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COMMENT

Units in Ceramic Analysis and the Problem of Vessel Use Life

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Abstract

Shott (2022, *American Antiquity* 87:794–815) argues that making inferences from ceramic data requires first inferring use lives of vessels—something that is difficult to do. This comment argues that the problem of differential use life becomes more tractable if the assemblage, rather than the vessel, is the unit of analysis. Aside from empirical reasons, theoretical considerations also favor the assemblage as the appropriate unit.

Resumen

Shott (2022, *American Antiquity* 87:794–815) argumenta que para hacer inferencias a partir de datos cerámicos primero es necesario inferir la vida útil de las vasijas algo que es muy difícil conseguir. En esta reseña, propongo que el problema para diferenciar vida útil puede ser mejor tratado si utilizamos la colección cerámica (o conjunto cerámico) en vez de la vasija individual como unidad de análisis. Al margen de razones empíricas, existen consideraciones teóricas que favorecen la colección o el conjunto cerámico como la unidad apropiada.

Keywords: ceramic analysis; units; use life

Palabras clave: análisis cerámico; unidades; la vida útil

In a recent article in *American Antiquity*, Shott (2022) argues that making inferences from ceramic data requires first inferring use lives of vessels, including both their means and distributions. Inferring use life is currently difficult to do, but Shott, much to his credit, takes some initial steps in framing the kind of argument that would need to be made. In the conclusions, he maintains that vessels are the "integral units of ceramic analysis" and the "fundamental units of observation and study" (Shott 2022:811). He makes this argument in opposition to the idea that sherds should be the fundamental unit of analysis. His argument against sherds is uncontestable, but he does not consider another possibility: the assemblage. In these brief comments, I argue that assemblages should be the unit of analysis, and consequently may make the problem of use life more tractable.

All scientific endeavors require definition of units: what is it that we observe and compare? It is both an empirical and a theoretical question. Empirically, units must be observable and measurable. Theoretically, they must relate to the questions being asked.

The use-life issue has two dimensions. One is the relationship between the proportion of different kinds of ceramics during the time of active use (what Orton [1993] calls a life assemblage) and the proportion of different kinds of ceramics in the archaeological deposit (a death assemblage). It is a problem about trying to reconstruct the inventory of pots in use at any one time from time-averaged deposits (often called "palimpsests" in archaeology). The problem can be illustrated by a simple example. If storage pots last on average 10 years, and cooking pots two years, then an archaeological deposit covering at least 10 years will have an overrepresentation of cooking pots by a factor of five. The second problem is tied to the duration of a deposit, the time span over which artifacts accumulated. To continue with the example, if the deposit spans less than 10 years, then the overrepresentation of cooking pots will depend on how many storage pots happen to break during that period. There could be no storage pots in the deposit. This is largely a problem of sample size, and it is well known that measures of diversity such as richness and evenness are affected by small sample size. Shott recognizes this as well when he states a provisional preference for ceramic types, such as cooking pots, with short use lives that break by chance rather than those with long half-lives, such as storage pots, that break through attrition, when making comparisons among deposits. Short-use-life vessels that break by chance are more likely to be represented over short periods. Chance versus attrition could be distinguished by the shape of use-life distributions, *if* these could be obtained.

Empirically, three possible units can be considered: sherds, vessels, and assemblages. Because vessels appear to be the unit of use (not counting such things as sherd scrapers), vessels would seem to be the logical choice for archaeological analysis. However, vessels have a distinct observational problem. They are rare (creating small sample size), often unrepresentative (those used as burial goods are more likely to survive), and expensive and destructive to obtain (often requiring extensive excavation). Because of this, sherds are the main unit of measurement, but they have several biases that make them unsuitable as comparative units. Differential breakage is the obvious one. There is an exponential relationship between the degree of vessel fragmentation and both the number and size of sherds. Differential sherd size means that some sherds carry more information than others. For example, if decoration covers only part of a vessel surface, large sherds are more apt to have decoration than small ones. Differences between assemblages may reflect nothing more than differential sherd size. Number of sherds are also affected by vessel size and durability (use life).

How can one deal with sherd bias? One way is to convert sherds into vessels. Refitting is time consuming and requires special preservation conditions (e.g., sherds confined to a burial), although, as Shott notes, computer assistance has been increasingly applied (Eslami et al. 2020). Still, this is not practical for most situations. One could also estimate the minimum number of vessels present by assigning them to "vessel lots," based on their composition. This becomes problematic if there are a large number of similar vessels or if sampling is incomplete. Shott argues that this may be less so if the assemblage is not highly fragmented, and, indeed, he considers highly fragmented assemblages to have little analytical value. Another way to deal with sherd bias is not to use unadjusted counts. Adjusting by weight/thickness ratios or surface area calculations can control for differential sherd size. Consideration of curvature and rim/body ratios can partly control for differential vessel size. Vessel equivalents can be determined by calculating the percentage of circumference represented by rims, although an adequate sample must be available.

