# Plotting Predictions and Prediction Uncertainty

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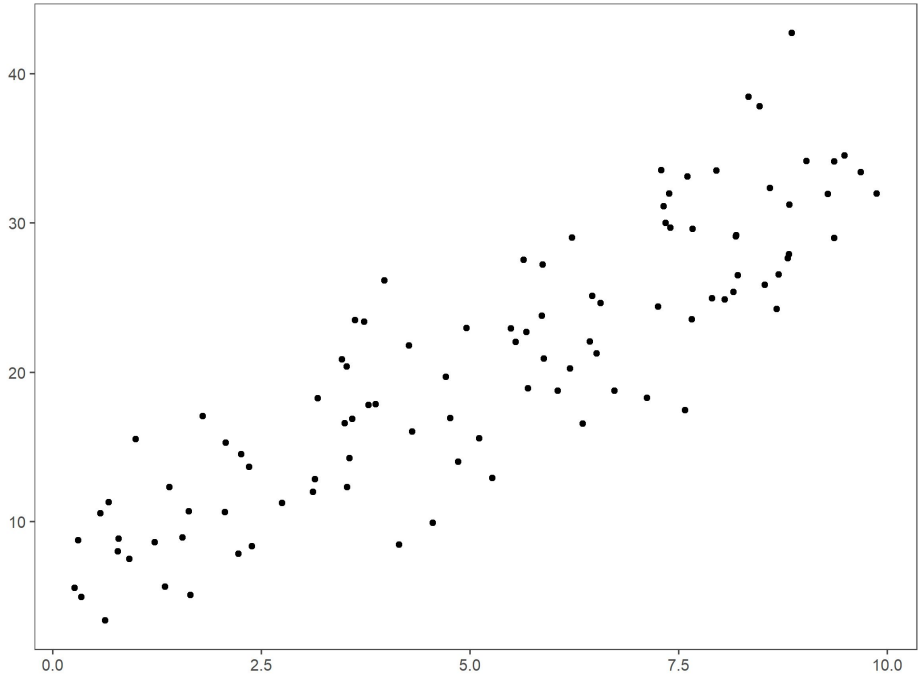
# Overview

- Most modeling in statistics is concerned with estimating the mean function and the prediction of the model
- Today: Visualization of uncertainty is often as important (or more so) than the prediction!

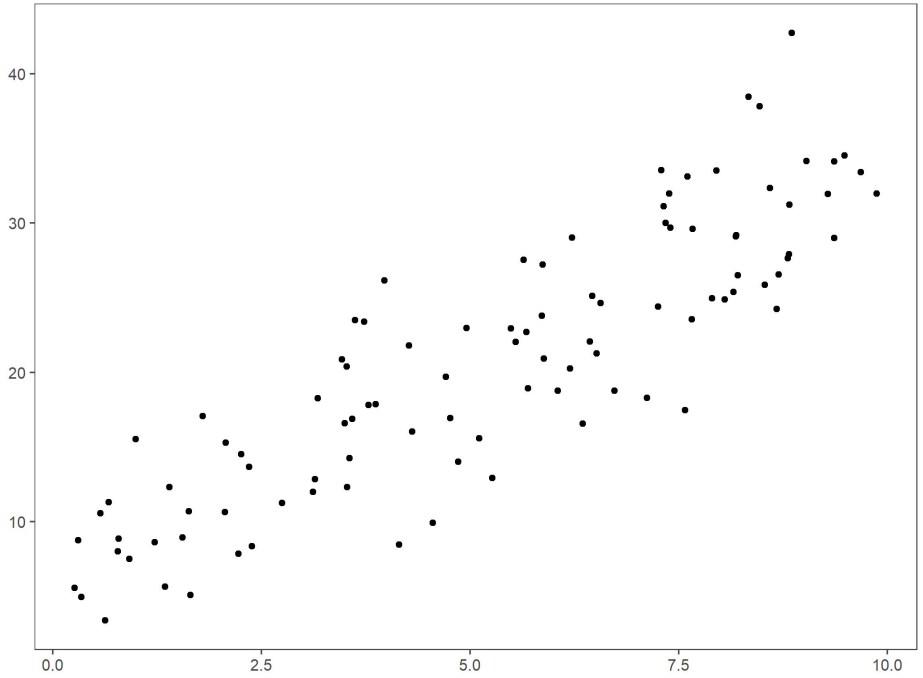
# Blindly Fitting Models

- Imagine I'm working on a project. I plotted my data and saw the scatterplot to the right



