irregular rounded tips; trimmed flat butts; 100–500g in weight), the accompanying range of types evident in the assemblage (Table 4) hinted at considerable variation in technological practise and the apparent absence of imposed standardisation upon tool-making. These patterns contrast markedly with White's (1998) documentation of distinctive pointed/ovate biface assemblages across Southern Britain, suggested to relate to the types and quality of immediately available raw materials.

Examination of the individual biface sub-samples indicated that each of the samples bore a considerable resemblance to the overall Broom assemblage. In the majority of categories the dominant types were the same, and there was a similar range of variability in biface technology and typology within each of the samples (Table 5). In other words, the samples demonstrate limited inter-sample variation, but considerable intra-sample (internal) variability. These data therefore indicate little evidence for technological change over the 20,000-60,000 year period associated with the Broom sedimentary sequence. Moreover, at the higher resolution geochronological levels associated with each of the sub-samples, there is evidence for variation in technological practise and a lack of imposed standardisation (as was suggested above for the overall assemblage).

Social Learning?

Do these patterns provide a window through which we can discuss the roles of the individual? The work of Shennan (2001) is of some assistance here, since the model focuses upon technological innovation. The overall absence of long-term technological change might therefore be suggestive of small populations, within which successful innovations were relatively rare. With respect to the absence of imposed standardisation, Mithen's (1996) model of group size, social learning and cultural traditions also provides a potentially useful framework. He proposed that in small groups the opportunities for social learning would be relatively limited. Consequently, knapping practises would be highly diverse due to the weakness or complete absence of cultural traditions (propagated through social learning). The Broom data could therefore be interpreted through this model, suggesting both small

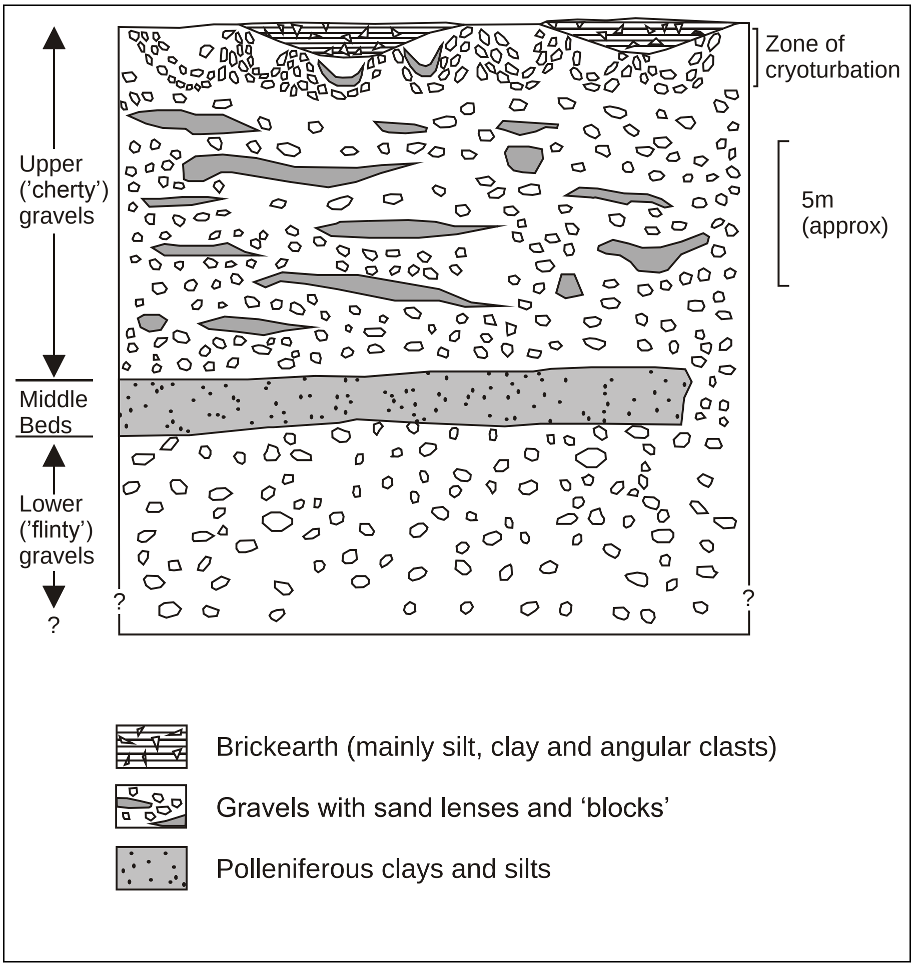

Figure 8: the Broom sedimentary sequence (lower 'flinty' gravels > middle beds (including polleniferous clays and silts) > upper 'cherty' gravels). After Shakesby & Stephens (1984: Figure 2)