Do some of these biases become less of a problem if the assemblage is the unit? An assemblage is defined as a group of ceramics deposited in the same place (with no necessary limit on the size of place) over some time period. The following discussion stems from my interpretation of Orton (1993), who discusses how assemblages can be compared. His question is whether or not assemblages (death assemblages) being compared each represents a valid sample from the same population (the life assemblage). The concern (in Orton's level iii analysis) is whether assemblages can be meaningfully compared in relationship to the population, not whether the initial population can be reconstructed, which he thinks is not possible. Consider first the comparison of assemblages, just among themselves, without being concerned over how they represent the original population. Sherd counts are biased only if breakage patterns among vessel types differ from assemblage to assemblage, which may be likely. Weight comparisons are biased only if the weights of different vessel types differ from assemblage to assemblage, which is less likely. Vessel equivalents are not biased. Now consider how the assemblages can relate to the parent population. Differential use life must be controlled. But if use life is similar for vessels of similar kind, which is a fairly innocuous assumption, then comparing assemblages of long durations has no bias. Use life is a function of many variables related to vessels—including use, size (as Shott points out), and durability—but many of these can be measured just as well on sherds: use wear, curvature/thickness (as proxies for size), and strength. They can be measured in assemblages without problematic vessel reconstruction. Assemblage information drawn from sherds is not inferior to vessel information. It is just different. However, use life is also related to assemblage characteristics such as vessel inventory (which might affect frequency of use) and production trade-offs. Producers usually make more than one kind of vessel, but it is likely that manufacturing constraints will not favor tailoring each vessel to its intended use. Rather, efficiency dictates manufacturing compromises. Replacement rates are therefore embedded in the functional variability of assemblages. Assemblages make even more sense as a unit for time-averaged deposits. If a time-averaged deposit reflects storage pots lasting five times longer than cooking pots, then it will have different functional characteristics than one where storage pots last 10 times longer. These comparisons are meaningful even without knowing what the exact ratios are. Even if use life is not similar for vessels of similar kind (for example, if cooking pots last longer in the parent population of one deposit than in another), this will still get reflected in the functional variability between the two assemblages (for example, cooking pots being stronger, larger, or used less often in one deposit than another). As long as one is not trying to reconstruct activities at any given time, but rather how functional characteristics change across time and space, meaningful comparisons can still be made.

Even at the assemblage scale, differential use life is a problem for short-duration sites (at the time scale of use lives). At such sites, frequencies of discarded vessels will be highly variable largely because of small sample size, making assemblages less comparable. It is possible to have a large sample size at a short-duration site if the site is large, but with a large number of ceramics being discarded, the effect of differential durations on frequencies is probably minimal. Small, short-duration sites are probably mainly of interest in regional studies, but if comparison among them is important, measurement of duration by some other means than sherd frequency might be necessary. Luminescence dating is an expensive way to do it, although it is less so with careful sampling (Lipo et al. 2005). Overdispersion of luminescence dates on ceramics is a measure of duration.

Seriation, if possible, on small assemblages, might provide another way. Shott maintains that seriation is not valid if the types seriated do not have equal half-lives, if the assemblages do not represent equal duration, or if occupation spans are considerably shorter than use lives. That occupation spans must be approximately equal has long been appreciated (Dunnell 1970). The test for that is the seriation itself. If it works (type distributions follow battleship curves), occupation spans must be approximately equal. Perhaps, the same test could apply for use life. If the seriation works, differential use life of types is not a problem. If seriation does not work, one could, through trial and error, figure out which types do work. Seriation then could be used to identify differential use life. (Something similar was done by Lipo and colleagues [1997] to identify interaction spheres, where spatial areas were reduced until the seriation worked.) Seriation, by the way, is done on the assemblage level. Assemblages are what are sequenced—the types being characteristics of assemblages. Vessels are not necessarily relevant.

Even if the assemblage makes sense as a unit on empirical grounds, does it make sense as a theoretical unit? Can it be used to answer questions of archaeological importance? Of course, the proper unit may vary with the kind of question, but in general terms, neither sherds nor vessels seem to be adequate units. I use evolutionary theory to frame my argument. Evolution involves interactors, the units on which selection (or sorting) occurs, and aggregates, the evolving unit that is made up of interactors (Hull 1980). Evolution is differential persistence of interactors within the aggregate based on traits that the interactors have. It is monitored by the change in frequency of different kinds of traits. To be an interactor requires three things (Dunnell 1995). First, there must be some means of reproduction or replication. Pottery does not reproduce, but it does get replicated through the intermediary potter. Second, an interactor must have rapid turnover in relation to conditions of selection (or sorting). Cultural transmission promotes rapid turnover. Third, it must be functionally independent. Does pottery fail here? Ceramics have no purpose beyond that of its user—no more independent than a stomach (to which, in one sense, pottery is analogous because, for many uses, it aids in digestion). But unlike a stomach, pottery is not tied to any one person. Individuals can make more than one pot and change the kinds of pots they make. More than one individual can participate in making a single pot. The people who make the pot are not necessarily the same ones who use the pot. Replicative success is independent of individual human reproduction.

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So what can serve as an interactor? Certainly not sherds. They are a depositional product. What about vessels? They certainly can be replicated. But what is it that gets transmitted? Is it the recipe for a single vessel? It could be so if each individual exclusively made and used their own pots and made a different kind of pot for each kind of use. But that is rarely the case. In addition to division of labor, which leads to trade-offs between the needs of producers and users, there are also compromises in manufacture. It is more cost effective, especially in preindustrial societies, to produce one or a few pots designed for many different uses than to produce multiple pots specifically designed for each use. What gets transmitted, then, is a recipe for a *suite* of vessels. The interactor would be the assemblage.

Use of the assemblage as the unit begs the question of how assemblages are to be bounded. The criterion for boundaries is functional integration. Spatial boundaries are widened until all parts of the manufacturing and use system can stand independently. Ceramics appear across the landscape as clusters, but actual units could be larger or smaller than individual clusters. Defining temporal boundaries is less problematic because cultural transmission occurs more or less continuously, and any arbitrary division of time of equal duration gives units suitable for measuring change. Inadequate dating prevents strict adherence to this rule, but suitable approximations are often sufficient. Boundaries can change with time or place, even for individual attributes.

These comments are mainly a thought experiment. But as a concrete example, I applied this concept of units in a study of shell-tempered pottery in Southeast Missouri (Feathers 2006), using, by the way, highly fragmented ceramics from the plow zone.

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