Slippery and Billy: Intention, Selection and Equifinality in Lithic Artefacts

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Although the most appropriate explanation for human activities has been long debated in the social sciences, few observers deny the purpose-driven nature of many aspects of modern human behaviour. One reflection of this opinion is the concentration of research effort on the exploration of prehistoric cognition. For instance, the mental processes underlying behaviour represented in the archaeological record are a specific focus of many archaeological studies. A fundamental issue being explored in such studies is the nature of cognitive differences between ancient hominids and the context and processes by which modern mental processes emerged. Stone artefacts play a central role in those deliberations, but the basic strategy of inferring ancient intent is increasingly under attack (see Bleed 2002; Dibble 1984; 1987; 1995; Hiscock & Attenbrow 2003; in press). Concerns often pivot on the existence of powerful mechanisms that may cause non-random archaeological patterning. Such patterning may not be the consequence of ancient knappers following a prepared plan leading to a fixed and specific, designed end-product — the proposition embedded in typological analyses of lithic assemblages.

Lithic typology is an analytical framework that reduces variability in artefact assemblages by focusing on describing the central tendency of only a small portion of the assemblage: retouched specimens and specific unretouched flakes and cores. This normative focus is usually justified by reference to the design presumed to be reflected in the form and abundance of retouch, employing the principle that artefact form is explicable in terms of the presumed purposes for which it was created (see Dibble 1995; Hiscock in press a; Steffen *et al.* 1998). Using this framework, lithic analysts infer intentions on many levels: distinguishing designed tools from debris, end-products from unfinished items, one functional design from another, and so on. Such analyses are typically based on the presence of a complex combination of morphological characteristics that are taken to be suggestive of design: repeated shapes, regular (usually symmetrical) form, morphological features in excess of those needed for the performance of activity, and extensive modification of a specimen

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(using the proposition that the more the specimen is shaped, the more obvious the design becomes). These traits are taken to be material expressions of the designs held by the artefact maker. In recent decades these principles have been employed not only in typological classifications, but also in depictions of the intents guiding manufacturing process. In this context Dibble (1995, 304) has explained that the *chaîne opératoire* '. . . is based on a very strong notion of intentionality on the part of prehistoric flint-knappers, i.e. that every stage of manufacture is preconceived for the production of certain final and desired end products' (see also Sellet 1993).

One of the strongest critiques of typological-based statements of intent is founded on the problem of equifinality. Perhaps the best-known Palaeolithic example is the explanation of implement form in terms of the point at which specimens were discarded in a process of ongoing morphological modification incurred by resharpening. This mechanism has proved to be a powerful depiction of archaeological patterns at some sites, and a severe challenge to typological assertions of intent because it is an explanation that does not require archaeologists to presume types were end-products or reflect designs (see Dibble 1995). Resharpening models do not deny that the knappers' actions may have been laden with intention, but they do suggest the knappers' plan centred on goals of prolonging useability rather than creating specific implement morphologies. Debates about this and similar mechanisms have highlighted the question of how archaeologists might distinguish patterns associated with predetermined design from those that are not. By acknowledging the existence of pattern-generating mechanisms other than prepared design of end-products, lithic analysts are obliged to acknowledge the methodological complexities of identifying that aspect of intentionality from the material consequences of knapping behaviour, and the implications of being unable to do so unambiguously.

Concerns have also been expressed about the capacity of simple notions of directional and standardized manufacture of a designed end-product to account for the complexity of all lithic assemblages. For instance, Bleed (2002) observed that archaeologists often employ linear models to describe technological activities, while the archaeological evidence is frequently so variable and complex that linear models seem inappropriate. Concluding that ancient knappers '. . . did not think like modern archaeologists' Bleed (2002, 341–2) proposed that researchers should consider non-linear conceptual systems for understanding the non-random behaviours of ancient people. This is an intriguing suggestion, but the notion that non-random manufacturing patterns may not be explicable in terms of linear plans can be extended and explored both archaeologically and ethnographically.