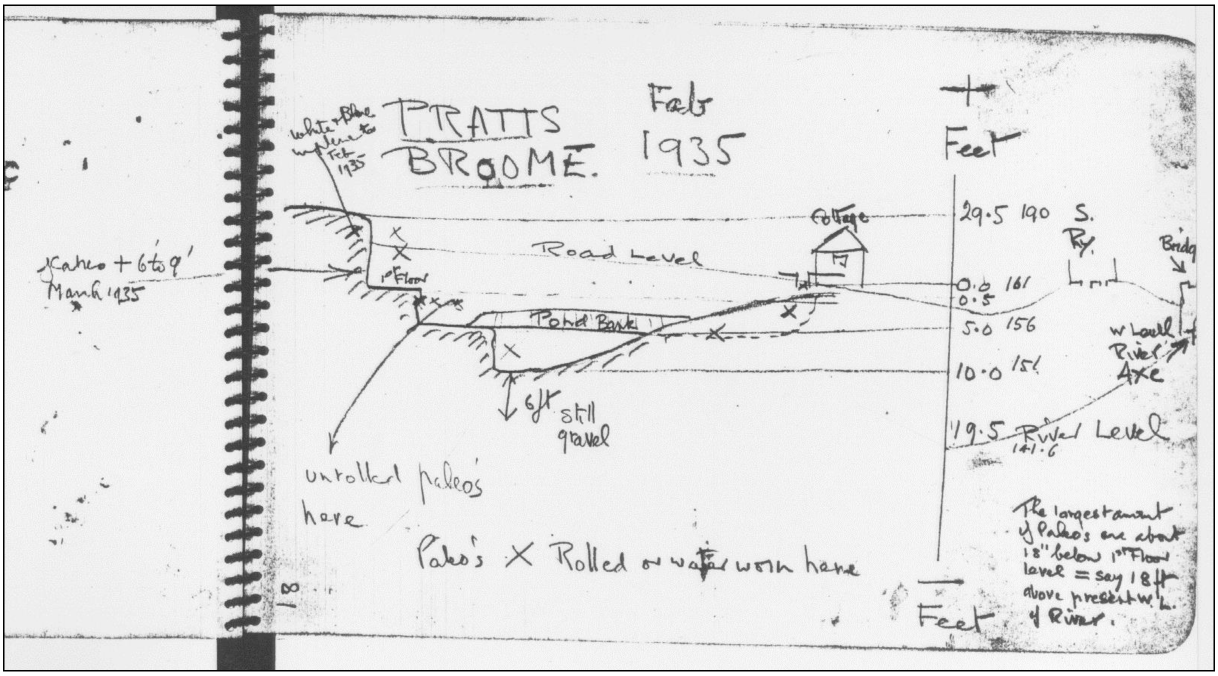

Figure 9: a schematic section of Pratt's Old Pit by C.E. Bean (February 1935). Note the location of the '1st floor' level and the site datum (at the road level by the cottage)

Biface type	Raw materials	Blank form	
Cordate/ovate (188)	Medium-grained chert (309)	Flakes (103)	
Cordate (122)	Fine-grained chert (187)	Cobble (96)	
Pointed (80)	Coarse-grained chert (97)	Nodule (12)	
Ovate (44)	Flint (46)		
Sub-cordate/ovate (39)	Quartz (1)		
Pointed/sub-cordate (39)			
Sub-cordate/cordate (29)			
Sub-cordate (27)			
Cleaver (13)			
Pointed/ficron (8)			
Ovate/flat-butted cordate (8)			
Ficron (8)			
& a range of other types			
Tip type[iii]	**Butt type**	**Edge profiles**	**Size (weight index)**
Irregular rounded (274)	Cortex (126)	Straight;	Minimum (38)
Rounded (111)	Trimmed (513)	Sinuous;	Maximum (2437)
Ogee point (64)		S-twist combinations	Mean (408.33)
Lingulate point (32)			s.d. (243.33)
Basil point (29)			
Irregular pointed (27)			
Acute point (22)			
Cleaver (17)			
Pointed (9)			
Tranchet (7)			
Irregular tranchet (2)			
Rounded tranchet (1)			

Table 4: technological/typological categories present in the Broom biface assemblage (Hosfield & Chambers 2003)

