Example of Experimental Design

• Basic idea is to set values for one or more variables ("explanatory variables", and then measure *other* variables ("response variables")
• Values are measured on **subjects**
  – Example: 200 patients with heart problems
• **Explanatory variable** is a variable for which a value is set
  – Example: Each patient has surgery, an increased exercise program, or meditation
• Response variable: a variable for which values are measured
  – Example: level of blood flow through the heart
• **Goal:** reduce the likelihood that other unmeasured factors play a role in the response
• **Good Strategy:** randomly assign subjects to treatments
Example of Experimental Design (cont)

- **Randomization** reduces bias, or systematic favoritism
  - **Example:** every heart patient randomly assigned one of the treatments

- **Comparison** of multiple treatments provides control over possible influences
  - **Example:** Regardless of treatment, each patient subject to same blood flow analysis

- **Repetition** is important to reduce the influence of random chance
  - Each “heart therapy” is tried on 66 patients

- Failure to observe the “basic principles of statistical design” (randomization, control, and repetition) can lead to confounding factors (lurking variables).
Two common experimental design paradigms: block design and matched pairs

- **In a block design** experiment subject are grouped into blocks, and each block is treated in a similar way
  - Example: Heart disease may progress differently in men and women. Solution: first group subjects into a “male” group and a “female” group, then apply randomization.

- **A matched pairs design** compares two treatments by first matching similar subjects, and then applying one treatment to one subject and the other to the other (a variant is to apply both treatments to each subject, but in random order.)
  - Example: Group heart patients into pairs with similar age and Body-Mass-Index, then have one do the meditation treatment, the other the exercise program.