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Curation and recycling: Estimating Paleoindian endscraper curation rates at Nobles Pond, Ohio, USA

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ABSTRACT

Reduction, recycling, and other changes that stone tools experienced during their use lives reflect design, circumstance and opportunity. The result is discarded artifacts whose sizes and shapes are plain to see and easy to measure. If we can infer their original size, we also can determine tools' degree of reduction from first use to that discard. The difference between original and discarded size reflects curation, which itself subsumes the concept and practice of recycling. Endscrapers are a common retouched-tool type both in North American Paleoindian and Old World Paleolithic assemblages. In this pilot study, we estimate degree of reduction in a sample of unifacial endscrapers from the Nobles Pond Paleoindian site in Ohio, USA. Also, we demonstrate how resulting curation measures can be fitted to the Weibull and other statistical models, not for the sake of mere mathematical virtuosity but to compare curation rate and implicate different failure processes between data sets. Compared to an experimental known, failure in Nobles Pond endscrapers is characterized by attrition, thus fits a Weibull model whose shape parameter $\beta > 1$. This result is useful for comparison between assemblages and for modeling how the record formed. The better we can estimate original size of discarded retouched tools, the better we can gauge curation and exploit the value of this theoretical concept.

1. Introduction

"The Origins of Recycling: A Paleolithic Perspective" conference explored the patterns, forms, and causes of recycling of stone and other tools largely from Old World Paleolithic assemblages. Our subject is North American Paleoindian assemblages, Paleolithic only by the broadest conceivable definition but nevertheless worth contemplation in the same context. Archaeology being a hybrid science-humanities discipline, it suffers the semantic ambiguity that more mature fields mostly avoid. In this context, "recycling" is an ambiguous term that, as discussion at the conference made clear, means different things to different archaeologists.

In Schiffer's (1976, pp. 38, 41) terms, "reuse" involves repeating earlier processes or stages of manufacture or use in the same way. Such reuse includes routine resharpening to rejuvenate working edges, but also can include salvaging of damage or mistakes in resharpening. "Recycling" involves continued use in different, often opportunistic, ways. In this sense, recycling is a special case of reuse, for different purposes. Thus, tools used as designed to the point of depletion are reused, not recycled. In contrast, tools such as endscrapers used opportunistically, either while remaining serviceable for their intended use or after depletion, as, for instance, bipolar cores (e.g. Goodyear, 1993), are recycled. However, engaging subtleties raised at the conference, tools could have been designed with the possibility of opportunistic use in ways inconsistent with their design. If so, Schiffer's distinction between reuse and recycling becomes ambiguous. Nevertheless, our subject is reuse in Schiffer's terms, not recycling, of endscrapers.

2. Curation: reuse and recycling

Anyone who has read the archaeological literature in the past three decades knows that "recycling" is not its only ambiguous term. Leaving aside the semantic free invention of archaeology's unfortunate post-modern interval, in Paleolithic archaeology broadly "curation" is another contested term. Rather than revisit the debate over curation's meaning (Shott, 1996), we use it here to denote the relationship between how much a tool was used and

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how much it could be used. That is, we understand curation as a ratio of realized to maximum utility in tools (Shott, 1996; pp. 267).

Of course, this definition begs another: What is "utility?" That question too is explored elsewhere (e.g. Elston, 1992; Kuhn, 1994; Shott, 1996; Macgregor, 2005; Surovell, 2009; Lin et al., 2013). To Shott (1996, pp. 269–271), utility was the work that can be performed, the time that a tool can be used, or the return to effort in use of the tool. "Maximum utility" is the most work or return that a tool can deliver, "realized utility" the actual work or return that is less than or equal to the maximum. Work performed can be measured in strokes, uses, amount of material worked. Return can be measured in kCal or gross weight of food or the value of transformed materials. Accordingly, maximum or realized utility can be expressed on many scales or in many currencies. To reduce this variation to a common scale, Elston (1992, pg. 40) defined "use life utility," arguing that the longer tools could be used (and the more work they could perform) for any given size (Elston used tool mass to estimate these quantities), the more utility they possessed. By extension, the longer that any tool was used relative to the maximum amount of work performed, measures the tool's curation rate.

In retouched stone tools, utility is extracted as tools are used and resharpened. Thus, following Elston's logic Shott described "maximum utility in stone tools as the amount of usable material found on the tool at the start of its use, and realized utility as the amount removed following episodes of use" (1996, pg. 270), and Kuhn (1994, pg. 429) described "potential utility" essentially as the amount or length of usable working edge (and, by extension, work accomplished by that edge) that any tool could produce as a result of its design and its pattern and degree of resharpening during use. Again following Elston (1992, pp. 40–41), utility can be measured on a common scale from 0 to 1 across toolstones and tool types.