One of the more productive uses of ethnographic observations is as a test of archaeological principles. Here I shall describe an example of Aboriginal knapping from the Australian desert that has implications for interpretations of intentionality in lithic material. As such, it adds to the observations of Australian Aborigines working stone, which have on occasion revealed alternatives to conventional principles used in archaeological analyses. It is a mistake, however, to consider ethnographic displays from Australia as aberrant or unique to that landmass. Hayden (1977) called the challenging ethnographic observations of Western Desert Aboriginal knapping 'surprises', because they presented images of artefact manufacture that were radically different from those presented by archaeologists; but it should hardly be surprising that modern human manufacturing behaviour is diverse, creative and socially complex. The only surprise is that archaeologists might expect ancient knapping to be otherwise. Late Holocene Australia may be considered to offer an exemplary opportunity to comprehend modern human knapping, since it contains not only abundant ethnographic observations of knappers but also archaeological evidence of the production of all major classes of stone implements: bifaces and bifacial points, 'microlithic' backed artefacts, scrapers, ground-edge axes, grindstones, and so on (see Hiscock 1994). Since there is no reason that the kinds of knapping activities observed in Australia were, in the past, restricted to Sahul, the following model of human knapping may have value in archaeological interpretations of both the Old and New World. Failure to consider this antipodean information would condemn archaeological interpretations to reproduce only one of a number of possible images of past intentionality; an outcome that could obscure variability in past hominid organization.

Ethnographic knapping in Australia

In September 1978 I spent time with Slippery Morton and Billy Dempsey, who were then old men, Alyawerre (Alyawarra) speakers from Amaroo, in Central Australia. Slippery and Billy were old enough to have been exposed to traditional practices of stone knapping and resin preparation when they were

Figure 1. *Illustration of the body position of Billy Dempsey while knapping.*

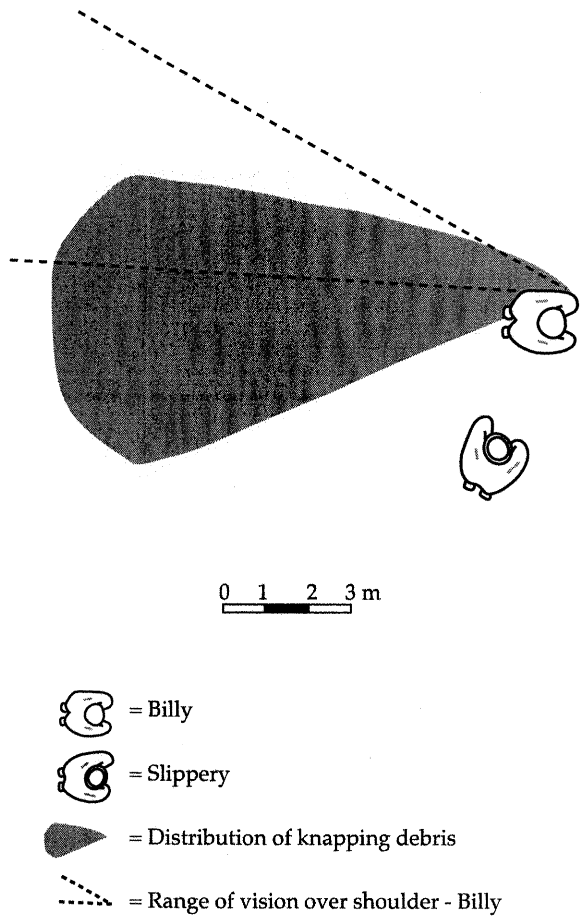

Figure 2. *A depiction of the spatial distribution of knapping debris in unvegetated areas. (From Hiscock in press b.)*

young men at the start of the twentieth century. During that period Slippery was somewhat subdued because of a recent coronary and left most of the active roles to Billy. Slippery's incapacity may have modified their behaviour, but the activities I observed were virtually identical with the previously filmed knapping of these men.

