Spring 2019 ARCHY 483 Experimental Assemblages Report

Ashlee Breedlove

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## Introduction

The purpose of this report is to study the five assemblages that Professor Cuthbert Calculus collected from the island of Pulau-Pulau Bomba in Sondonesia. Each assemblage is an undated surface scatter, likely made during the Holocene by the same group of people. All relevant field notes were confiscated by Bordurian agents and are consequently unavailable. It is known that the forager societies found on the island were extinct when Professor Calculus collected the assemblages. We studied the artifacts in advance of a resort being built on the site.

The questions we sought to answer were: what is the variability in and between these assemblages? How can they be explained in terms of mobility and risk management? These questions are part of the longstanding debate in archaeology over what what factors drive the complexity of tools and toolboxes a culture used (Collared, Kemery & Banks, 2005)(Shott, 1986)(Parry, Kelly, 1986). In this study we sought to investigate what the assemblages collected by Professory Calculus can say about the lives of the people from Pulau-Pulau Bomba. Three predictions were tested. First,

## Methods

Measurements from the five assemblages were recorded in our spreadsheet. The assemblages varied from seven to 25 pieces each, totalling 74. There were three materials recorded. We labelled each artifact as either debitage, flake, or core. Each of our team members took turns measuring and recording the data. Generally, Ashlee measured artifacts, Megan inputted, and Alec made the input more correct by creating drop-down menus for variables that fit to reduce input error (everything except mass, width, thickness, dorsal number). We followed best practices as laid out in this article (Broman & Woo, 2018).

Overall we recorded the following variables: artifact type, mass, platform type, platform thickness, platform width, dorsal scar number, dorsal scar pattern, material, and the 16 numbers needed to calculate index of invasiveness. These were chosen based on an analysis of what measurements are worth taking (Scerri, Gravina, Blinkhorn, & Delagnes, 2015). According to the authors, weight, number of scars, platform width and thickness, platform type, and dorsal scar pattern all give meaningful results. In addition, we chose Index of Invasiveness to measure retouch since some of our retouched pieces were very small (Clarkson, 2002). The measurements were decided to take were also quick, due to our limited time.

These variables us answer the questions of how the assemblage reflects the lifestyles of the people who created them because

## Results

Open with 1 or 2 sentence(s) describing just the one or two most striking findings of your work. Use the words ‘striking findings’ or similar

The text must emphasize the most important observations and present them in order of decreasing interest, beginning with the main finding, for each method. You must describe obvious similarities and contrasts in the data. If there are none, say so.

Charts are used to summarise and visualize contrasts and similarities in your data and they are immediate (quick to interpret), intraocular (hit the reader between the eyes) and inescapable (the trend is obvious). Describe in your text the similarities and differences, the highest and lowest, the most diverse and least diverse, that kind of thing

Your text must not state the result of every variable that you measured because that is very boring for the reader. Show that you have made a thoughtful choice of the variables to investigate and discuss

Note that I have set every chunk below here to eval = FALSE. This means that you can knit this Rmd but no code will be run. When you want to knit and have some code run, delete eval = FALSE from the chunk that you want to run. The purpose of this is to allow you to test your work as you go by knitting. If the knitting succeeds, then all your code so far is working!

library(tidyverse)  
library(cowplot)  
library(ggbeeswarm)  
  
