Advancing Archaeological Classification of Fish Hooks from Hawaiʻi: A Case Study from Nuʻalolo Kai, Kauaʻi

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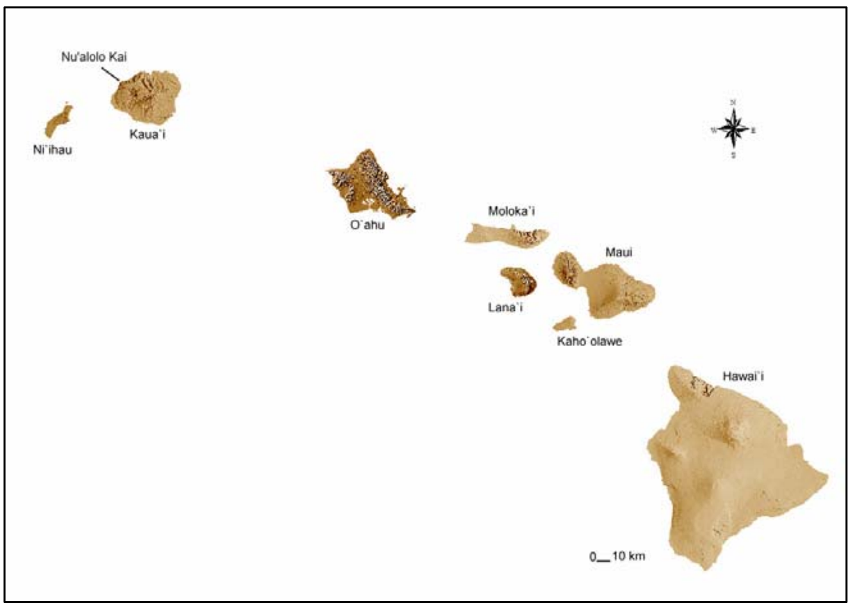
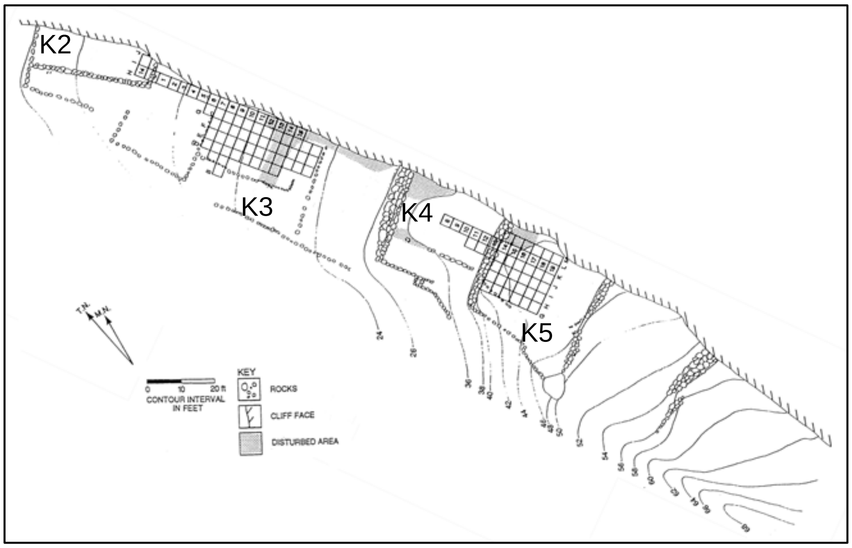
For the past decade archaeologists at the University of Hawaiʻi have been involved in a study of artifacts excavated from the site of Nuʻalolo Kai on the Nā Pali coast of Kauaʻi.

This site complex was first identified by Bennett during his archaeological survey of Kauaʻi in the 1920s. The Bishop Museum organized an expedition to the site in the late 1950s, when excavations of potentially deep and well preserved archaeological deposits held out great hope for better understanding the settlement and subsequent development of Hawaiian culture. And by all measures, Nuʻalolo Kai fits this description, with cultural deposits more than 2 meters in depth, and with an incredible variety of organic and inorganic objects preserved.