Over one two-day period Slippery and Billy spent six hours knapping stone, a labour which produced 12 stone 'knives' set in resin handles. The men claimed to have a distinct image of suitable specimens: white quartzite flakes more than 8 cm long and with strong, circular edges. They described the functioning of these 'knives' as a cutting motion produced by a circular movement of the wrist. Billy and Slippery regarded the colour of the material on the cutting edge and main faces of the artefact as the most important trait. To qualify for selection, the colour of the flake had to be the brilliant white that was found in the unweathered inner section of quartzite boulders, rather than the grey or orange cortex encasing the boulder, a requirement often noted by observers of Aboriginal knappers from central and northern Australia (see Taçon 1991).

Despite these stated goals the specimens that were given resin handles were morphologically variable. They ranged from 6 cm to 15 cm in length, and had edge angles of 43° ± 15°. While some were circular in shape, others were semi-circular, or elongated with circular ends. Some flakes had feather terminations, while others had hinge terminations. Most specimens were unretouched, but one was retouched. This variation in tools can be partly understood in terms of the dynamics of the manufacturing process. The knapping involved a distinctive twisting, cross-body motion that struck flakes behind the knapper; a system commonly observed in Australia and which I have termed reverse knapping (Hiscock in press b).

The typical knapping posture for Billy was kneeling on the ground (see Fig. 1). The core rested on the ground to the left and in front of Billy's left knee, between 0.3 and 0.8 metres from his body. This core was positioned and manipulated by Billy's left hand. The hammerstone was held in his right hand. In the act of knapping Billy would bring the right hand round in an arc and down toward his left kidney, hitting the uppermost part of the core by his left knee.

Table 1. *Retouching pattern.*

	Unretouched	Retouched	Total
Not selected	24	12	36
Selected	34	1	35
Total	58	13	71

$\chi^2 = 9.077$, d.f. = 1, $p = 0.003$, Cramer's V = 0.394

Successfully detached flakes would fly to the left and behind the knapper, hence the description of this as 'reverse knapping'. Figure 2 shows schematically the spatial relationship between Billy, the scatter of flakes he produced, and his field of vision when seated. Knapping created an elongated cone-shaped distribution of artefacts behind the knapper. Detached flakes landed out of Billy's sight and anywhere from centimetres to twelve metres from his back. The highest density of material was found up to four metres behind the knapper, and could not be viewed by him. Because Billy was unable to observe flakes he struck off, it was his habit to have an aide, in this case his friend Slippery. Slippery looked at the flakes that had been detached behind Billy's back and retrieved some for closer inspection. Slippery sat to the right of the knapper and parallel to, or slightly behind him (see Fig. 2). In that way Slippery was protected from any airborne flakes, but he remained some distance from the landing flakes; and on occasions where he was not far behind the knapper he also had to twist his torso to examine the knapping results. This created the intriguing circumstance in which a knapper was often unaware of the flakes that were produced, and the identification of flakes suitable for use was made by someone other than the knapper.

This circumstance provided the selection of flakes for hafting through negotiation between Slippery and Billy; a process that produced variable outcomes because of the different information available to each man. As Billy knapped he sang quietly to himself (a song he believed assured the eventual success of his activity) and at certain points in the song he had a strong expectation of producing a useable flake; he often exclaimed after striking those flakes. In addition Billy used the feel and sound of the blow as cues to alert him to those flakes which deserved inspection. Sitting to Billy's right Slippery's main cue was visual, reinforced with the sound produced as the flake was removed. Slippery often exclaimed when he saw a promising flake land behind Billy. Sometimes Billy did not suspect the possibility of a successful flake and continued both knapping and singing until interrupted by Slippery's yell. When either man felt a flake was worth examining he would alert the other, and both men would retrieve the specimen and discuss whether that flake was acceptable. Often the two men initially failed to agree on whether a flake was suitable, and the negotiation continued until one yielded. An example will illustrate the consequences of these different expectations and cues during the negotiation. On two occasions Billy, having struck off a flake, exclaimed loudly to the effect that he could 'feel' that a suitable flake had been removed. In both instances the flake in question had shattered and dispersed in fragments, although neither Billy nor Slippery saw this. Slippery was bemused at the absence of any 'good' flake behind Billy. The strength of Billy's conviction was great, however, and he strained, turning to his left, in an attempt to find his flake. Influenced by his friend's determined conduct, Slippery reached over and picked up a flake. Both Billy and Slippery accepted this artefact as a suitable knife, though both had previously examined and rejected it. This kind of negotiated outcome characterized the interactions of Slippery and Billy throughout the core reduction, as they selected thirty-five flakes for possible hafting. These flakes were placed in a box and moved to a site where resin handles would be applied.

