Statistical Analysis of Designed Experiments. Helge Toutenberg. Springer Verlag, P.O. Box 140201, D-14302, Berlin, Germany. 2000. Second Edition, 500 pp.

Design of experiments is one of the most widely used aspects of statistics. The subject was founded and developed single handedly by R. A. Fisher in 1920s and 30s. His book of the same title became well known among a broad spectrum of scientists. Over the last seven decades or more, the subject has gone through several molts. The current *avatar* continues to impact research in many fields of science and technology.

Prima facie, the very name of the topic seems incongruous. How can statisticians design experiments in various fields without detailed domain knowledge? The obvious answer is that they cannot. What is attempted is tackling of problems shared by many domains. The basic problem is comparison of so-called treatments. Fisher set out to find efficient ways of comparing varieties of wheat or mixtures of inorganic fertilizers (N, P, K) or agronomic practices (shallow or deep ploughing, weeding), etc. In the process, he laid down the fundamental principles of randomization, replication and local control. These were meant to ensure (a) level playing field, (b) segregation of signal from noise, and (c) elimination of hidden biases. These concerns are indeed universal in scientific experimentation. He explained various methodological issues using the example of a lady testing tea. He asked himself how he can verify the claim of a lady that adding milk to tea gives one taste while adding tea to milk gives another. This legend has inspired a whole book[1]. Fisher also devised a powerful algorithm to analyse observational data gathered from such meticulously planned experiments. This procedure better known as Analysis of Variance or ANOVA is in universal practice today.

Further developments in the area came while resolving specific difficulties encountered in practice. Incomplete block designs circumvented shortage of homogeneous experimental units (plots) and the need to compare many treatments. Split plot designs can combine treatments requiring very different plot sizes (incubator temperature common to all petri dishes versus growth medium changing from dish to dish). Factorial designs were for experiments in which treatments consisted of various 'factors' at different levels. These designs came as a big surprise to those who swore by the established convention in scientific method, that one factor be changed at a time so that any change in response can be unambiguously attributed to the single change in plan. Fisher, it seemed, devised an Indian rope trick in which all factors were changed at once and yet valid deductions were possible. Not only that, a new feature called 'interaction' that was totally missed earlier could now be identified and studied as a routine. Indian statistician Raj Chandra Bose did pioneering work in applying ideas of Galoi fields and finite geometry to construction of 'plans' for factorial designs.

An interesting aspect of history is that George E. P. Box, son-in-law of Fisher, became famous for his many contributions to design of experiments including his idea of evolutionary operation which improves a manufacturing process by trying small changes in various control parameters.

The latest name in the design pantheon is that of the Japanese engineer Taguchi who proposed very economic designs for quality enhancement in manufacturing. Earlier researches were focused on maximizing average yield of a process. Taguchi sought to identify factor combinations which reduce variability. Such experiments yield robust parameter choices that lead to uniform output in spite of variable inputs. Today search for good designs continues but with revised focus. Instead of yield or variability one may be interested in reliability of a complex system.

A typical opus on this topic generally traces this entire history and discusses construction and analysis of experiments (e.g. Wu and Hamada[2]). The book under review has a different flavour. First, it emphasizes analysis (as indicated in the title itself) rather than construction of plans. Secondly, unlike traditional books which restrict themselves to continuous response variables and develop analyses under assumption of normality, this book also describes rank methods and methods for categorical data. Problems involving repeated measures are covered in a separate chapter. Also we find good discussion of 2×2 crossover designs which are a staple in clinical trials. These are welcome inclusions. The book is essentially a 'methods' book and mathematical aspects are relegated to brief appendices. One encounters some incongruities, e.g. the section 1.5 titled 'Experimental design in biotechnology' has little to do with biotechnology. In section 3.2 one encounters results and theorems involving matrix derivatives and generalized inverses more appropriate for a theoretically oriented book. While it is not stated explicitly, the book is oriented to biomedical fields rather than agriculture or manufacturing. There are a few exercises given at the end of each chapter.

The book contains outputs from SAS, SPLUS and SPSS which can be useful for someone trying these analyses without other help. The first quarter of the book is devoted to material not strictly necessary for conventional experiments though it is useful otherwise. On the whole the book is reasonable and useful. I will recommend it to a library if its members include users of methods discussed.

1. Salsburg, D., *The Lady Testing Tea : How Statistics Revolutionized Science in the Twentieth Century*, 2001.
2. Wu, C. F. J. and Hamada, M., *Experiments, Planning, Analysis and Parameter Design Optimization*, Wiley, New York, 2000.

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Agrarian Studies: Synthetic Work at the Cutting Edge. James Scott and Nina Bhatt (eds). Oxford University Press, YMCA Building, New Delhi 110 001. 2002. pp. 310. Price: Rs 595. ISBN 019566216-4.

True to its subtitle, the volume under review represents a collection of essays that are cutting-edge in theory, perspective and understanding of issues related to different agrarian worlds. Emanating from the Program in Agrarian Studies at Yale University, these essays indicate the promise of genuine interdisciplinary studies without the pretense of fashionable

post-modernism. The volume covers an eclectic mix of essays; starting with those on agrarian history in different parts of Europe to that of issues relating to the agrarian historiography of India.

