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Handbook of Regular Patterns: An Introduction to Symmetry in Two Dimensions. By PETER S. STEVENS. Cambridge, Mass.: MIT Press, 1980. Pp. 400. \$37.50. ISBN 0-262-19188-1.

Patterns are made by artists and designers. Scientists find them in nature. Peter S. Stevens has shown how the pattern makers and finders are both governed by mathematical rules that describe the geometric properties of space and how it can be filled with patterns that repeat themselves. This beautiful book is really a catalog of regular pattern possibilities found in designs of ancient and modern origin and of the corresponding patterns that can be seen to occur in nature.

Any catalog must have an organizing principle, if only to make reference to its contents easy and reliable. Such organizing principles are often arbitrary, with an occasional appeal to aesthetic criteria to justify some taxonomy. Stevens has nicely finessed this issue by using the algebraic methods of group theory to classify patterns. The wary reader will not, however, have any inkling that he is involved in some very deep and beautiful parts of mathematics until he reaches an appendix where some mathematics is done for the first time in the book. Along the way, he will be shown beautiful examples from art and nature that illustrate the fundamental results of group theory which show how patterns may repeat themselves in one and two dimensions. He will find that there are only seven repeating patterns along a line and only seventeen in two-dimensional space. No more! But in that confined set of possibilities can be found much of the history of graphic design. So also can the physical world of regular patterns like crystals be described in a few classes. Even in three dimensions there are only 230 possible patterns.

Throughout this handsomely illustrated book, Stevens gives simple examples of each kind of symmetry that a pattern can exhibit. He then follows each with many fascinating examples from recent and ancient origins of patterns having the same symmetries. The examples drawn from nature follow a tradition of showing the simplicities in natural patterns. The simple patterns in nature, whether in animals, plants, or crystals, determine many basic properties. The work of artists like M. C. Escher is shown to illustrate how the supposedly arbitrary designs of graphic artists also follow the same patterns. Of course this is no coincidence, but rather reflects the very fundamental properties of how space is organized and how it can be occupied with regular patterns.

If one wants to classify regular patterns, then here is a clear description of how to assign any such pattern to a unique class. If one wants a source of interesting and beautiful examples for any such class, they are here too. Finally, if one wants to get a good intuitive feel for how the mathematics of symmetry is used, Stevens's book is a good starting point.

The readers of this journal might be interested in classification systems for patterns that can be used in archiving and retrieving them. The group-theory methods used here are of some use for that purpose, although the resulting system will not be as highly ramified as one usually expects in bibliographic taxonomies, for example. But this system has the virtue of being systematic, objective, and clear in its principles. It may also be the best that can be done with geometric patterns unless one is willing to invoke the complex algorithmic methods used with computers.

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