Excavations have focused mostly on the site known as K3, a habitation terrace, with smaller areas excavated in K2, a canoe shed, and K4 and K5, which are probably ancillary habitation features. Radiocarbon dates and introduced Euroamerican artifacts from the site suggest an occupation as early as the 12th or 13th centuries AD, and extending through the 19th and probably early 20th century.

Our most immediate goal on this project is to produce an inventory and limited catalog of the more than 20,000 objects that have been recovered from the Bishop Museum excavations at the site. This includes an array of materials and pieces that are not usually found in Hawaiian archaeological sites, ranging from parts of wooden images, canoe parts, gourd containers, house construction materials, matting, cordage, *kapa*, bird feathers, even a piece of Hawaiian language newspaper.

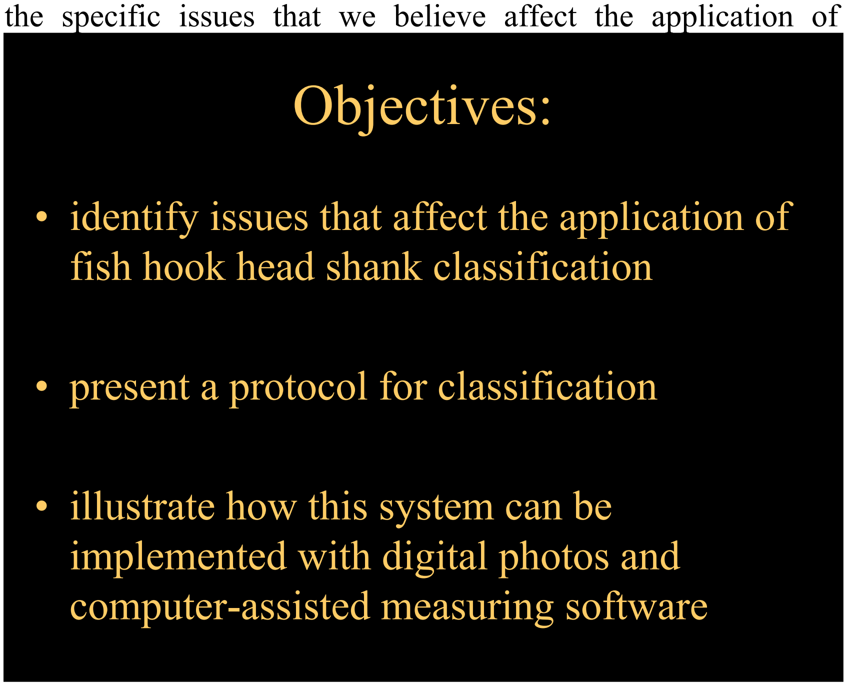


K3 was one of the early excavated sites whose fish hooks were reported on by Sinoto and Emory. In the early 1990s Jade Moniz-Nakamura and Melinda Allen re-examined the fish hooks from the site (Moniz-Nakamura et al. n.d.). Our talk today takes up where they left off.

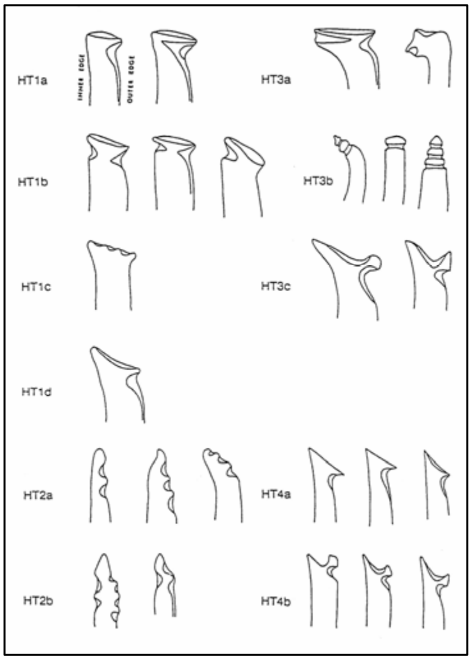
Our rationale for continuing research on fish hooks is as follows:

1. We recognize that new object scale artifact analyses can generate increased amounts or levels of information over traditional approaches.
2. For these analyses to be successful, they must be based on measures or classifications that are useful, replicable, and reliable (to a known level of accuracy and precision).
3. We also sought to develop approaches that minimize wear-and-tear on fragile materials, like fish hooks.