# read the data --------------------  
data <- readxl::read\_excel("raw\_data.xlsx")

#TIDY DATA

#fix character NA in numerical values  
# calculate index of invasiveness   
  
data <-   
data %>%  
 mutate(dorsal\_scar\_pattern = ifelse(dorsal\_scar\_pattern == "subcentripital",   
 "subcentripetal",   
 dorsal\_scar\_pattern)) %>%  
 mutate(platform\_width = ifelse(platform\_width == "NA", NA\_integer\_, platform\_width)) %>%  
 mutate(platform\_thickness = ifelse(platform\_thickness == "NA", NA\_integer\_,   
 platform\_width)) %>%  
 mutate(ioi\_d1 = ifelse(ioi\_d1 == "NA", 0, ioi\_d1)) %>%  
 mutate(ioi\_d2 = ifelse(ioi\_d2 == "NA", 0, ioi\_d2)) %>%  
 mutate(ioi\_d3 = ifelse(ioi\_d3 == "NA", 0, ioi\_d3)) %>%  
 mutate(ioi\_d4 = ifelse(ioi\_d4 == "NA", 0, ioi\_d4)) %>%  
 mutate(ioi\_d5 = ifelse(ioi\_d5 == "NA", 0, ioi\_d5)) %>%  
 mutate(ioi\_d6 = ifelse(ioi\_d6 == "NA", 0, ioi\_d6)) %>%  
 mutate(ioi\_d7 = ifelse(ioi\_d7 == "NA", 0, ioi\_d7)) %>%  
 mutate(ioi\_d8 = ifelse(ioi\_d8 == "NA", 0, ioi\_d8)) %>%  
 mutate(ioi\_v1 = ifelse(ioi\_v1 == "NA", 0, ioi\_v1)) %>%  
 mutate(ioi\_v2 = ifelse(ioi\_v2 == "NA", 0, ioi\_v2)) %>%  
 mutate(ioi\_v3 = ifelse(ioi\_v3 == "NA", 0, ioi\_v3)) %>%  
 mutate(ioi\_v4 = ifelse(ioi\_v4 == "NA", 0, ioi\_v4)) %>%  
 mutate(ioi\_v5 = ifelse(ioi\_v5 == "NA", 0, ioi\_v5)) %>%  
 mutate(ioi\_v6 = ifelse(ioi\_v6 == "NA", 0, ioi\_v6)) %>%  
 mutate(ioi\_v7 = ifelse(ioi\_v7 == "NA", 0, ioi\_v7)) %>%  
 mutate(ioi\_v8 = ifelse(ioi\_v8 == "NA", 0, ioi\_v8)) %>%  
 mutate(dorsal\_scar\_no = ifelse(dorsal\_scar\_no == "NA", 0, dorsal\_scar\_no))

### Flakes

# plot artefact types per assemblage  
# tally up the artefact types per assemblage  
data\_artifact\_type\_tally <-   
 data %>%   
 group\_by(assemblage\_no, artifact\_type) %>%   
 tally %>%   
 filter(!is.na(artifact\_type),  
 !is.na(assemblage\_no))  
  
# tally up the raw material types per assemblage  
data\_raw\_material\_type\_tally <-   
 data %>%   
 group\_by(assemblage\_no, raw\_material) %>%   
 tally %>%   
 filter(!is.na(raw\_material),  
 !is.na(assemblage\_no))

# plot artefact types per assemblage  
 ggplot(data\_artifact\_type\_tally,  
 aes(assemblage\_no,   
 n,   
 fill = artifact\_type)) +   
 geom\_col() +  
 labs(x = "Assemblage",  
 y = "Number of artffacts",  
 fill = "Artffact type") +  
 theme\_minimal(base\_size = 12) +  
 scale\_fill\_viridis\_d()

# subset complete flakes only for next metric and technological analysis  
cf <- data %>%   
 filter(artifact\_type == "cf") %>%   
 mutate(assemblage\_no = as.factor(assemblage\_no))

# scatterplot of three variables  
ggplot(cf,  
 aes(Length\_mm,   
 Width\_mm,   
 size = Thickness\_mm,   
 colour = assemblage)) +  
 geom\_point() +  
 labs(x = "Length (mm)",  
 y = "Width (mm)",  
 size = "Thickness (mm)") +  
 scale\_color\_viridis\_d() +  
 theme\_minimal(base\_size = 12)

# create data frame of all numeric variables except retouch  
# we need this to make a facetted plot to efficiently show   
# many variables in one plot  
cf\_numeric\_long <-   
cf %>%   
 select(assemblage\_no,   
 which(sapply(., class) == "numeric"),   
 -c(paste0("ioi\_d", 1:8),   
 paste0("ioi\_v", 1:8))) %>%   
 gather(variable,   
 value,   
 -assemblage\_no) %>%   
 filter(!is.na(value)) %>%   
 filter(!is.na(assemblage\_no)) %>%   
 mutate(assemblage\_no = as.factor(assemblage\_no))   
  
# facet plot of boxplots of metric variables   
 ggplot(cf\_numeric\_long,  
 aes(assemblage\_no,  
 value)) +  
 geom\_boxplot() +  
 geom\_quasirandom(alpha = 0.4) +  
 facet\_wrap (variable,  
 scales = "free") +  
 labs(x = "Assemblage",  
 y = "") +  
 theme\_minimal(base\_size = 12)

# plot all categorical variables on complete flakes  
   
# make a list of tallies of categorical variables  
 cf\_list\_categorical\_variables\_tally <-   
 cf %>%   
 select(which(sapply(., class) == "character"),   
 platform\_type1,   
 -artifact\_type,   
 -artifact\_no,   
 -raw\_material) %>%   
 gather(variable,   
 value,   
 -assemblage\_no) %>%   
 mutate(assemblage\_no = as.factor(assemblage\_no)) %>%   
 group\_by(assemblage\_no,   
 variable,   
 value) %>%   
 tally %>%   
 filter(!is.na(value),  
 !is.na(assemblage\_no)) %>%   
 ungroup %>%   
 group\_split(variable)   
  
