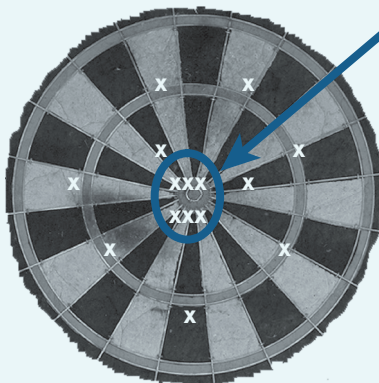


**FIGURE 7.5**

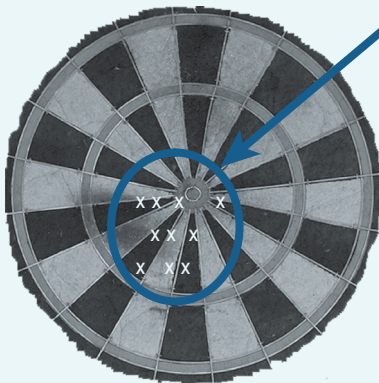
An Analogy for an Unbiased Estimator (top dartboard) and Minimum Variance (bottom dartboard)

**Unbiased Estimator**



Darts hit the bull's-eye on average—similar to how the sample variance equals the population variance on average when we divide  $SS$  by  $df$ .

**Minimum Variance**



Darts fail to hit the bull's-eye on average, but they are grouped closer together—similar to how the sample variance varies minimally from the population variance when we divide  $SS$  by  $n$ .

The bull's-eye represents the population variance, and the darts being thrown (indicated with an  $x$ ) represent a sample variance that could be selected from a given population.