We have three objectives that we hope to achieve in this presentation. First, to identify the specific issues that we believe affect the application of fish hook head shank classifications in Hawai‘i; second, to develop and present a protocol for the classification and identification of fish hooks based on a paradigmatic system; and third, to illustrate how such a system can be effectively implemented using digital photography and computer-assisted measuring and positioning software.



We offer only a brief review of fish hook classification issues as many of these have been discussed previously (e.g., Allen 1992, 1996; Pfeffer 2001). Traditional systems of classification in Americanist archaeology were based largely on types, a hierarchically structured system of classification.



In Hawai‘i, Yoshi Sinoto developed such a system for the classification of fish hook head shank types. While this classification has been of great utility, it has some limitations, including unequal weighting of classes and their attributes.

Figure at left is from Sinoto (1991:98).

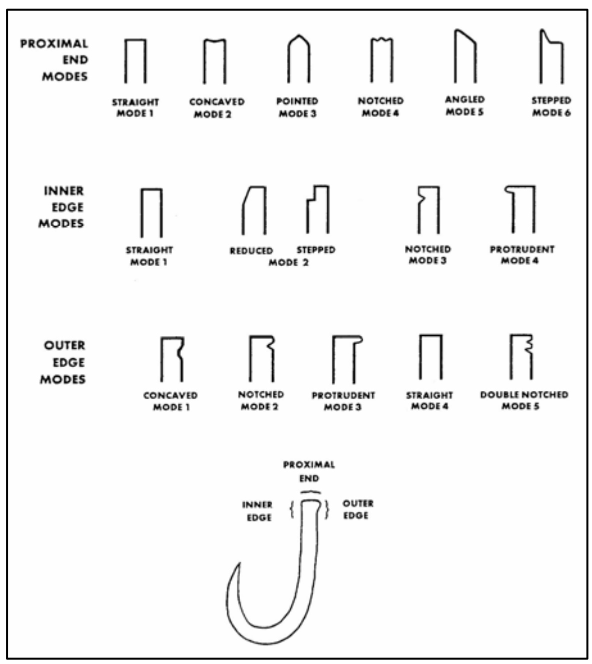
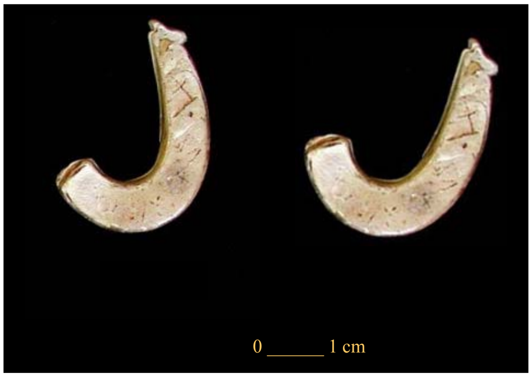
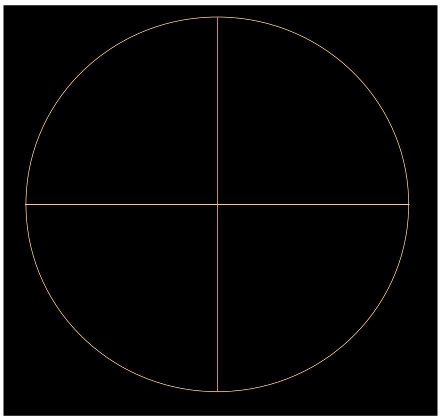


Figure above is from Moniz-Nakamura et al. (n.d.:46).