	Sub-samples		
	Lower gravel	**Middle beds**	**Upper gravel**
Primary types	Cordate & cordate/ovate bifaces	Cordate bifaces	Cordate/ovate bifaces
	Medium-grained chert	Medium-grained chert	Medium-grained chert
	Flake & cobble blanks	Flake & cobble blanks	Flake & cobble blanks
	Irregular rounded tips	Irregular rounded tips	Irregular rounded tips
	Trimmed butts	Trimmed butts	Trimmed butts
	Straight edge profiles	Straight edge profiles	Straight edge profiles
	400-600g	200-500g	200-500g

Table 5: technological/typological categories present in the Broom biface sub-samples (Hosfield & Chambers 2003)

populations and the restricted involvement of individuals within social learning activities and processes.

The assumptions of this approach were identified above (Page 14) and can now be dealt with in more detail:

1. The magnitude of the time-averaging within the palimpsest samples. It is argued above that the deposition of the three sedimentary units (upper gravels, middle beds and lower beds) was rapid, interspersed with longer periods of relative fluvial inactivity. However, the magnitude of the time-averaging relates not only to the duration of the sedimentary events but also to the length of time over which archaeological materials were accumulating on the floodplain (prior to incorporation within the fluvial terrace sediments through entrainment, transport and deposition) since the last major sedimentary event[iv]. The time interval is impossible to assess accurately, but probably represents several centuries or even millennia, following models of lateglacial fluvial behaviour (e.g. Cleveringa *et al*. 1988; Schirmer 1988, 1995; Vandenberghe 1995, 2002; Collins *et al*. 1996; Maddy *et al*. 2001). It is therefore acknowledged that the archaeological sub-samples are partially time-averaged. However, with respect to whether short-term technological innovation and/or standardisation is really absent or just invisible within these palimpsests, the similarity of the three samples points to the former and not the latter. If there had been

distinctive, brief phases of innovation and/or standardisation, then differences between the samples might be expected (e.g. a dominance of pointed biface production in the youngest sample), yet such patterns are absent.

2. Are the derived artefacts broadly contemporary with their sediments? It was indicated above that artefacts may lie upon floodplains for hundreds or thousands of years (during periods of fluvial inactivity) prior to incorporation within sediments during the next major aggradation phase. It is also argued however, that the levels of fluvial energy associated with the deposition of gravel units would have been sufficient to incorporate the majority of the extant archaeological material lying upon the floodplain and shallowly buried within near-surface sediments. Therefore, while the derived artefacts are not directly contemporary with their sediments, they do represent distinctive periods of time, perhaps dominated by fluvial quiescence, but curtailed by the deposition of a sedimentary unit.

3. Are individuals evident through lithic technology? It is worthwhile recalling that lithic technology may reflect only a small fraction of the hominin behavioural repertoire and its complexity. Moreover, the information concerning the individual in these archaeological palimpsests is severely handicapped by the absence of the specific contextual data with respect to tool use, through which innovative behavioural and technological strategies might be detected.

In summary, this case study has demonstrated that site-based palimpsest assemblages (as represented by the Broom bifaces) can be interrogated to explore mid-term (e.g. tens of millennia) patterns in tool-making and technological practice. As with the previous case study however, can we relate these patterns to the individual? Once again we are dealing with generic individuals, and frameworks such as those provided by Shennan (2001) and Mithen (1996) provide a means of exploring the roles of that category of individuals with respect to behavioural change and social learning. The Broom assemblage is characterised by an apparent absence of technological innovation over the mid-term and a lack of standardisation in tool-making throughout the time period represented. Following the arguments of Shennan (2001) and Mithen (1996), these patterns can potentially be linked to small populations, which restricted social learning opportunities, both reducing the possibilities for successful and sustained innovations and producing weak or non-existent cultural traditions. Two key points are stressed however: firstly, that the arguments of Shennan (2001) and Mithen (1996) are not the only ones that can be applied to these data. They are simply examples of the evolutionary theory from which the behaviour of generic individuals in particular situations can be modelled (Mithen 1993). And secondly, it is stressed that the interrogation of palimpsest data sets requires considerable understanding of (and the occasional assumption regarding) the geoarchaeological processes associated with the formation of the sediments and the incorporation of the archaeological materials.