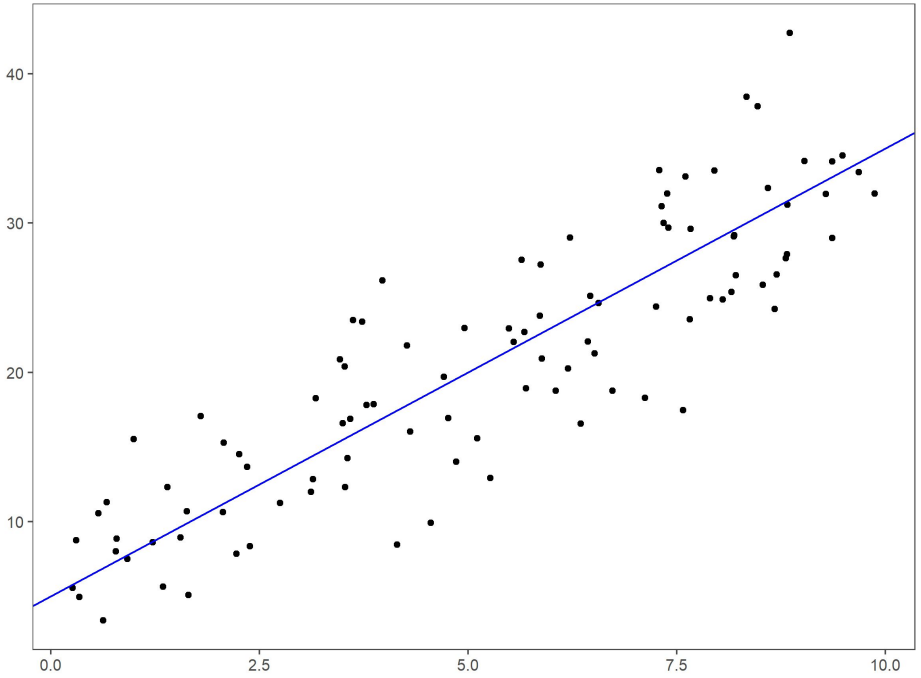
# Blindly Fitting Models

- I plotted my data and saw the scatterplot to the right
- Then my boss says, "Hmm.. a linear model seems OK. You should fit one"



