Supplemental Text 3: Code for Calculating the Probability of Observed Overlap Given Models of Known Initial Overlap

First we quantitatively calculated a reasonable interval around 466 years of observed overlap. We calibrated the youngest atlatl date in the dataset (1250 ± 40 14C BP) and the oldest bow date in the dataset (1300 ± 60 14C BP). Then, we probabilistically sampled from the range of calibrated calendar years produced by each date (for the bow and atlatl date separately). We reverse-calibrated each sampled calendar date, re-calibrated those dates, then calculated “observed overlap” for 1,000 iterations. The first and third quartiles of these models ranged between 370 and 489 years of observed overlap, so our reasonable statistical interval around 466 is (370,489).

Bayes’ formula is:

$$p\left(obs\in \left(370, 489\right)\right)=\frac{p\left(obs\in \left(370,489\right)\right|True)p(True)}{\sum\_{}^{}\begin{array}{c}800\\true=0\end{array} p\left(true\right)p(true)}$$

In the following code, as the values of true range from {0, 2, *. . .*, 800}, the probability mass function of true given observed in (370,489) is mapped out. This analysis uses a discrete uniform prior for probability of true values. That is, P(true = j) = 1/401 for j = {0, 2, …, 800}.

# Code:

p\_obs\_int\_given\_true<-as.vector(rep(NA,401))

for(i in 1:401){(sum(ifelse(sims[,i]>=(370) & sims[,i]<=489,1,0))/nsims)->p\_obs\_int\_given\_true[i] }

p\_true\_given\_obs<-rep(NA,401)

p\_true<-rep(1/401,401)

p\_true\_given\_obs<-p\_obs\_int\_given\_true\*p\_true

p\_true\_given\_obs<-p\_true\_given\_obs/sum(p\_true\_given\_obs)

true<-seq(0,800,by=2)

plot(true,p\_true\_given\_obs,type="l")

true[p\_true\_given\_obs==max(p\_true\_given\_obs)]

cumulative\_probs<-p\_true\_given\_obs

for(i in 2:401){ cumulative\_probs[i]<-cumulative\_probs[(i-1)]+p\_true\_given\_obs[i]}

print(cbind(true,cumulative\_probs))