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Glaeser, Georg

Geometry and its applications in arts, nature and technics. (Geometrie und ihre Anwendungen in Kunst, Natur und Technik.) 3rd ed.

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This is the third edition of the book (1st ed. (2005; Zbl 1159.00019), (2nd ed. 2007; Zbl 1160.00011)). The author is a professor of applied geometry and applied mathematics at the University of Applied Arts of Vienna. The books contains 2300 pictures, photos, diagrams and numerical images. Looking into them gives quite a good idea of the scope of the applications of geometry in art and technics (technique = art in its original Greek meaning). Architecture, painting, photography and music are among the arts that are discussed all along the book. Technics includes here biology, chemistry, physics, astronomy, geography, mechanics, design and construction. The photographs of living organisms and natural phenomena illustrate the place of geometry in nature. The book is addressed to a wide audience. For most parts, no special mathematical skill is required for the reading this book, although the author at some points gives rigorous proofs. The book is pleasant to read. It is divided into an introduction, 13 chapters and 2 appendices. Most of the chapters can be read separately. The introduction contains 12 practical questions whose answers are given in the book. Chapter 1, titled "An idealized world based on simple elements", contains basic material and some elements of non-Euclidean geometry and of projective geometry (polarity, duality, inversion). Chapter 2, titled "Projection and shadows", concerns projections. Chapter 3, titled "Polyhedra: multiple faced and multi-sided" is an introduction to polyhedra (Platonic and Archimedean) which the author considers as basic in any geometrical knowledge. Chapter 4 is titled "Curved but simple." It contains an introduction to curves, surfaces in 3-space and their planar sections, and in particular developable surfaces. Chapter 5 is titled "Deeper into conical sections and developable surfaces." It concerns conic sections, generatrices, and the properties of the sphere preserved by projection. Chapter 6 is titled "Prototypes." It concerns the study of surfaces of second order. The author introduces curvature and the local geometry. The torus is a fourth-order surface. Chapter 7, titled "Other remarkable surfaces", concerns surfaces defined by motion of their generatrices (spirals, helices, etc.) There is also a notion of "minimal surface." Chapter 8 is titled "The infinite variety of curved surfaces." ("free-form surfaces" is the technical English word in this domain.) Such surfaces are particularly interesting for designers and architects working with computers. One question concerns the search for surfaces passing through a certain number of points with certain boundary conditions. Bázure and B-spline curves and surfaces are introduced. Chapter 9 is titled "Photographic images and individual perception." The chapter is dedicated to the central projection which is involved in human eye-vision, as well as a camera-lens. Chapter 10 is titled "Kinematics and geometry in motion." The title is self-explanatory. The author points out several problems which can be solved using geometrical theorems. In particular, mechanical assembling problems are mentioned. Chapter 11 is titled "Motion in space." It concerns space (spherical) kinematics, transmission of motion, with the example of the motion of the earth relatively to the sun, time-equations. Chapter 12 is titled "The multiplicity of tiling motives." It concerns tilings of surfaces (periodic and non-periodic) and non-Euclidean tilings. Chapter 13 is titled "The nature of geometry and the geometry of nature." The main object os the relation between geometry and nature. The author addressees the question of whether geometry "copies" nature ot is an independent science. Appendix A is titled "A course in hand-drawing." Appendix 2 is titled "A course in photography based on geometry." Thus, the book is an excursion into history: From Antiquity (Platonic and Archimedean solids) until today (computers). Geometry is at the center of the discussion. It governs the laws of motion in space and it provides the rational and intellectual bases. However, the author does not reject the possibility of a development without geometry. Chapter 13 and the two appendices concern such issues. Appendix A is an illustration of the use of geometry as a formalization of the perception of objects and motions by man in the surrounding world. Appendix B shows how geometrical laws allow a more precise vision. Thus, in placing human activities at the center of this book, the author makes geometry a living science. *Athanase Papadopoulos (Strasbourg)*

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