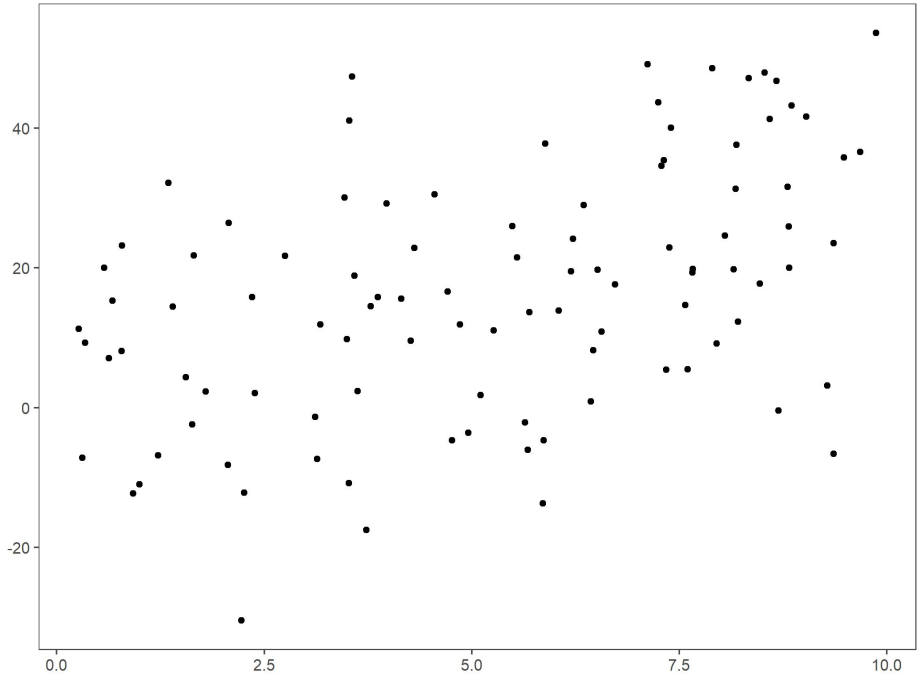
# Blindly Fitting Models

- I plotted my data and saw the scatterplot to the right
- Then my boss says, "Hmm.. a linear model seems OK. You should fit one"
- $Y = a + bx$
- $b \approx 2.97, a \approx 5.43$ !



# Blindly Fitting Models

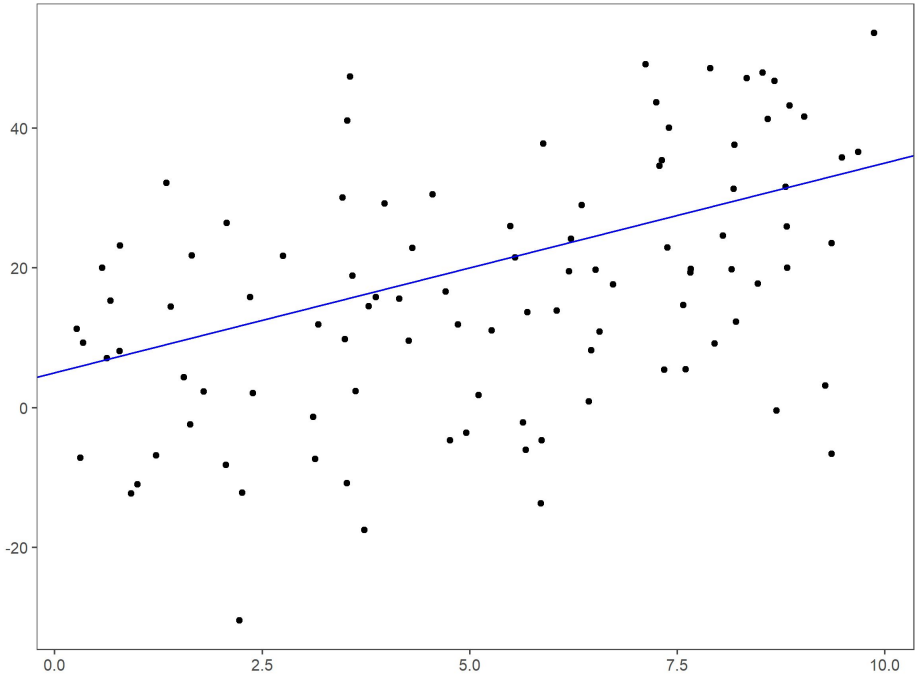
- Before I go home, I get some more data from a different sensor or data source. We plot it and get the scatterplot to the right.



