The Vectors of Mind. By L. L. Thurstone. (The University of Chicago Science Series.) University of Chicago Press, 1935. xv+266 pp.

It has been found by psychologists attempting to "explain" the correlations resulting from a set of tests, that the original Spearman hypothesis of a single common factor is generally untenable. The natural extension of the hypothesis is that the correlations can be explained by several common factors operating linearly. During the last few years this general hypothesis has attracted the attention of several investigators, particularly Hotelling, Kelley, and Thurstone. In this book, Professor Thurstone has given a detailed exposition of methods which he has developed for handling the multiple factor problem. He has found the theory of matrices to be an effective tool for treating the problem and has included a lengthy introduction on elementary matrix theory and linear transformations required for the subsequent pages.

Expressed in its simplest form the fundamental problem is essentially that of finding a matrix F containing as many rows as traits measured, and having the least number of columns and greatest number of zero elements (subject to various restrictions) such that, except for sampling variations, $FF'=R$, where F' is the transpose of F, and R is the matrix of correlation coefficients with variances due to common factors, as diagonal elements. The first two chapters are devoted to an elaboration of the nature of this problem and its mathematical formulation. By considering each trait as a point in the common factor space, a geometrical interpretation of the factor problem is developed along with its analytical treatment. In fact, most of the definitions are written in geometrical language.

A procedure for factoring R, called the centroid method, is developed in Chapter 3. This method consists of finding the elements of F from the matrices of several sets of transformations of the common factor space, each set being a cycle of rotations, translations, and reflections, designed to locate the centroid of a corresponding "residual configuration" of trait points. A method for finding an F from the orthogonal transformation associated with the principal axes is given in Chapter 4. This method is similar to Hotelling's method of principal components. In Chapters 3 and 4 the author deals mainly with the problem of finding an F with a minimum number of columns, so that, except for sampling variations, $FF'=R$. In Chapters 6–10, he is concerned with isolating primary traits, that is, a further trimming of F by transforming to new coordinates in the common factor space in such a way as to get (ideally) a maximum number of zero elements in F. Chapter 11 is a discussion of the regression method of appraising the primary traits in each individual. The book is well equipped with applications of the method to real as well as fictitious data. Several appendices of laboratory directions are given which are extremely valuable to those interested in applying the centroid method or the method of principal axes to actual data.

The author has presented an enlightening discussion of the multiple factor problem and methods for handling it. However, as many, if not more, problems are raised than solved, which is often inevitably true of works in a new field. The author scarcely mentions the sampling aspect of the multiple factor problem, which is a matter of considerable importance in an application of the