The next selective activity took place at a different locality following transportation and involved taking flakes from the top of the box without any inspection. The top six flakes in the box were taken out and laid on the ground in front of Slippery and Billy. It was from this fraction of the thirty-five flakes in the box that a selection of flakes was taken for hafting. The choice of specimens was made after negotiation between the two men. When only two or three of the initial six flakes remained on display, or too few seemed suitable, more would be added from the uppermost flakes in the box, to provide a choice of five to seven displayed flakes. This process of 'blind', effectively haphazard, removal of specimens from the box to replace displayed ones that had been hafted continued until all of the resin had been used, leaving some flakes in the box which had not even been examined for their suitability during this second stage selection. The consequence of selecting from a haphazardly constructed sub-set of specimens rather than from all of the thirty-five flakes in the box was that the specimens hafted, and the order in which they were hafted, might depart substantially from the preferred rank order given by Slippery and Billy. If movements of the box had produced a size- or shape-sorted collection, that departure may have been regular and directional.

Retouching was not a common practice in these initial stages of manufacture; flakes that were selected as suitable were rarely modified. However, when Slippery and Billy found flakes that had some appropriate characteristics but were not entirely acceptable, they sometimes altered them in an attempt to make them more suitable. Most commonly, this alteration was done by breaking (or attempting to break) the flake with the fingers. Only when this was unsuccessful did Billy retouch a specimen. On some flakes he tried to remove cortex, while on other flakes he retouched the sharp margin. This retouch usually produced a jagged edge and edge-angles with which Billy was unhappy. In fact, with one exception these attempts to modify unacceptable flakes were failures and each retouched flake was discarded without ever having been used (Table 1). Of those specimens examined and compared during core reduction there is a clear pattern of rejecting specimens that had been retouched.

Conclusion

This brief example of modern human knapping is congruent with many other ethnographic observations in challenging the narrow set of principles employed in archaeological classification. Emerging from this case study are three implications for inferences of intentionality developed from Palaeolithic artefacts.

The first and most obvious implication is a reminder that retouch, even extensive retouch, cannot be taken universally as an indication of the nature of design or as a signature of use or resharpening. This is hardly surprising, since Palaeolithic researchers have always understood that artisans could make mistakes, but this case study is spectacular in the consistency with which retouch is associated with items that were unacceptable to the artisan. This pattern operates for early stage production, those flakes retouched prior to hafting in an attempt to make them suitable for hafting and use; whereas later stage hafted flakes which were retouched to resharpen them are more likely to correspond to forms acceptable to the maker. Contextual distinctions of this kind may assist archaeologists in developing filters to identify better those specimens for which discussions of intent may be robustly developed; but in the absence of considerations of this kind the design status of retouched implements must be considered ambiguous, a manifestation of equifinality. Associations of morphology and use-wear are rarely simple in Palaeolithic assemblages (e.g. Beyries 1988), and in any case the argument that morphologies are designed to facilitate specific uses is problematic (see Dibble 1995; Hiscock & Attenbrow in press).

A more radical surprise is the observation of selective mechanisms involving the random or haphazard drawing of specimens from created subsets constraining the choices made by the knapper. While the example presented above involved the selection of unretouched flakes for transport and hafting, similar blind selections might conceivably operate in the selection of specimens for retouching, use, or resharpening. Where such procedures are in place they may have a powerful effect on the outcome of the manufacturing process, including the variability displayed by tools. The processes by which specimens are chosen for transport, reworking or use warrant close examination simply because of their consequences for inferences about knappers' intentions. Slippery and Billy remind archaeologists that the interpretive choice is not between design and randomness in human tools, any more than it is in biological systems. Selective mechanisms may act to create patterns which need not be congruent with ethno-taxonomic categories or with the stated goals of the knapper. A process of this kind generates significant complexities in developing inferences concerning the designs of ancient knappers. Yet selection itself may be an indication of intention, and the existence of complex selective processes may provide archaeologists with an insight into the mode by which decisions were made in ancient societies.

