

Chapter 9: Producing Data: Experiments

Key Ideas

Basic Terminology

- **Subjects:** individuals on which the experiment is carried out.
- **Factor:** an explanatory variable in an experiment (drug, exercise, etc.)
 - **Factor level:** e.g., high dose, no exercise.
- **Treatment:** the experimental condition being studied
 - If more than one factor is under study, a treatment is a specific combination of factor levels (e.g., high dose AND moderate exercise)
- **Placebo:** a neutral treatment that simulates the idea of a treatment of interest.
- **Control group:** a group of subjects from which the treatment of interest is withheld.

Principles of Statistical Design of Experiments

1. Control of the effect of outside variables
2. Random allocation into experimental groups
3. Replication on many subjects to reduce chance variation.

Types of Experimental Design

- **Completely randomized design:** ALL experimental units are allocated at random among ALL the treatments
- **Block design:** the random assignment of units to treatments is carried out separately within each block
- **Block:** a group of experimental units or subjects that are known before the experiment to be *similar* in some way that is expected to affect the response to the treatments.

- **Matched pairs design:** special case of a blocked design in which pairs of subjects are matched as closely as possible; each block has 2 subjects.

Mechanics of Random Assignment

- Technology (e.g., Randomizer) can be used to carry out the random assignment of subjects to experimental groups.

		Randomized experiment	Observational study	Can inference to the population be drawn?
Selection of experimental units	At random	A random sample is selected from one population; units are then randomly assigned to different treatment groups	Random samples are selected from existing distinct populations.	Yes
	Not at random	A group of study units is found; units are then randomly assigned to treatment groups.	Collections of available units from distinct groups are examined.	No
Causal inference?		Yes	No	