1. Goal of Chapter 14: Test of the whole model. (Boring - we really want to test pieces of models and compare models.)

2. The “model utility” null hypothesis: there is no (linear) relationship between the explanatory and response variables (i.e., the model is not “useful” in explaining variation in the population)

3. The `birthwt` data set in the `MASS` package has data on the birth weight of children and several characteristics of their mothers.
   - `bwt`: birthweight in grams
   - `age`: age of mother
   - `lwt`: mother’s weight in pounds at last menstrual period
   - `smoke`: mother’s smoking status

   \[
   \text{bwt} \sim 1 + \text{age} + \text{lwt}
   \]

4. Test statistic: $R^2$.

5. What could the data have been if the null hypothesis were true?

   \[
   \begin{align*}
   r & \leftarrow \text{do(1000)} \ast \text{rsquared(lm(shuffle(bwt) \sim age + lwt, data = birthwt))} \\
     \text{pdata}(0.03784, \sim \text{result, data = r})
   \end{align*}
   \]

   \[
   [1] \ 0.972
   \]

6. The permutation test: if there is no relationship between the explanatory and response variables, then any value of the response could result equally from any set of the response variables.

7. Two different computer-intensive methods:
   - **bootstrap (resample)** What could the sample have looked like if we took a different sample from the same population (if the population looked like the sample we actually got)
   - **permutation (shuffle)** What could the sample have looked like if there was no relationship between the explanatory and response variables?

Chapel: Scott Cairns, poet, Festival of Faith and Writing