Chapter 4

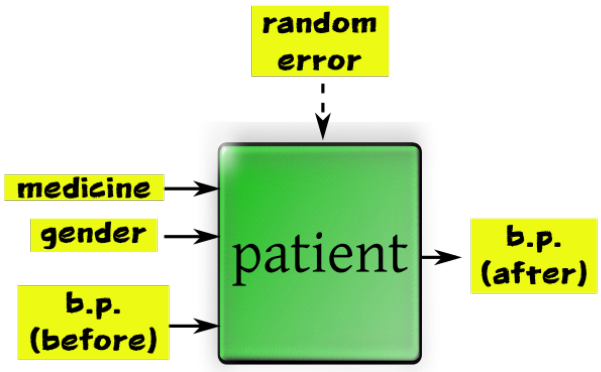
Some Important Concepts

4.2 Terminologies: Control and Treatment

Since the black box is a very useful tool that we shall encounter repeatedly, we ought to know certain terminologies concerned with it. Two such very important terms are *control* and *treatment*.

Let us try to understand them using an example.

Consider the following black box diagram.



Here, the *patient* plays the role of the system. We have a set of inputs, namely: *medicine*, *gender* and blood pressure before the taking the medication, denoted by *b.p.(before)*. The output is a diagnostic measure, which in our case is the blood pressure after taking the medication or *b.p.(after)*. The effect of any other factor has been accounted for in the *random error*.

Consider the input medicine. It is something that has been applied deliberately, i.e the medicine has been introduced in a voluntary manner according to the experimenter's wish. Such an input is called ***treatment***.

Now let us look at the input gender. This is something that is beyond our control, and cannot be voluntarily administered. Ironically enough, the accepted name for such input is ***control factor***.

These inputs are usually categorical variables or factors, but sometimes they may be continuous as well. In our example, the input *b.p.(before)* is a covariate which is beyond the control of the experimenter. In either case, the terms *treatment* and *control factor* are reserved for factors only.

We are now in a position to define *treatment* and *control factor*.

- **Treatment**: A treatment is a type of input which can be administered by the experimenter.
- **Control Factor**: A control factor is a type of input which is beyond the experimenter's control.

Sometimes, special names are given to certain situations based on the number of treatments or control factors that is taken as input. Some of them are described below.

- If the system takes *at least one treatment* as input, i.e, we must have at least one input that can be controlled by the experimenter, then we have a situation known as ***statistical experiment***.

  It gets the name "statistical" due the random error that is taken into account.

- If there are *no treatments* being taken by the system as input, i.e. there is no input that can be controlled by the experimenter, then we have a situation known as ***observational study***.

  It gets its name from the fact that we are merely observing the system interact with the inputs and have no active control over the inputs. For example, suppose we wish to study the scores of high school students who wrote their exams in either English or Hindi. Here, the input is the medium, over which we do not have any control. Hence, this is a case of observational study.