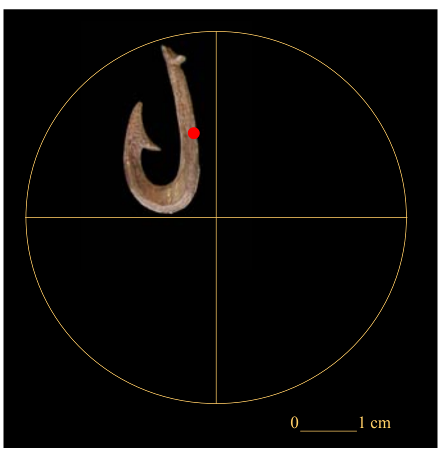
A system employing paradigmatic classification was developed by Melinda Allen (1996) for head shanks; it employs three dimensions: the top or proximal end, and the inner and outer edges. She identified several modes associated with each dimension and her classification gave no weighting of dimensions or attributes. Intersection of dimensions and attributes produces a large potential number of classes, even though many may not be represented in a given assemblage. This system of classification was applied to the one-piece Nu‘alolo Kai fish hooks by Allen and Moniz-Nakamura (Moniz-Nakamura et al. n.d.). We discovered recently that there were additional fish hooks from the collection that had not been classified, but our efforts to replicate identification of classes using Allen’s system met with only limited success. There continues to be inter-observer variation in the identification of the three dimensions. This is the result of having no clear, unambiguous definitions for what constitutes the basis for identifying these dimensions. This, in turn, is affected by how researchers have positioned the head of the shank relative to the base.



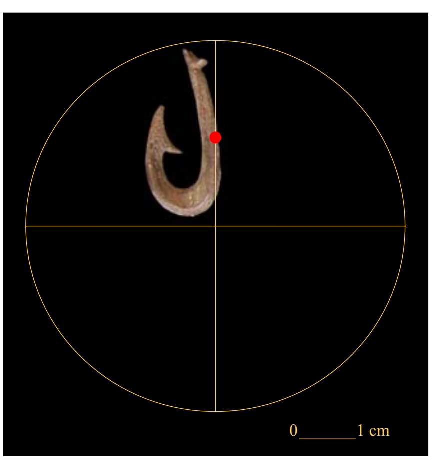
This slide illustrates how the same hook can be classified differently depending on how it is oriented. It looks like a notched hook on the left, but if it is oriented differently, such as on the right, it would be classified as a knobbed hook.



So, we have developed a protocol for studying head shanks on fish hooks that we believe reduces potential inter-observer variation. We do so by standardizing observations, in this case employing a common system of orientation to all hooks, by superimposing a circle with a right angle grid comprised by lines representing two axes of the diameter of the circle.



We then measure the length of the hook to determine its midpoint; the midpoint of this hook is indicated by the red dot.

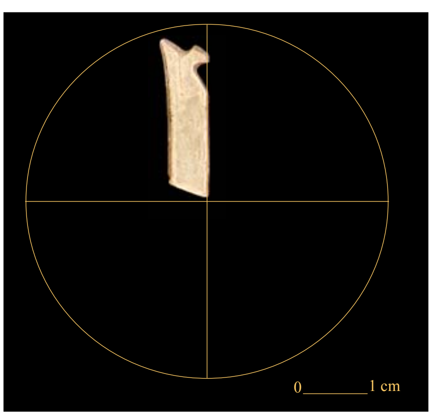


We then move the hook to align the midpoint of the outer edge with the vertical line of the grid.

Then we orient each hook shank so that the long axis of the outer edge forms a tangent at the mid-point of the shank with the vertical line of the grid.

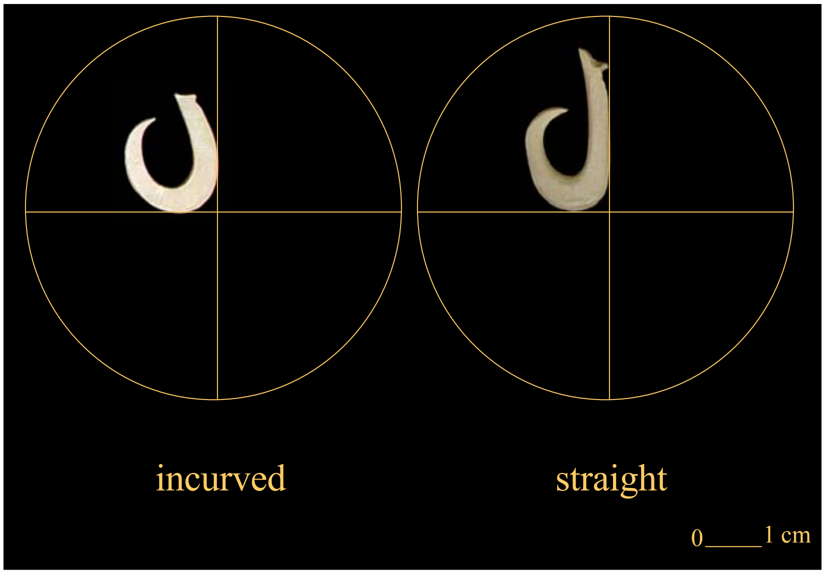
From there we slide the hook along this vertical tangent so that its base forms a tangent with the horizontal line of the grid.