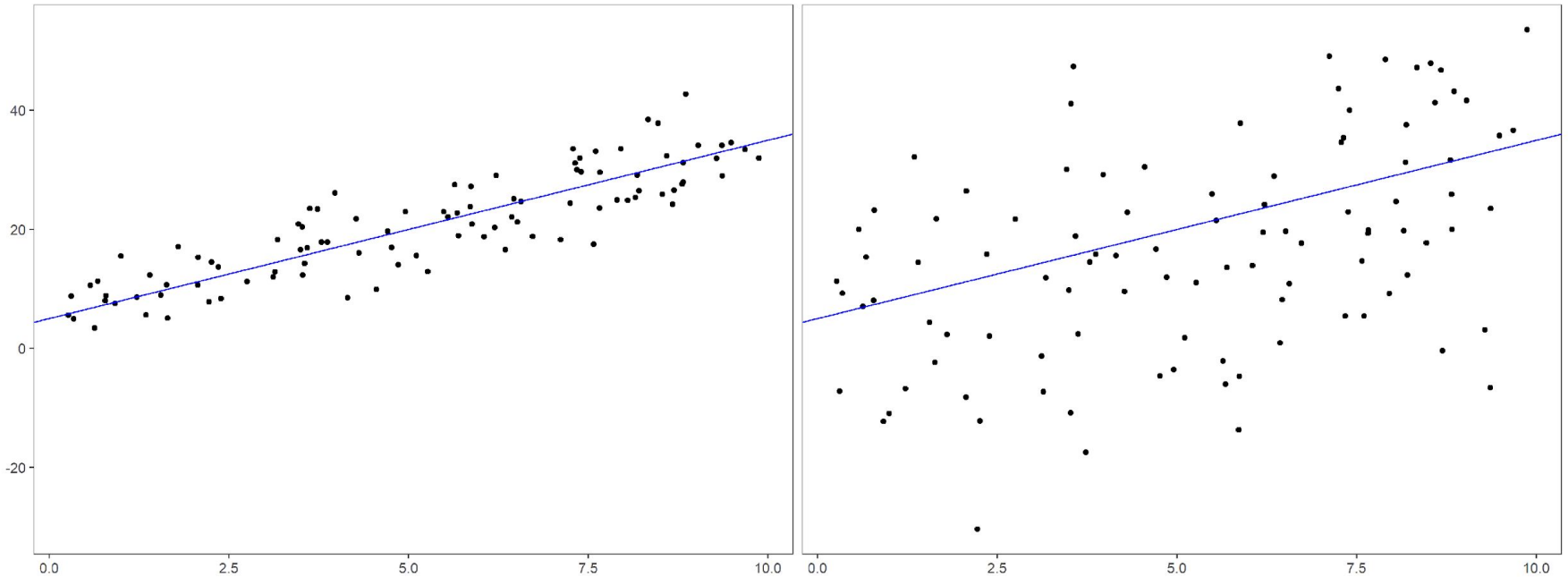
# Blindly Fitting Models

- Before I go home, I get some more data from a different sensor or data source. We plot it and get the scatterplot to the right.
- I fit the linear model again, and get the line in blue.
- $Y = a + bx$

