INTERVENTION EXPERIMENTS, RANDOMIZATION AND INFERENCE

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Abstract

This essay gives a discussion of processes of design and analysis of a study of the effect of two or more interventions or treatments on a set of experimental material (e.g., an agricultural area, or a set of mice, or a human). The problems of design, which includes, critically, the plan by which treatments are conjoined to experimental units, and of analysis are discussed. The author suggests that everything be based on randomization, both design and analysis by randomization tests and inversion thereof. The problem that usual conventional randomization gives bad plans is discussed and suggestion made to overcome it. Parametric models are not used, so defects in conventional parametric inference do not arise. Discussion is given on subjectivity and objectivity.

Introduction

The term *experiment* is commonly interpreted to mean a variety of activities. It can mean nothing more than observation of a piece of space-time; e.g., observing the moon by sending a moon shot. It can mean making a piece of material and measuring attributes of this piece. It can mean doing a study to attempt to determine the effects of a treatment protocol on a disease in humans. It is not entirely unusual to refer to a study estimating an attribute of a defined population such as the human population of the United States as an experiment, though most statisticians would say that such a study is a survey. Then we have the writings of theoretical statisticians that an experiment is a triple $(X, A, P(\theta))$ where X is a sample space, A is an algebra of subsets of X and $P(\theta)$ is a set of probability measures indexed by a parameter θ.

I have taken the position that there is a case for distinguishing three types of *experiment* with associated types of inference that I named sampling, observation and experimental (Kempthorne, 1979).

In the sampling problem, there is a real existent population, say, the totality of human beings of the United States. Each individual has unambiguously defined attributes, such as age, height, weight, amount of education and so on. The problem is very simple to state and to understand; namely, what is the frequency distribution of an attribute in this real population?

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