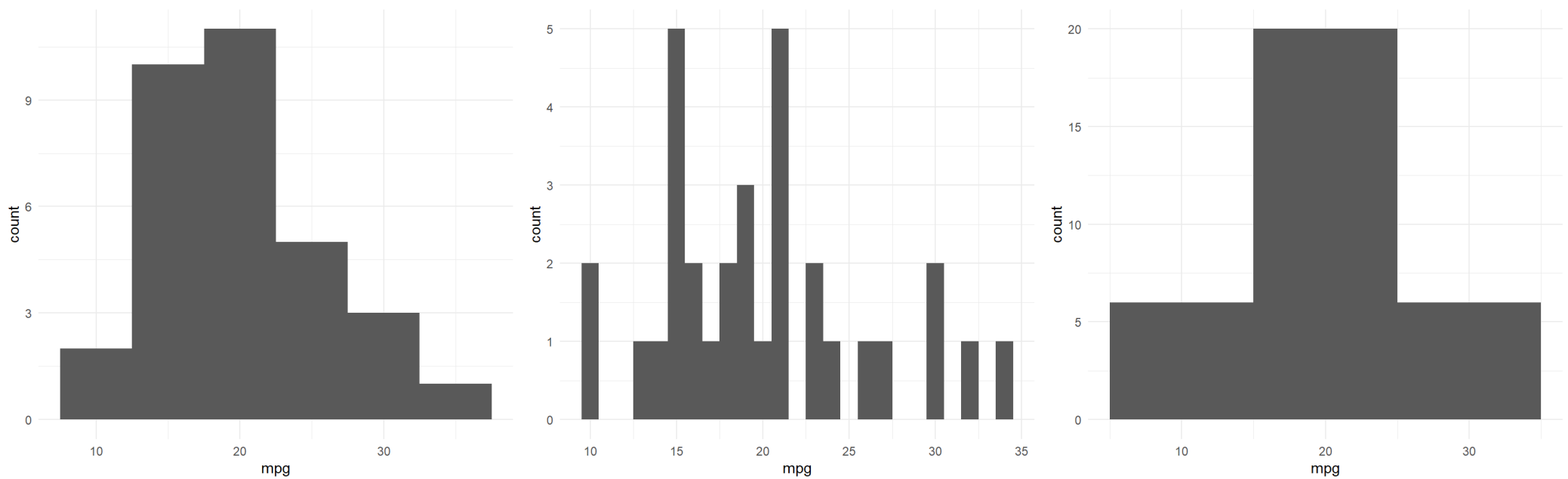
Histogram binwidth

- Binwidth has nothing to do with bandwidth in Kernel density.
- Binwidth simply controls for the size of breaks in the histogram.



$\hat{F}$-function

Empty space distances:

$$d(u, \mathbf{x}) = \min\{\|u - x_i\| : x_i \in \mathbf{x}\}$$

from a fixed location $u \in \mathbb{R}^2$ to the nearest point in a point pattern $\mathbf{x}$ is called the empty space distance or void distance.

The empty space function F:

$$\hat{F}(r) = \frac{1}{m} \sum_j \mathbf{1}\{d(u_j, \mathbf{x}) \leq r\}$$

The F-function measures the distribution of all distances from an arbitrary reference location u (random or evenly distributed) in the plane to the nearest observed event u.

$\hat{K}$-function

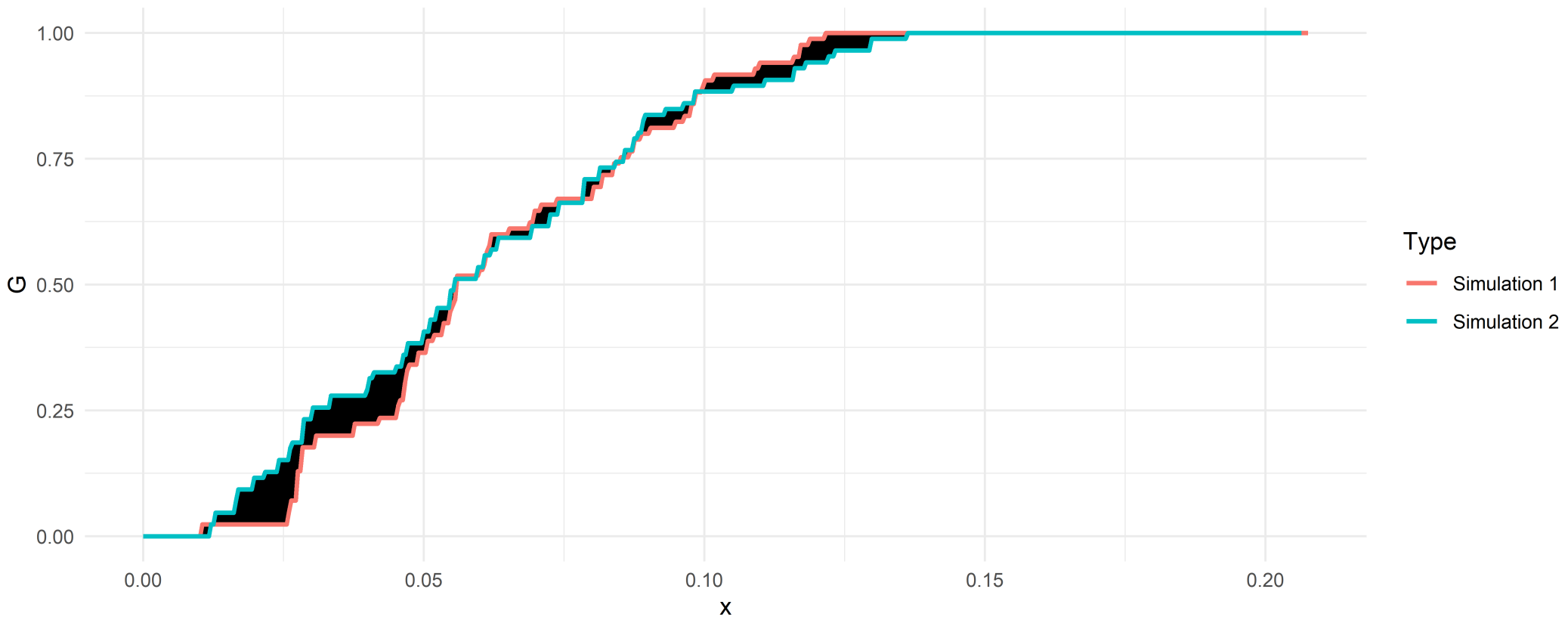
$$\hat{K}(r) = \frac{1}{\hat{\lambda}\,\mathrm{area}(W)} \sum_i \sum_{i \neq j} \mathbf{1}\{\|x_i - x_j\| \leq r\}$$

where $\hat{\lambda}$ is the estimated intensity of the point patterns.

Of the distance-based techniques that you have seen so far, $\hat{G}$ and $\hat{F}$ are often used as complements. The $\hat{K}$ is useful when exploring multi-scale patterns.

Simulation to obtain a confidence interval

Given the challenge of solving for the standard deviations of test statistics, we employ simulations to derive a confidence interval.



Activities for today

- We will work on the following chapter from the textbook:
  - Chapter 16: Activity 7: Point Pattern Analysis IV
  - Chapter 18: Activity 8: Point Pattern Analysis V
- The hard deadline is **Tuesday**, **February 10**.

Reference

- https://www.geo.fu-berlin.de/en/v/soga-r/Advances-statistics/Spatial-Point-Patterns/Analysis-of-Spatial-Point-Patterns/Interactions-in-Point-Pattern-Analysis/index.html