What this does is give us a common standard for the orientation of all hooks; we also believe this is what archaeologists have implicitly been trying to accomplish when they classify head shanks. While this orientation of fish hooks can be done manually using a printed circle and grid along with the fish hooks, it is probably done as well using digital photograph images of fish hooks and a computer created circle and grid. One can then copy one image at a time out of a series for appropriate positioning.



For broken hooks, which we still wanted to attempt head shank classification, we simply oriented the long axis to the vertical line to form a tangent.

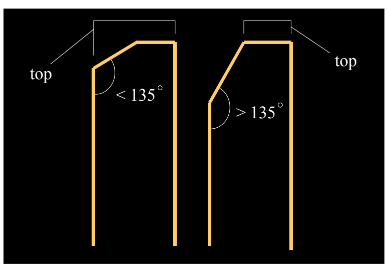
We focus on the upper shank limb and define it as the portion of the hook above the midsection.



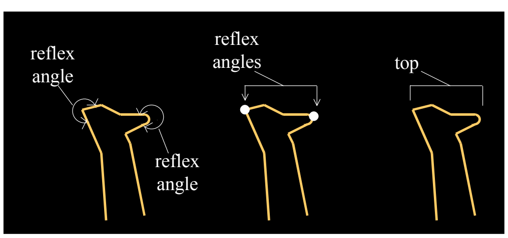
Because we had not seen it recorded before, we identified three modes for the positioning of the upper limb of the hook as straight, angled in, or angled out.

The shank head represents the area of modification on and adjacent to the top. Our protocol drew upon Allen's (1996) work to stipulate that all hook shanks for classification purposes should have three intact planes or sides in plan view: proximal end or top, and inner and outer edges.

We identified what constituted the top plane of a fish hook, and defined this dimension in two ways:



First, as a relatively horizontal plane with an interior angle of less than 135° on either end.



The second definition of the top of a hook was based on reflex angles and inflection points. For most shank heads, this is relatively unambiguous but there are some that one needs to actually apply this protocol to satisfactorily identify the top and sides, like the one shown in the figure on the right.

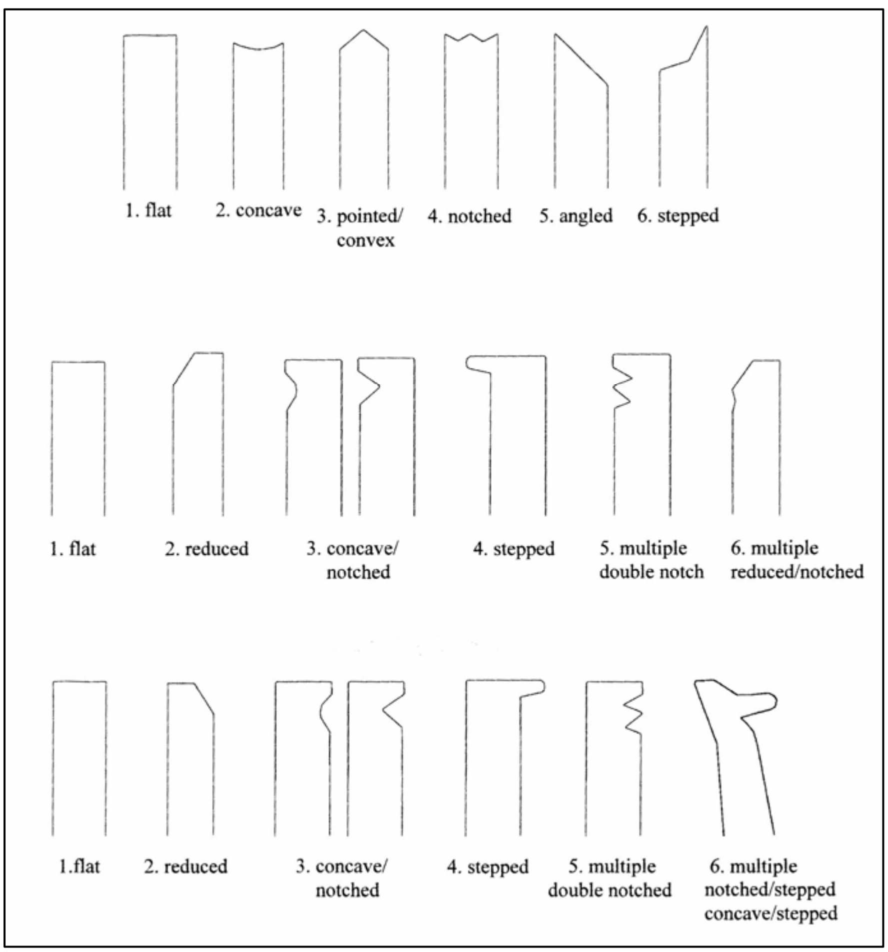
We identified the edges as the locations on the hook above the midsection that were potentially modified.

