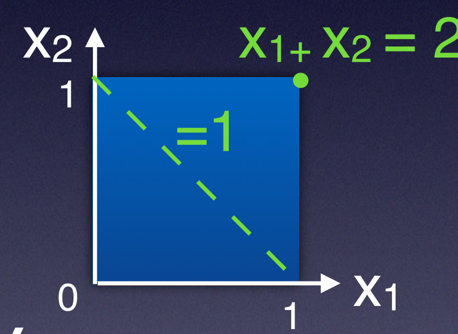
- **Why is Gaussian the most important h(x)?**
  - o Because of the Central Limit Theorem:

Given an *arbitrary* distribution $h(x)$, characterized by its location μ and scale σ, the mean of N values x_i drawn from that distribution will approximately follow a Gaussian distribution with $N(\mu,\sigma/\sqrt{N})$, with the approximation accuracy improving with N.



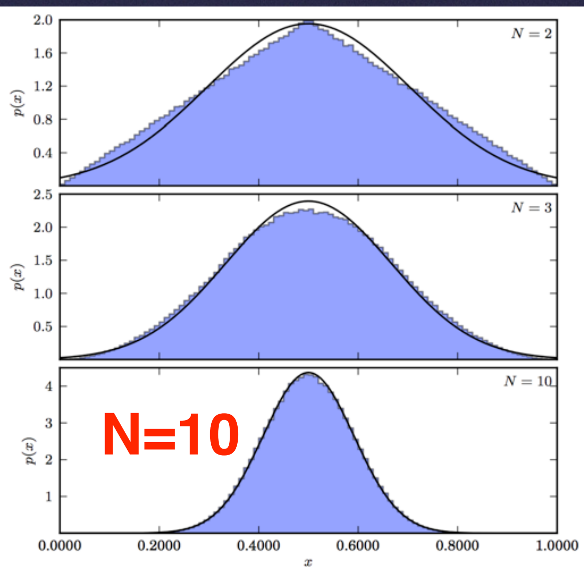


Figure 3.20.: An illustration of the central limit theorem. The histogram in each panel shows the distribution of the mean value of N random variables drawn from the $(0, 1)$ range (a uniform distribution with $\mu = 0.5$ and $W = 1$; see eq. 3.39). The distribution for $N = 2$ has a triangular shape and as N increases it becomes increasingly similar to a Gaussian, in agreement with the central limit theorem. The predicted normal distribution with $\mu = 0.5$ and $\sigma = 1/\sqrt{12N}$ is shown by the line. Already for $N = 10$, the "observed" distribution is essentially the same as the predicted distribution.

The CLT can be easily proven using standard tools from statistics, such as characteristic functions and convolutions. Here is an example of CLT in action based on a uniform distribution.