# Introduction to linear models

# Modern statistics are easier than this

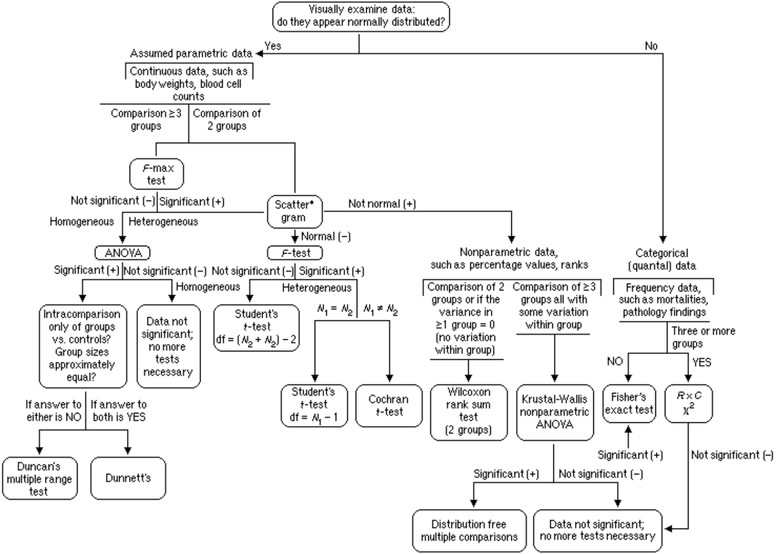
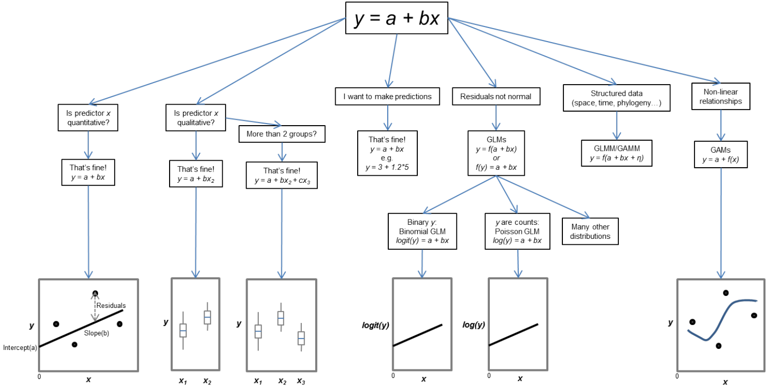


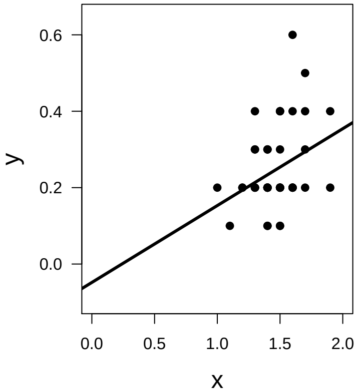

Figure 1:

# A unified framework



# Our unified regression framework

$$y_i = a + bx_i + \varepsilon_i$$
$$\varepsilon_i \sim N\left(0, \sigma^2\right)$$




**Data**

$y$ = response variable

$x$ = predictor

**Parameters**

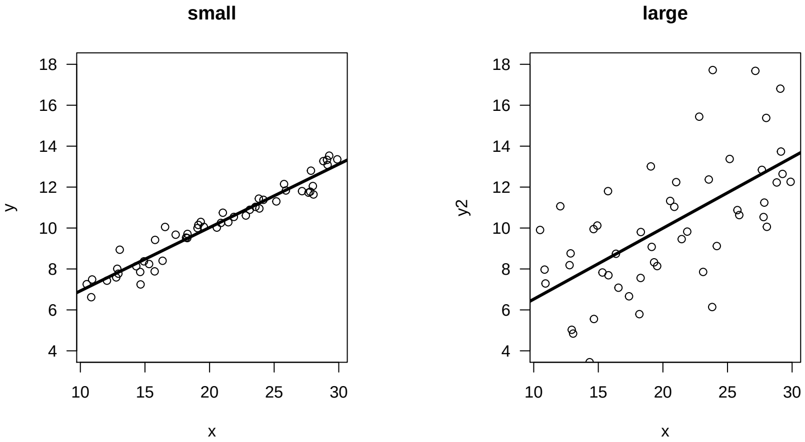
$a$ = intercept

$b$ = slope

$\sigma$ = residual variation

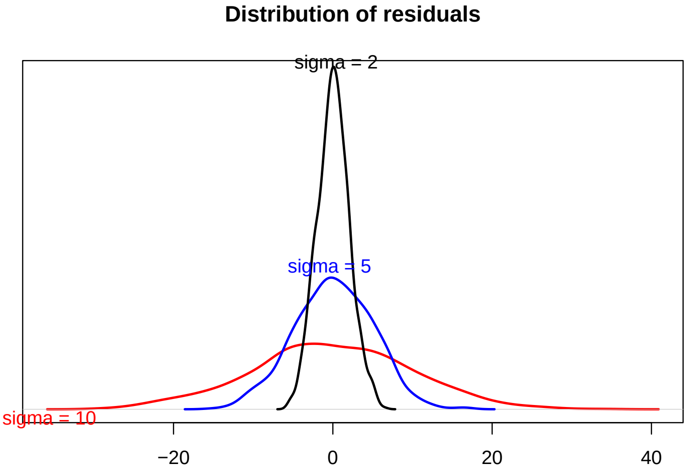
$\varepsilon$ = residuals

# Residual variation (error)



# Residual variation

$$\varepsilon_i \sim N\left(0, \sigma^2\right)$$



# In a Normal distribution

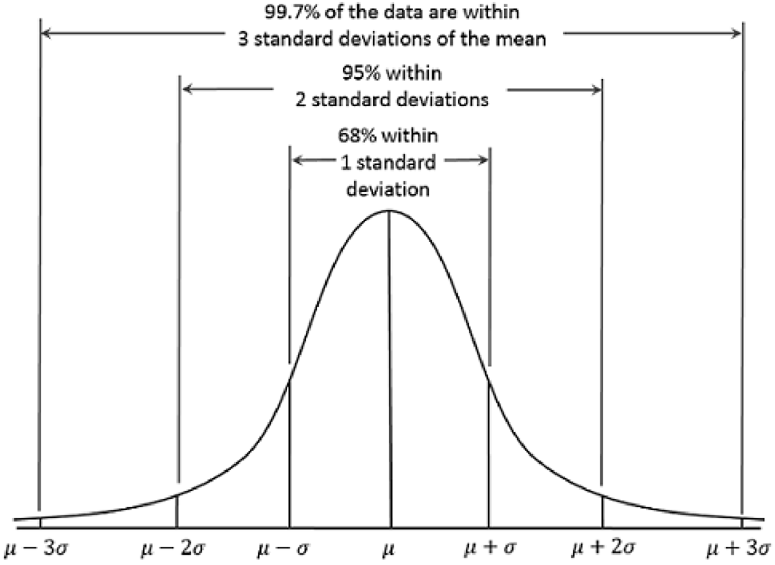



Figure 2:

# Different ways to write same model

$$
\begin{aligned}
y_i &= a + bx_i + \varepsilon_i \\
\varepsilon_i &\sim N\left(0, \sigma^2\right)
\end{aligned}
$$

.

$$
\begin{aligned}
y_i &\sim N\left(\mu_i, \sigma^2\right) \\
\mu_i &= a + bx_i \\
\varepsilon_i &\sim N\left(0, \sigma^2\right)
\end{aligned}
$$