# plot each variable across all assemblages   
 map(cf\_list\_categorical\_variables\_tally,  
 ~ggplot(.x, aes(assemblage,   
 n,  
 fill = value)) +  
 geom\_col() +  
 labs(x = "Assemblage",  
 y = "Number",  
 fill = .x$variable) +  
 scale\_fill\_viridis\_d() +  
 theme\_minimal(base\_size = 12)) %>%   
 plot\_grid(plotlist = .)

### Cores

# subset complete flakes only for next metric and technological analysis  
cores <- artefacts %>%   
 filter(artefact\_type == "core") %>% # you may need to change artefact\_type  
 mutate(assemblage = as.factor(assemblage)) # you may need to change assemblage

### Retouched pieces

# You don't need to change this chunk unless we tell you to update it to make it work.  
# If you recorded columns of t1, T1, t2, T2 etc., then use this chunk, if not,  
# delete it and look for the next one  
   
# we assume that the data include a set of columns like this  
# t1 T1 t2 T2 ... and we select only those columns, then  
# we divide pairs of columns to get the ratio for that zone  
   
divide\_two\_cols <- function(df){  
 col<-seq(1,ncol(df),by=2)  
 df[,col] / df[,-col]  
}  
  
giur\_ratios\_per\_zone\_long\_df <-   
artefacts %>%   
 select(matches('t\\d|T\\d'),   
 assemblage) %>%  
 group\_split(assemblage, keep = FALSE) %>%   
 map(~divide\_two\_cols(.x)) %>%   
 set\_names(unique(flakes$assemblage)) %>%   
 map\_dfr(rowMeans) %>%   
 gather(variable, value)   
  
 ggplot(giur\_ratios\_per\_zone\_long\_df,   
 aes(variable,   
 value)) +  
 geom\_boxplot() +  
 geom\_quasirandom(alpha = 0.4) +  
 labs(x = "Assemblage",  
 y = "GIUR") +  
 theme\_minimal(base\_size = 12) +  
 scale\_y\_continuous(trans='log2')

# You don't need to change this chunk unless we tell you to update it to make it work.  
# If you recorded columns of i1, i2, i3, etc. then use this chunk  
# If you recorded the GIUR, then use the chunk above. If you did neither,   
# let me know so I can help you  
  
ioi\_ratios\_per\_zone\_long\_df <-   
artefacts %>%   
 select(matches('i\\d')) %>%  
 mutate(ioi\_mean = rowMeans(.)) %>%   
 mutate(assemblage = artefacts$assemblage)   
  
 ggplot(ioi\_ratios\_per\_zone\_long\_df,   
 aes(assemblage,   
 ioi\_mean)) +  
 geom\_boxplot() +  
 geom\_quasirandom(alpha = 0.4) +  
 labs(x = "Assemblage",  
 y = "IOI") +  
 theme\_minimal(base\_size = 12) +  
 scale\_y\_continuous(trans='log2')

## Discussion

The first sentence must be an explanation of how findings link to the context of the anthropological problem stated in introduction

Offer some brief explanations of your results and ward off counter-claims. Connect your data to conceptual frameworks from readings we’ve discussed in class, and cite those readings here.

Describe suprising and unexpected results and offer an explanation for them. List the most substantial limitations to the study that you encountered. Do not go overboard with every little hiccup you encountered.

You need to have a minimum of five citations of relevant work in the Discussion section, they must be very clearly relevant to, and tied deeply into, your discussion. You must draw on papers we’ve read and discussed in our seminars. They should be papers that you want to use as an analogy, so you want to refer to the details of their interpretation and their data to make an analogy to your own data

## Conclusion

Remind the reader of your aim and the exact questions that you stated in your introduction.

State whether your predictions was supported or contradicted, and connect them to the broader anthropological issues that you mentioned in your introduction, including citations

Recommend specific further research to address unresolved and new questions that arose during your work.

## Collaboration

This report was produced in conjunction with Meghan and Alec.

## References cited

Broman, K. W., & Woo, K. H. (2018). Data Organization in Spreadsheets. The American Statistician, 72(1), 2-10.

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Parry, W. J., Kelly, R. L. (1986). Expedient Core Technology and Sedentism. In J. K. Johnson & C. A. Morrow (Eds), The Organization of Core Technology (pp. 285-304). Westview Press, Boulder.

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