$b \approx 2.97$ $a \approx 5.43$

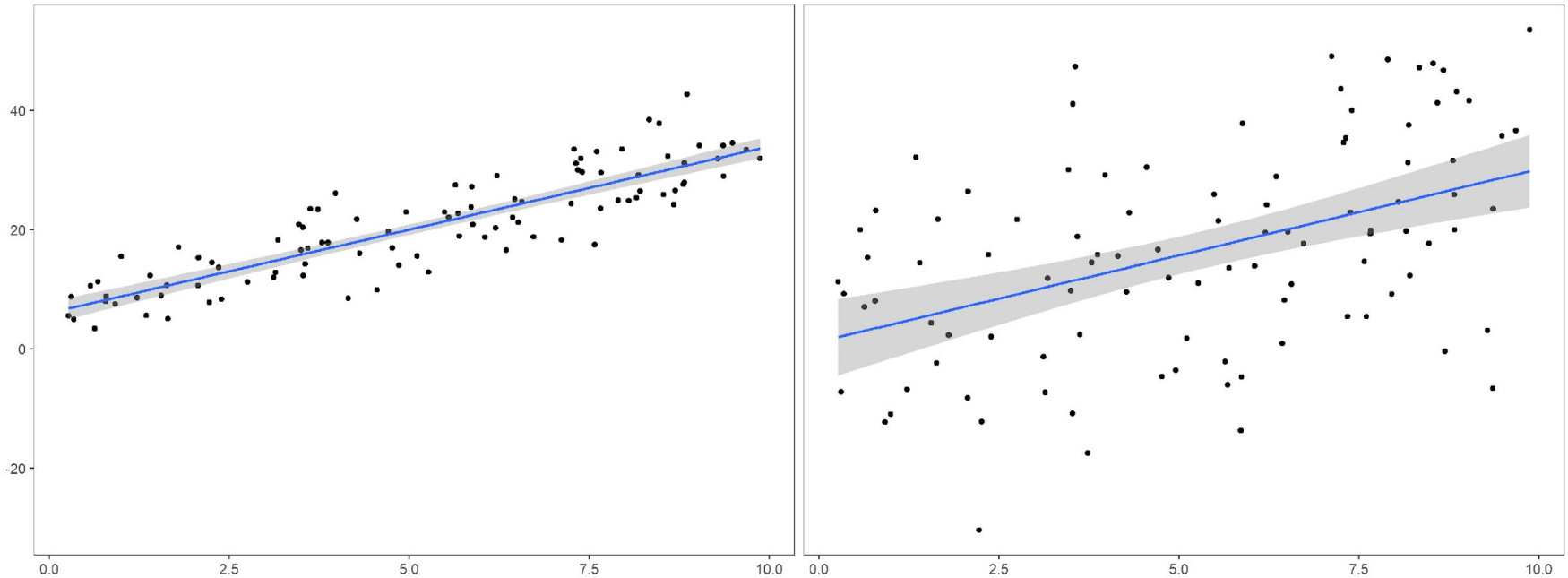


# Blindly Fitting Models




They have the same linear regression line – but widely different variances !

# Estimation Uncertainty



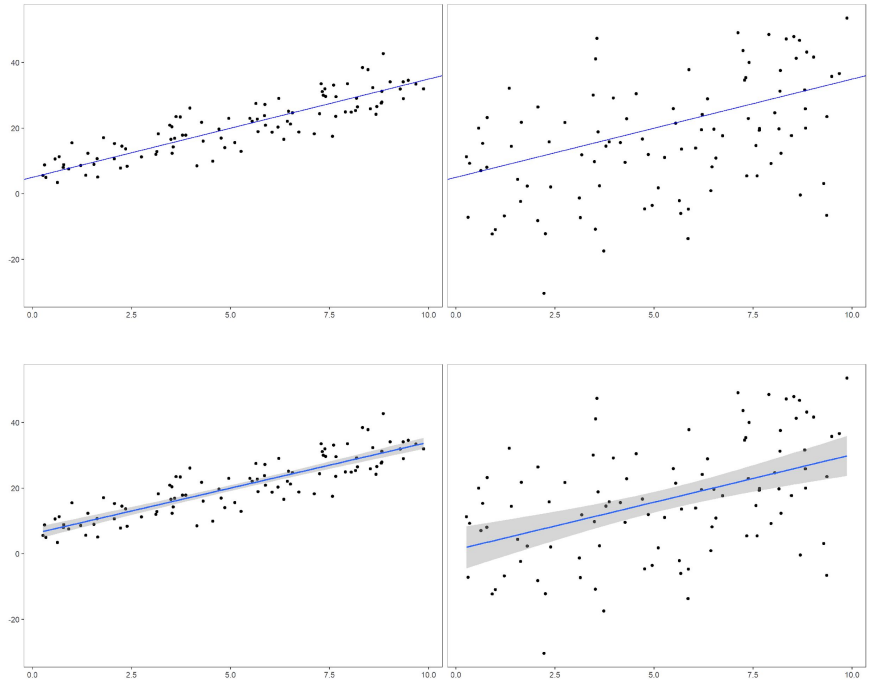

Plot your uncertainty!

# Estimation Uncertainty

- We can determine most of our uncertainty using a notion of **Standard Errors**
- **Standard Errors** provide how far we expect our estimates to deviate from the truth

| Estimate | Estimate | First Model SE | Second Model SE |
|---|---|---|---|
| a | 2.97 | 0.92 | 3.36 |
| b | 5.43 | 0.15 | 0.56 |

bigger



# Estimation Uncertainty

- If possible, plot your data and fits
- If using a model, always try to determine what the variance is on your estimates
- High variance of estimates → Caution in using estimates

| Estimate | Estimate | First Model SE | Second Model SE |
|---|---|---|---|
| a | 2.97 | 0.92 | 3.36 |
| b | 5.43 | 0.15 | 0.56 |