Curation originally was identified with recycling among other things, but the two should not be confused (Shott, 1996; pg. 265). Curation is a relationship between realized and maximum utility that all tools possessed in varying degree. Recycling is a process that only some tools experienced. However, curation subsumes recycling if maximum utility is considered to include not just use consistent with original design but also the potential for use in other ways, either during a tool's planned use life or at its point of depletion where realized utility equals maximum (design) utility (Shott, 1996; pg. 271). This expansion may apply to tools that clearly were recycled, for which Elston's 0–1 scale must be extended or separate scales for original use and recycling observed.

Recently, Horowitz and McCall (2013) criticized the curation concept and the indices and concept of utility that follow from it, advocating restoration of curation as a categorical state opposed to "expediency." Leaving aside the terminological and conceptual confusion spawned by curation's original formulation, which Horowitz and McCall's position would restore, their stimulating argument suggested problems in the definition of utility already mooted by defining utility as above. Also, Horowitz and McCall (2013, pg. 350) apparently believed that Johnson's (1981, pg. 13) thinning index (JTI) is or can be used to measure curation as the progressive resharpening and reduction of finished bifaces, citing Shott et al. (2007) in support. The fact that JTI did not pattern with two other unusual curation measures (e.g., Quinn et al., 2008) studied was prominent among the reasons that Horowitz and McCall cited for rejecting curation measures.

We do not read Johnson to suggest that JTI is applicable to the resharpening experienced by finished tools *in use,* instead to measure the progress of preforms from earliest production stages to completion as points (1981, pp. 13, 18, 23). That is, curation begins where JTI ends. Others' use of JTI (e.g. Beck et al., 2002) seems consistent with our understanding. Treating JTI as a curation measure for finished bifaces therefore is questionable, especially considering the conclusion of Horowitz and McCall's authority that JTI "is not a useful reduction measure" (Shott et al., 2007; pg. 210). The most accurate use of Shott et al.'s (2007) results is, as they did, to question, not legitimate, JTI as a curation measure. In this perspective, JTI's failure to correlate with other unusual reduction measures is neither surprising nor legitimate cause to question the curation concept. Otherwise, Horowitz and McCall's criticism of measures (e.g., invasiveness indices) resembled Shott (2005). Horowitz and McCall raised valid questions about the commensurability of reduction measures, which this and other studies (e.g., Shott et al., 2007; Shott, 2009; Hiscock and Tabrett, 2010) seek to engage constructively and for which methods of integration have been proposed (Shott, 2005; pg. 120), not by replacing a line of productive research with an inherently ambiguous categorical term that reproduces, not reduces, confusion.

2.1. Endscraper curation

Prehistoric hunter-gatherers in northern latitudes processed and tanned animal hides for obvious reasons. As modest, even prosaic, as they may seem today, endscrapers—flake blanks retouched usually at the distal end to form a beveled unifacial bit and used in a haft mostly in hideworking—were essential elements of the broad Paleolithic repertoire. They certainly are a common stone-tool type in North American Paleoindian assemblages (e.g., Rule and Evans, 1985; Morrow, 1997; Daniel, 1998; Lancashire, 2001; Surovell, 2009; Loebel, 2013; Seeman et al., 2013).

Endscrapers have been analyzed for their raw materials, technology of production, retouch and use, and the use-wear left on their bits, margins and faces as evidence of patterns of hafting and use, kinetics of use, and material worked. Less often are endscrapers studied for how their size and shape reveal duration of use and curation (Shott, 2009). These can be as important functional attributes of tools as the form, angle and retouch technology of their used edges, and may have evolved or otherwise varied with organizational properties of lithic technologies (Ioviţă, 2010; pg. 236). In retouched tools such as endscrapers, use life and curation partly are functions of the degree and pattern of resharpening retouch from first use to discard, whether to rejuvenate dulled edges or repair damaged ones.

Their technology of production and use suggests that Paleoindian endscrapers were hafted, often in socketed hafts (e.g., Nissen and Dittemore, 1974; Weedman, 2000; Sahle et al., 2012), and experienced considerable retouch during their use lives in working hides or for other purposes (e.g., Rule and Evans, 1985; Shott, 1995; Seeman et al., 2001, 2013), an inference that ethnoarchaeological (e.g., Weedman, 2000; Shott and Weedman, 2007; Sahle et al., 2012) and experimental (Beyries, 1993; Giner and Sacchi, 1994; Morrow, 1997; Seeman et al., 2013) research corroborate. For most endscrapers, therefore, size and shape at first use and at discard differ in pattern and degree that are directly proportional to retouch, if only indirectly to use (Daniel, 1998:66–83; Shott and Weedman, 2007; pg. 1028; Seeman et al., 2013; Goldstein, 2014). Depending upon the technology of the blanks from which tools were made and the degree and patterning of retouch that they experienced, however, endscrapers may preserve evidence at discard from which original size and perhaps shape may be inferred. This study concerns inference to curation from size and shape, partly on the logic that constraints imposed by flake-blank technology and intended shape of endscrapers preserve aspects of size and shape in reduced specimens.

3. Curation and allometry

Allometry is key to estimation of original flake size of retouched tools. By definition, the allometry that governs resharpening