of these theories, but will probably carry little if any meaning to the person approaching the subject for the first time.

In the second chapter the author presents a condensed summary of the matrix mechanics of Heisenberg, Born, and Jordan. The treatment is sketchy, purely analytical and stated in general terms with no illustrative problems. In a later chapter the linear oscillator and the hydrogen atom *are* worked out comparatively from both matrix and wave equation points of view. These are the only illustrative applications in the book. In the second chapter mention is also made of Dirac's $q$-number theory and Schrödinger's operators and their corresponding matrices.

Chapter III is devoted to the de Broglie waves, where the treatment, due to the compression of the material, lacks the clarity and grace of de Broglie's own papers and monographs. This is followed by chapters on Schrödinger's wave mechanics, the perturbation theory in quantum mechanics, wave mechanics and relativity (in which the five-dimensional theory of Kaluza and Klein is discussed), and finally the general transformation theory with its statistical implications. A few pages are here devoted also to the new statistics of Bose-Einstein and Fermi-Dirac.

The reader who is familiar with the details of the current theories will find much that is stimulating in this book, even though it can hardly be termed a thoroughgoing critique.

R. B. LINDSAY

*An Introduction to the Geometry of n Dimensions.* By D. M. Y. Sommerville. New York, E. P. Dutton, 1930. 196 pp.

In recent years books on some phase of $n$-dimensional geometry have appeared in all languages. In England and America, however, there seemed to be little interest in this subject before the appearance of general relativity, and the interest then was connected with Einstein. In the preface Sommerville tells us that Englishmen were among the first to write on this subject, and that the subject was entirely neglected until recently; now, however, there are signs of a revival of interest. This book is a most valuable addition to the English literature of the subject.

The aim of the author is not to write an introduction to the Einstein theory but rather to select topics which will reveal to the reader the inherent beauties and surprises of the subject. Neither has he confined himself to metric, projective, or euclidean geometry, but has used freely the ideas of all three. The book starts with the fundamental concepts of incidence, parallelism, and perpendicularity (largely synthetic). Then follows the analytic treatment in which algebraic varieties are discussed, especially the quadric. We also find Plücker coordinates introduced and neatly applied. The applications of integral calculus are also given.

The last half of the book is devoted to the study of the polytope (analogue of the polyhedron) which is treated in considerable detail. This part of the book the reviewer found most fascinating both on account of the material chosen and the elegance of the treatment. The last chapter discusses the regular polytopes.

I would not call this an elementary book and yet I believe it could profitably be placed in the hands of the young student of geometry very early in his career.

C. L. E. Moore

*Principes Géométriques d'Analyse.* By Gaston Julia. Paris, Gauthier-Villars, 1930. vi+116 pp., 35 figures.

The present volume has for its purpose the development and explanation of those geometric concepts which are employed in connection with rational, and particularly linear, transformations of a complex variable $z$, and the consequent transformations of uniform and of multiform functions of $z$.

The first chapter is concerned with circles of convergence, and is then extended to infinite regions by means of spherical stereographic projection and circular inversion, with special reference to domains including invariant points. The second chapter contains a systematic geometry of the circle, including a number of interesting particular cases. To make the treatment uniform a number of pages are employed to interpret the results in terms of non-euclidean (hyperbolic) geometry. In the third chapter these ideas are applied to $(l, m)$ correspondences. The treatment here seems to the reviewer rather too restricted; in the preceding discussion free use was made of projectivity, of fixed points—distinct or coincident—but in this one no corresponding use is made of the involutions, branch points, coincidences and neutral elements that play such an extensive role in algebraic geometry. It is true that the geometry of the circle furnishes only a limited interpretation of these ideas, but the extension to the projective field would add considerably to its interest without entailing any digression greater than that employed in the preceding chapter.

Applications of the principles already established are made to solve a large number of problems in mapping. Free use is made of the lemma of Schwartz, which the author states in the form: Given a function $f(z)$ holomorphic within the unit circle and vanishing at the origin and with modulus less than unity, then $|f(z)| \leqq |z|$. If for $|z| = 1$ the equality sign holds, then $f(z) = e^{i\theta}z$.

The last chapter is devoted to the theory of the modulus and to the mean, both linear and of order $p$, of moduli of analytic functions, extended to multiply connected regions. This part is to be further extended in a later volume.

Virgil Snyder

*Cours de Géométrie, Pure et Appliquée.* By M. d'Ocagne. Paris, Gauthier-Villars, 1930. vi+429 pp., 180 figures.

This work is a printed revision of the author's earlier mimeographed course in two volumes, designed primarily for students of the technical schools of France. It is introduced by a very rapid review of projective geometry of one to three dimensions, mostly from the analytic standpoint. This is followed by some fifty pages on differential geometry of curves and surfaces; a large number of properties are derived, almost all from the standpoint of infinitesimals, as employed by Bertrand in his treatise, but with many proofs replaced by simpler and more direct ones supplied by the author or by students who have taken the course in recent years. This part contains the essence of