Conclusion: Seeking Individuals

This paper began by addressing two questions: how do individuals influence wider hominin society and behavioural evolution; and which elements of evolving hominin behaviour are evident in a palimpsest record? The manner in which individuals influence larger scale social units and processes has received relatively little attention with respect to hunter-gatherer communities, where the focus has traditionally been upon the group as the unit of analysis (e.g. Clark 1992; Binford 2001). This partially reflects the chronological resolution associated with much of the archaeology dating to the earlier prehistoric periods — groups rather than individuals are commonly perceived as the instinctive analytical unit when dealing with time-averaged archaeological debris (e.g. Clark 1992: 107), despite Mithen's (1993) lucid critique of this approach. The search for individuals is also undermined by our inability to reach any sort of consensus as to whether we are dealing with essentially modern humans or some other type of social hominin (e.g. contrast Gamble (1995) and Roberts (1996)). At a practical level, archaeologists have repeatedly failed to relate the occasional archaeological "moments in time" to long-term patterns in behavioural evolution, reflecting an absence of appropriate frameworks and analytical mechanisms. Finally, the apparent uniformity of material culture prior to the Upper Palaeolithic seems to have promoted the identification of traditions (e.g. represented by typological artefact groups) over individuals (e.g. represented by unique material culture such as grave goods or decorated technology). Yet it seems to me to be inevitable that individuals, whatever their specific character, must have played key roles within the hominin social sphere, through actions ranging from day-to-day social interactions to technological innovation and changes to behavioural strategies (e.g. hunting or scavenging techniques). The problem has been, and remains, how to access those actions through both high and low-resolution archaeological debris.

In his critique of the group-based approach, Mithen (1993) rightly highlights the problem that any individual will be a member of multiple groups, ranging from nuclear families and task-specific parties to mating systems and alliance networks. This approach can be adopted with respect to palimpsest data sets, to highlight the fundamental issue: what is the role of individual hominins? The answer is that individuals will have adopted countless roles, many of which are undetectable in the archaeological record (see below), but from an archaeological perspective all of these roles are defined by the analytical focus and scale of our enquiries. Figure 10 offers an exploratory framework which defines some of these analytical foci, scales of analysis and the relationships between them. For example, at the scale of the primary context site and ecological time, the focus will be on the decision-making of generic (and occasionally even specific) individuals, with respect to short-term social processes such as food procurement and movements around the local landscape. The analytical methodologies associated with the investigation of these processes are well established (e.g. Roberts & Parfitt 1998). Yet at the scale of palimpsest data (both on- and off-site) and generational/evolutionary time, our understanding of generic individual involvement within processes of learning and transmission or behavioural evolution is seriously deficient. Moreover, the available analytical methodologies are also limited in scope. At first sight this is not surprising — assessing the role of individuals in long-term behavioural evolution or mid-term patterning in tool-making is neither straightforward nor intuitive. It is perhaps easy to think about generic individuals through the notion of innovators and inventors who leave their traces in the archaeological record as material signatures — a series of technological "Eves (or Adams!)". But this approach is rather disingenuous, and not only because it assumes a behavioural modernity in its notion of individual inventors. It also fails to draw any links between the different analytical scales. Rather it just looks for short-term aspects of behaviour *within* the palimpsest record. By contrast, the case studies presented here have tried to exploit the unique chronological longevity of the data, and explore analytical avenues that link the short-, mid- and long-terms.

The example presented here for the Solent River assumed a link between population size and rates of technological innovation, and suggested a possible long-term link between population growth and the first occurrence of Levallois technique, during MIS-9 in the Solent River region. Caution is advised however, since these results contrast markedly with those of Ashton & Lewis (2002) from the Middle Thames, where population is argued to have declined from MIS-11/10 onwards. Moreover, it is extremely difficult to assess absolute population sizes or densities on the basis of artefact proxies, since current understanding of frequencies of artefact production, use and discard during the Palaeolithic is extremely limited. Finally, since Bridgland (1994) has suggested a Thames-wide MIS-9/8 age for the first appearance of Levallois, further rigorous testing of Shennan's (2001) arguments with respect to Levalloisian technology is required, through the modelling of population data across multiple river systems.

