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Regular polytopes, by H. S. M. Coxeter, Methuen, London, 1948; Pitman, New York, 1949, 20 + 321 pp., $10.00

The study of polytopes (that is, polygons and polyhedra of three or higher dimensions) appears to interest more different kinds of people than any other branch of mathematics with the possible exception of number theory. Its beauties inspired the rug merchant, P. S. Donchian, patiently to construct a remarkable set of models representing all varieties of polytopes. It enabled the housewife, Alicia Boole Stott, a daughter of George Boole, to capitalize on her unusual powers of geometrical visualization in spite of her meager mathematical education. It provided the struggling young lawyer, Thorold Gosset, with an amusing and constructive pastime during his long waits between clients. And equally well it has attracted the attention of many famous mathematicians such as Klein, Poincaré, Poinsot, Schläfli, Cayley, Euler, and Goursat, to mention only a few. Nor is it solely a "pure" discipline devoted to beauty but not utility, for it has been cultivated by a number of crystallographers such as Fedorov.

Coxeter has spent a major portion of his mathematical career digging out the obscure references in early works, in making personal contact with contemporary gifted amateurs, and in developing his own outstanding contributions to the field. In this book he has poured forth all his devotion and scholarship and has produced a work which will be the standard treatise in this field for many years. It is beautifully illustrated with photographs of Donchian's models and with numerous drawings. Its value as a reference book is greatly enhanced by historical material at the end of each chapter, by tables giving the essential combinatorial and metric properties of polytopes of many varieties, by an exhaustive bibliography, and by a carefully constructed index. It is a particular pleasure to record this last feature; for its omission in so many mathematical books published in England greatly detracts from their value.

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The serious mathematics begins with the third chapter in which Coxeter introduces the symmetry groups of the Platonic solids. After a full discussion of this important topic, he turns to degenerate polyhedra such as tessellations and honeycombs and their groups. These lead to results of crystallographic importance. Under the heading "The Kaleidoscope" he then describes the discrete groups generated by reflections. The exposition is greatly illuminated by his own "graphical notation" which makes complicated relations self-evident.

. . .

I have only one regret about this theory, and Coxeter should not be blamed for this. I refer to the formidable terminology, doubtless invented by mathematicians with a far better education in classical languages than myself. Dry-sounding words like "enantiomorphous" and "great stellated triacontahedron" tend to obscure the

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geometrical treasures of the subject. This is a place where a judicious use of American slang would greatly improve the situation.

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