Peter Taylor's essay draws on the concept of 'cultural hegemony' to elaborate how the state ideologies of 18th century Germany matched the ideologies of family and household structures and relations. He details how familial norms and rules such as male primogeniture and inheritance rules led to the creation of a pool of men who were disinherited and therefore considered to be 'socially dead' and 'functional orphans' (p. 19). The expansive state appropriated such disconnected individuals into its own military regime and in many ways laid the basis for such marginal members to become, at a later stage, the most cruel and devout supporters of the Nazi regime. Going beyond historical data culled from various sources, Taylor draws on an analysis of even folk tales such as those collected by the Grimm brothers to indicate the cultural construction of marginal males in German society. Similar to this essay is Hermann Rebel's article on Austria which seeks to discern the social and agrarian bases of Fascism. Locating everyday life space and 'villages in larger systems' (p. 47), Rebel draws on Rene Girard's work on violence and its paradoxes to understand the 'dark events and lynching scenes' of 19th century Austria. Shifting to an understanding of agrarian issues in 18th century France is Peter Jones' essay that draws on the 'matrix events' such as the French revolution that 'destroyed the feudal regime but consolidated agrarian structures of France' (p. 74). In linking the past to the present, Jones indicates how agricultural and agrarian issues remain a key symbol even in contemporary France. In her essay, 'Imagining the Harvest in Early Modern Europe', Liana Vardi analyses paintings and some poetry of the period to indicate the shifts in the imagining and representation of rural life in the continent. She throws light on an interesting trend, when she notes that while paintings of the countryside were represented with peasants and workers in the 16th century, the 17th century saw an emphasis on the elite and the aristocracy. As with Raymod William's analyses of British poetry, Vardi indicates how the pastoral idyllic of the 17th century paintings represented not the reality (which was largely violent and brutal) but that of an ideal of a countryside that was peaceful and heartwarming.

The second set of essays focus on debates and themes from India and address a range of key issues pertinent to understanding the ecological, agrarian and peasant history of the nation. Paul Greenough challenges the 'standard environment narrative' which for South Asia consists of a narrative that idealizes the pre-modern and pre-colonial social and ecological links. Greenough provides an alternative view by highlighting the details of the faunal resources in the region and indicating the frequent violent encounters between humans and animals. David Arnold's essay draws on his earlier research on the epidemics in colonial India and argues for recognizing the extent to which the malaria resistance of tribals also enabled them, until a period, to resist political and economic encroachment on their terrain. A commentary on the use of technology and know-how indicates how DDT and the national malaria control programme then eroded this defense against intrusion and laid the basis for the increasing appropriation and exploitation of tribal resources and land. In an incisive and summative critique of Subaltern Studies, David Ludden points to the narrow perspective with which rural subcontinent has been understood and chastises the school for overlooking issues of caste and class structures, development and technological changes and focusing primarily on the expressions, languages and subordination and resistance of tribals and peasants. As the author of the seminal book on the agrarian history of South India, Ludden calls attention to the ecological, economic, social and agrarian diversities of rural India and to results of the colonial and post-colonial structures that have impacted them. Ronald Herring interrogates Karl Polanyi's thesis of the market as an agency of disruption and details how the communist party in Kerala drew on the ideology and structures of a pre-market system to re-organize the state on new political and economic structures. In what is a novel endeavour, Herring details the success of the leftist regime in Kerala to initiate the re-organization of labour and social relations which until then were mired in 'social moorings of humiliation and subordination' (p. 242). Deploying unions and ration shops as the new structures and symbols of the Left regime, the state provided, according to Herring, an alternative that catered to the collective needs of the labouring poor.

In the final essay of the volume, Herman Daly argues for recognizing the worth of nature and natural resources as capital which needs to be sustained. Arguing against the dominant paradigms of neo-liberal economics, Daly calls for a development orientation and economics which places nature at the centre of the system and in which an orientation to 'green the GNP' (p. 268) is made. The volume as a whole is enriching reading but would have been more comprehensive if essays representing trends in South America and Africa were included. One hopes the volume will be followed by others that will indicate the centrality of rural life, agrarian conditions and nature to a world which is increasingly turning urban and metropolitan.

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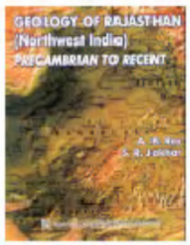

Geology of Rajasthan (Northwest India) Precambrian to Recent. A. B. Roy and S. R. Jakhar. Scientific Publishers (India), P.O. Box 91, Jodhpur. 2002. Price: Rs 1900, US $ 125.

Rajasthan is one of the most fascinating tracts in India preserving the record of about 3.5 billion years of earth's history and the book under review presents a comprehensive account of its geology. A. B. Roy and his associates have made signal contributions to the Precambrian geology of Rajasthan and the account in this book is strongly coloured by the perception of their school about various facets of the geology of this terrain.