This proposition is visible in the most intriguing and significant observation provided above: that many of the key decisions made by Slippery and Billy did not involve the predictable application of predefined and inflexible templates, but were instead negotiated through a complex social interaction between the two men. Decisions they reached were dynamic and contingent on the social context in which they operated, the outcomes variable and unpredictable. A view of decision-making in knapping as socially negotiated, as co-operative rather than individual, and as contextual rather than normative, creates new interpretive possibilities for Palaeolithic archaeology. In particular it yields a novel perspective on implement variation. Many archaeological studies of implement variation imply ancient knappers created standardized items as far as production technology and perceptual system permitted (e.g. Eerkens & Bettinger 2001), raw material shape and quality allowed (e.g. Brantingham *et al.* 2000; Dibble 1985), or functional and economic pressures encouraged (e.g. Torrence 1986). Such studies sometimes presume knappers hold a defined image of the objects to be reproduced and that their capacity to manufacture artefacts resembling that image is dependent on the precision of the production process and the advantage conferred by standardization. Elements of this framework are embedded in the idea that typological variation may measure the abundance of predefined normative images held by knappers, as measured by the number of implement categories in any assemblage (e.g. Foley 1996). These views of the fixed character of predefined plans and the rigid process by which they are given material form are not compatible with the process of ongoing social negotiation during manufacturing activities that Slippery and Billy reveal. While archaeologists have concentrated on a vision of knapping as an isolated activity in which the knapper replicates a predefined norm, this is only one mode of lithic production, and co-operative processes involving social interaction represent an alternative mode. The existence of at least two distinguishable expressions of intentionality in knapping, one that attempts to 'impose form' (*pace* Mellars 1989; 1996), and another that 'negotiates form', raises the spectre of equifinality again and demands an exploration of the criteria by which archaeologists will recognize each process in Palaeolithic implements. The exploration of this issue is likely to be intricate, since we can anticipate that there may have been multiple mechanisms of social interaction operating at different intensities and creating different patterns of implement variation.

The importance of distinguishing these contrasting expressions of intentionality may be illustrated by reference to significant archaeological transformations. One transition in Australia has been cited by Hiscock & Attenbrow (2003) as indicating the theoretical challenge we face: a transition from assemblages with no obvious imposed form, in which the extent of reduction is responsible for all implement variation, to assemblages dominated by standardized and carefully constructed implements. The interpretive challenge in Australia exists because modern humans manufactured all the assemblages, and an explanation that people lacking complex cognitive capacities created earlier assemblages is not tenable; a different explanation must be offered. The Australian situation stimulates a re-examination of other major archaeological changes of the same kind, such as the Middle to Upper Palaeolithic transition. Perceived difference in the production of tools between the Middle and Upper Palaeolithic has sometimes been explained by reference to the emergence of symbolism and conceptualization in the hominid lineage: with no well-defined or distinctive tool concepts present in the European Middle Palaeolithic and the appearance of these cognitive frameworks around the time that the Upper Palaeolithic began (e.g. Mellars 1991; 1996; Noble & Davidson 1996). Conventional typological depictions of this transition in terms of the emergence of large numbers of predefined implement concepts is an interpretation grounded in a view of individual knappers passively reproducing fixed social norms. Such a model may be obscuring the role of dynamic social constructions of implement variability at some periods or in some contexts. For instance, one possibility is that the Middle to Upper Palaeolithic transition in western Europe does not simply mark the development of 'imposed form' (Mellars 1989; 1991; 1996), but may indicate a change in the way social dynamics are played out in knapping; reflecting an emphasis on dynamic corporate decision making in the Middle Palaeolithic and a shift to more private, passive or normative decision making in the Upper Palaeolithic. From this perspective the proposition that continuous variation in archaeological assemblages necessarily indicates an absence or simplicity of cognitive capacity might be confronted by an alternative model in which dynamic social interactions underpin the archaeological configurations we observe.

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