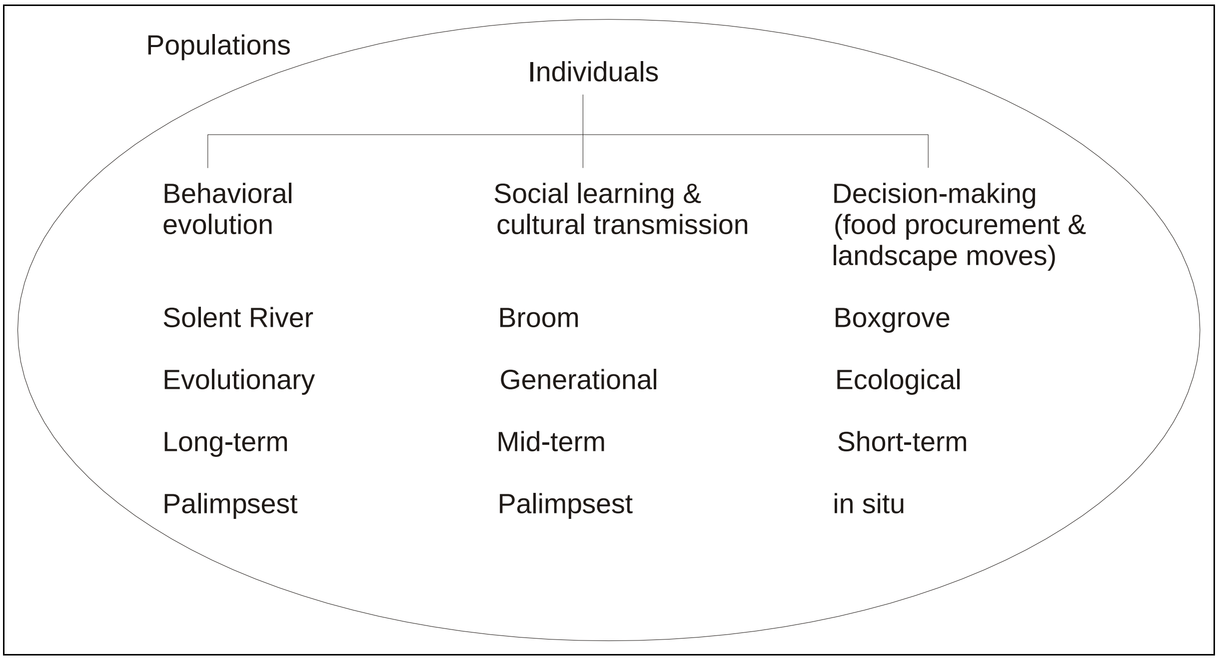

Figure 10: individuals, behaviour and analytical scales — an exploratory framework

The second example explored higher-resolution patterns over the mid-term, with a view to exploring individual actions through evidence of technological change or imposed standardisation in tool-making. The Broom data however showed little evidence of either of these trends, potentially recalling Shennan's (2001) observation that:

"it appears possible that rates of successful technological innovation may have been correlated with population sizes and densities from the origins of hominin culture to the present. Is this the reason why handaxes barely changed for a million years?"

(Shennan 2001: 15)

However, it is stressed that evidence of short-lived technological change and imposed standardisation may be effectively 'invisible' within time-averaged deposits, and also that modern archaeologists may be failing to recognise significant typological and technological variation within lithic assemblages, that are actually far more heterogeneous than our classifications make them. Finally, it should also be noted that there are other archaeological palimpsests within which technological change and variability is far more evident (e.g. Swanscombe (Conway *et al*. 1996)) and which could potential support the notions promoted by both Shennan (2001) and Mithen (1996).

Finally, while it is not possible to directly identify specific individuals through their material debris within the palimpsest record — such identifications require fine-grained data sets, such as the Boxgrove knapping scatters (Roberts & Parfitt 1998) — this is not a cause for despair. The concept of the generic individual (Mithen 1993), combined with models of mid- and long-term social processes allow us to assess the contribution made by individuals to processes that continue over centuries and millennia. The most prominent of these models are currently concerned with issues of social learning and knowledge transmission (e.g. Shennan 2001; Mithen 1996) and raise issues over the use of modern analogues with early hominins. However, what is not in doubt is that these approaches can be slotted into a framework that incorporates both the well-worn *in situ* short-term and the palimpsest long-term. I would suggest that a key need for the immediate future is further models that explore processes of colonisation and demography from the perspective of individual action and engagement.

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[i] Primary context sites such as Boxgrove (Roberts & Parfitt 1998) and Caddington (Samson 1978) have produced the majority of waste flake and débitage material, through a combination of differential preservation conditions and the selective recovery of artefacts from secondary contexts.

[ii] It is stressed however that the development of Bridgland's (2001) geochronological model for the Solent River system is partially dependent on the assignment of the first apparance of Levallois technology to late MIS-9 and early MIS-8, so there is potentially something of a circular argument at play here.

[iii] Caution is advised with respect to the interpretation of biface tips in derived assemblages, given the potential of these fragile biface elements to be damaged and/or modified during fluvial transport episodes.

[iv] This assumes that during major depositional phases, braided systems re-work near-surface sediments (and their archaeological content) from the floodplain within a few decades (Gibbard & Lewin 2002: 189).