The value of this protocol and classification system was that it established where the side of a hook terminated with respect to the beginning of the top. This was an area of ambiguity with Allen's classification and identification.

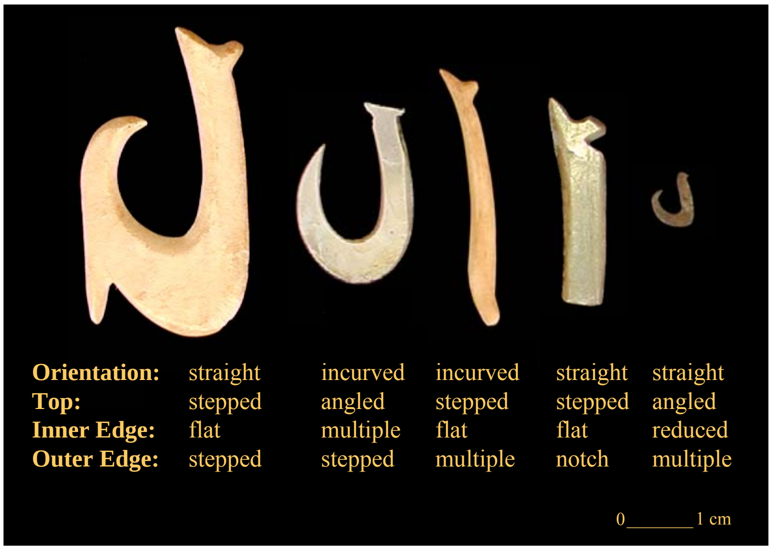
It also theoretically meant that the sides of a hook could have multiple attributes—something recognized by Allen but not fully realized. The figure on the left shows some examples of multiple attributes on the outer edge.

We defined and identified multiple modes for each of the dimensions, a total of six potential proximal end modes, six inner edge modes, and six outer edge modes (see classification at right). Again, we describe each mode, paying particular attention to differentiating sides that had been notched from those with a step, and for the top recognizing those that had been angled versus those that had an actual step.

We have now applied this system to most of the hooks that retain the upper shank limb from Nu'alolo Kai. Out of an



estimated 390 fish hooks, we have applied the classification to just under 300 of them. And as with most complex classifications we find that having both of us involved in the process of identification helps to reduce observer bias. Most of the hooks appear to be one-piece and most (but not all) were made of pearl shell. And we used digital photos almost exclusively, only handling the hooks when the photos did not illustrate the hook's characteristics sufficiently well.



This illustrates a set of hooks that we have analyzed to show how the classification can be applied to bone and shell one-piece hooks, two-piece head shanks, more or less complete and broken hooks, and hooks of different sizes.

