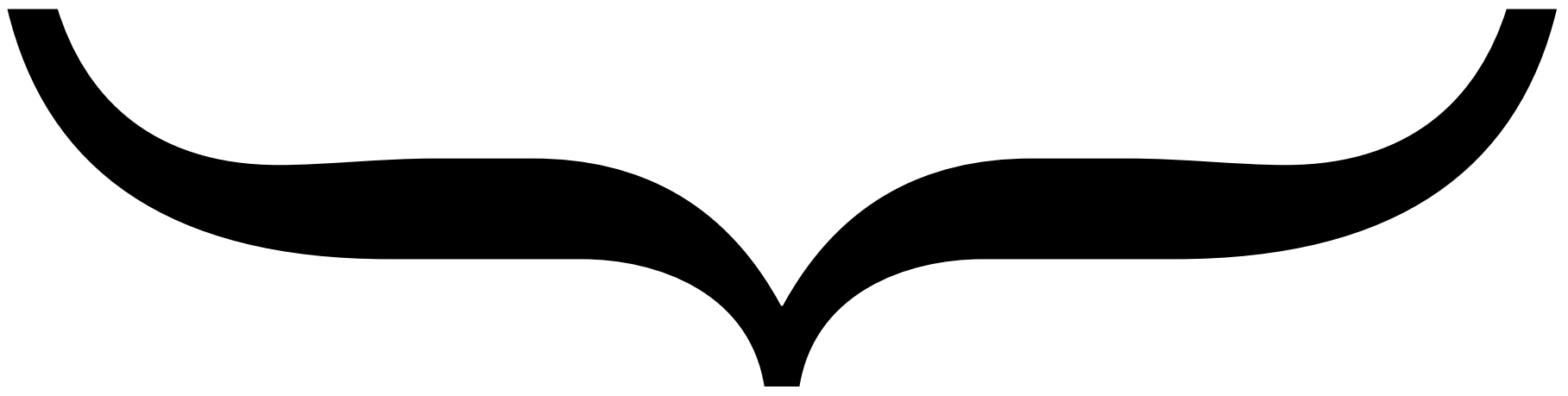
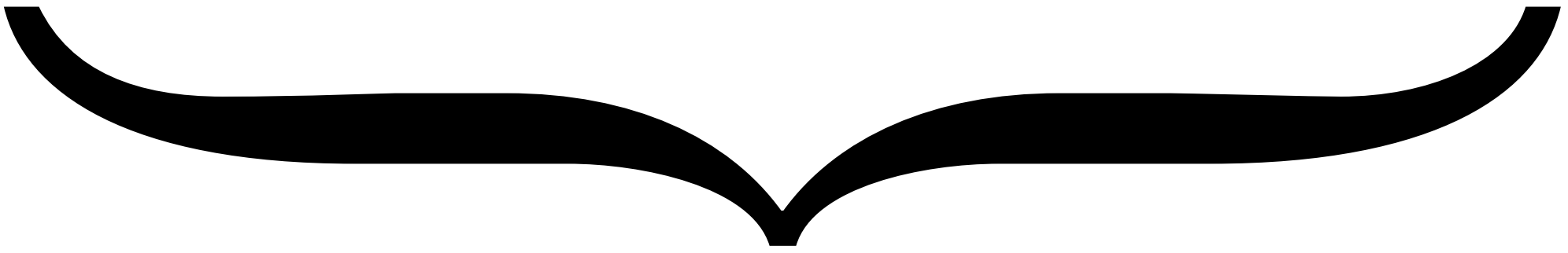
Expected **test MSE**

$$E\left(y_0 - \hat{f}(x_0)\right)^2 = \text{Var}(\hat{f}(x_0)) + \left[\text{bias}(\hat{f}(x_0))\right]^2 + \text{Var}(\epsilon)$$

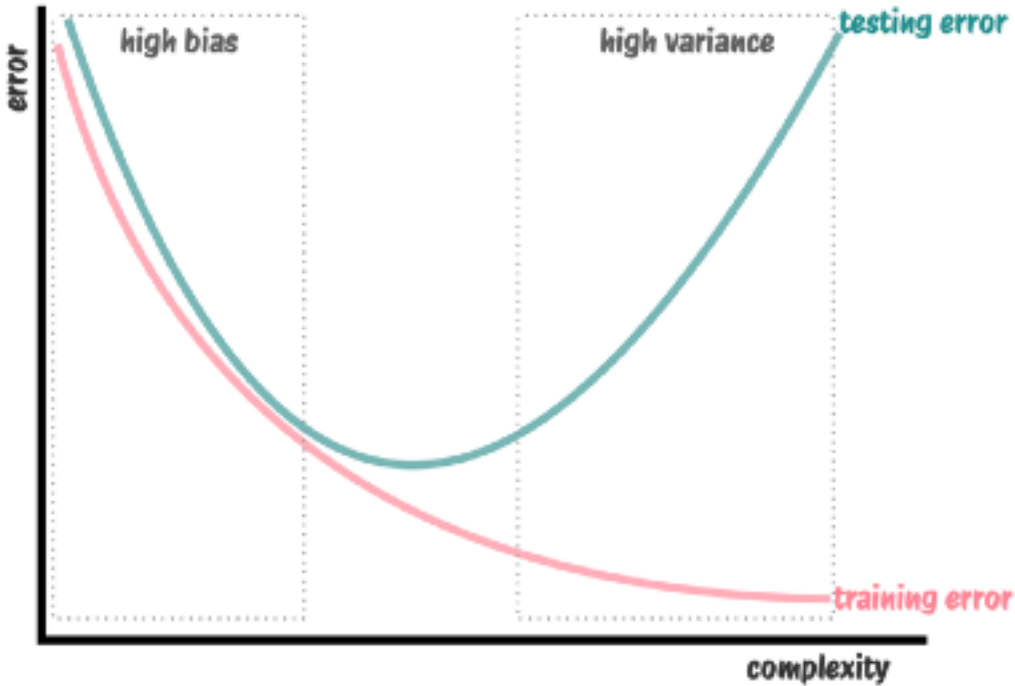


variance increases with complexity



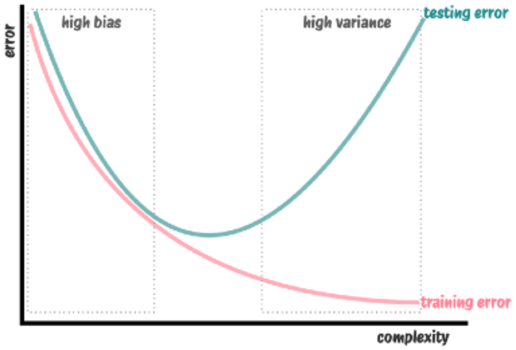
bias decreases
with complexity

Formalizing Bias Variance Trade-Off


error
high bias
high variance
testing error
training error
complexity

[try it out: https://floswald.shinyapps.io/bias_variance/]

Formalizing Bias Variance Trade-Off



Expected **test MSE**

$$E\left(y_0 - \hat{f}(x_0)\right)^2 = \underbrace{\text{Var}(\hat{f}(x_0))}_{\text{variance increases with complexity}} + \underbrace{\left[\text{bias}(\hat{f}(x_0))\right]^2}_{\text{bias decreases with complexity}} + \text{Var}(\epsilon)$$

[try it out: https://floswald.shinyapps.io/bias_variance/]

Bias Variance Trade-Off