Although our study is not complete, we can point to several patterns:

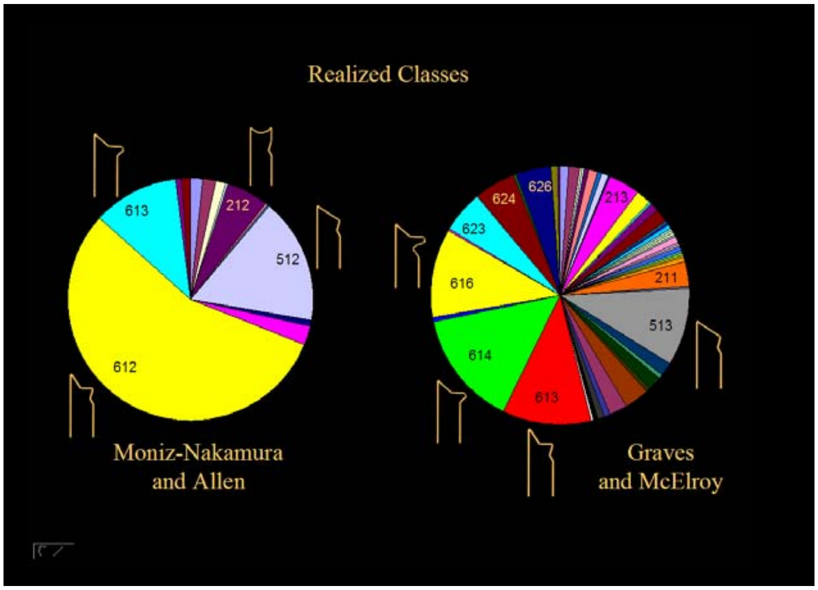
There is more variation in head shank morphology than was represented in the type system or Allen's paradigmatic system. While Sinoto (1962) found seven head types at Nuʻalolo Kai, and Moniz-Nakamura et al. identified 14 head shank classes that occurred in the assemblage, we have thus far identified more than 50 classes based on the three dimensions of top, inner edge, and outer edge.

This increase reflects two features of the current classification and its protocol. One, the different sides are now distinguished in a much clearer fashion. Before, the intersection of the outer edge with the top was ambiguous with respect to where the one left off and the other began. We have improved this distinction by orienting each hook before head shank classification begins. Second, we distinguish more modes, especially modes defined by multiple modifications. We have several examples of outer edges that have both a notch or concavity and a step.

Moreover, it is likely that this classification represents stylistic variability as this large a number of realized classes would be unlikely in a functional distribution of a single artifact group from a single site. It also mirrors the patterns witnessed in a recent study of ceramics from Fiji by Cochrane and Hunt (n.d.) and bifacially retouched Paleoindian points from North America by O'Brien and Holland (1992). In both of these cases, the study focused on the classes with at least 4 or 5 members and they have produced clade diagrams or phylogenetic trees of their assemblages. We hope to accomplish something similar with fish hooks in Hawaiʻi.

We can also compare and illustrate the overall distribution of head shank classes in the two paradigmatic systems.

In the Moniz-Nakamura et al. (n.d.) classification of 322 fish hooks, nearly 90% fall into only four classes. In fact, 56%, of the hooks in their study are represented by a single



class, and the other three most abundant classes are simple variants on this by altering either the top mode or the edge mode. Not only did we realize more classes of head shanks on the Nuʻalolo Kai fish hooks, but those classes are more evenly distributed. In our classification, the four most abundant classes contain less than 50% of the hooks. The largest class has only 15% of the total. There is overlap in some respects between the classifications; for example, hooks with stepped heads are the most abundant in every classification.

In conclusion, we think that we have devised a relatively error-free and bias-limited classification of fish hook head shanks. It can be applied to hooks that have been digitally photographed, limiting the effects of handling on these fragile objects. This classification results in greater head shank variation than has been previously recognized. This is potentially a good thing for researchers interested in accounting for artifact variability in the archaeological record. Whether this variation is stylistic or functional, or a combination of the two, we cannot conclusively say, although the sheer number of classes suggests we are tracking style.

However, by including all hooks and recording their limb orientation, material, and one or two piece manufacture, we think we have a good chance of identifying potential functional co-variation with head shank morphology. Also, since we have stratigraphic provenience data for most of these hooks, we can also examine the temporal pattern of head shank class distribution to determine if they conform to expectations of historical classes. These are the next steps in this study.

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