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Mathematics and the Arts—A Bibliography

complied by
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Despite its length, this bibliography is just a beginning. Please, dear reader, send me other items to include, so that the list will become more comprehensive and more useful. As you scan the present list you will find that some items have been annotated, and others await annotation. I will continue this process and will appreciate whatever assistance others can give to the effort.

INTRODUCTION

For many years, I have made brief mention of visual art, music, and literature in the mathematics courses that I have taught. Students have been surprised and pleased to learn of these links. At length, I decided that I wished to develop a full course on "Mathematics and the Arts." I am grateful to Bloomsburg University for a one-quarter released time to build this list of references on which a course may be based.

This collection begins with a list of items suitable for a general reader, imagined to be a college freshman who knows a bit of calculus and who enjoys mathematics and has interest in examining connections between mathematics and other arts. Selected items from this first general list may serve as texts for the "Mathematics and the Arts" course.

Following the general list, are specialized lists of references for topics listed below; these references will enable students to begin investigations for projects or term papers.

Aesthetic Standards for Mathematics and Other Arts
Biographies/Autobiographies of Mathematicians
Mathematics and Display of Information (including mapmaking)
Mathematics and Humor
Mathematics and Literature (fiction and fantasy)
Mathematics and Music
Mathematics and Poetry
Mathematics and the Visual Arts

Themes that recur again and again in these lists are: infinity, non-Euclidean geometry, ratio, repeated pattern, and symmetry.

In developing my list, I owe a debt to three others who have complied previous lists from which I have been able to learn and select. These are:

Hutchinson, Joan P., "Summertime and the living is...", AWM Newsletter, Vol 22, No. 4 (July-August 1992), 9-11

Hutchinson focuses on books in which mathematicians (especially women) play a significant role. Her list includes authors Sophia Kovalevsky (Vera Barantzova), Virginia Woolf (Night and Day), Charles Kingsley (Hypatia), Saul Bellow (The Dean's December), Rebecca Goldstein (The Mind-Body Problem), Marge Piercy (Small Changes), Lynne Sharon Schwartz (Rough Strife), Scott Turow (Presumed Innocent), Charles Baxter (First Light), Michael Crichton (Sphere), Erik Rosenthal (The Calculus of Murder and The Advanced Calculus of Murder), Robert A. Heinlein (The Number of the Beast).


Koehler features works in which mathematical ideas play a significant role in the content. Featured authors include: Jonathan Swift (A Modest Proposal), Robert Coates (The Law), Thomas Pynchon (Gravity's Rainbow), Jorge Luis
Borges (Death and the Compass, The Garden of the Forking Paths, and The Library of Babel), Lewis Carroll (What the Tortoise Said to Achilles, Alice in Wonderland and Alice Through the Looking Glass), Douglas Hofstadter (Gödel, Escher, Bach).


Lew's list contains over three hundred items that he and his father have gathered from their lifetimes of reading; some involve substantive mathematics while many are works in which a mathematical concept receives only a brief mention; he includes novels, plays, poems, science fiction tales, short stories, essays, biographies, and collections.

MATHEMATICS AND THE ARTS—GENERAL REFERENCES


This book was written to complement a BBC film series of the same name; Chapter 5, "The Music of the Spheres," deals with mathematics and harmony and symmetry.

Bronowski, Jacob, "The Imaginative Mind in Art," and "The Imaginative Mind in Science," Imagination and the University, University of Toronto Press, 1964. Also found in The Visionary Eye: Essays in the Arts, Literature and Science


An introduction to "border" and "wallpaper" patterns.

Davis, Philip J. and Reuben Hersh, The Mathematical Experience, Boston, Birkhauser, 1981.

Selections of interest in this collection of brief essays include: "The Aesthetic Component" (168-70), "Pattern, Order, and Chaos" (172-9), "Intuition" (391-9), "Four Dimensional Intuition" (400-5), "True Facts about Imaginary Objects" (406-11).


Activities for children than enable them to learn mathematics through artistic activities.


Reflections on the art of living.


Collections of mathematical stories and anecdotes by an eminent geometer and historian of mathematics.


A collection of readings that includes the works of mathematicians, letters, poems, and excerpts from plays and novels; attempts to give an historical outline of mathematical activity from ancient to modern times and to show the role that mathematics has played in culture.

Chapter 1 — "Mirrors"
Chapter 2 — "Lineland and Flatland"
Chapter 3 — "Solidland"
Chapter 5 — "Art, Music, Poetry, and Numbers"
Chapter 17 — "The Fourth Dimension"


Chapter 3 — "Aleph-null and Aleph-one,"
Chapter 4 — "Hypercubes,"
Chapter 18 — "Piet Hein's Superellipse"


Some well-written biographical remarks from an eminent mathematician.


Henderson focuses primarily on French art and artists and on Cubist ideas as she explores the effects on art (during 1900 - 1930) of the new, non-Euclidean geometries developed during the nineteenth century.


In careful detail, Hinton analyzes the changes that take place in perception as one moves from one to two and two to three dimensions, and deduces some properties of perception in a four dimensional space. Using colors to help keep things straight, he devises a model of a four-dimensional solid.


Essays by a nineteenth century mathematician who endeavored to teach everyone to see four dimensional space and who anticipated some of Einstein's discoveries.


This book is a revision of a book originally written to accompany a BBC television series written and narrated by Hughes. Although it provides few references to mathematics or science, this book documents the changes in art (primarily in painting and during the period 1880-1914) that accompanied or followed major changes in scientific thought.


Introduces the reader to many ways in which geometry underlies the creation of beautiful structures and serves as an intermediary between the harmony of the natural world and the humans who perceive it. The book grew out of a course, developed by the author, that related mathematics and design.


What is mathematics? What is beautiful? What is art? Provocative questions and answers are raised in this easy-to-read book.
by a mathematician who is also a poet.


A collection of poems, pictures and notes by the authors; sometimes thought-provoking.


First published in 1914, Manning explores the geometry of four-dimensions by taking "natural" extensions of two and three dimensional Euclidean geometry.


Geometric maps, tiling the plane, the Mobius strip, mirror reflections, and Maurits C. Escher are among the subjects of this provocative book.


These poems use mathematical concepts—zero, infinity, prime, distance, circle, and the like—to create poetic images.


Sections I and II suggests ways to visualize objects in a geometry with a different number of dimensions than three.


*HMN Journal #8*
Chapter 1 gives a short history of the various ways in which the term "infinity" is used.


**Aesthetic Standards for Mathematics and Other Arts**


The author has developed a systematic means of analysis of aesthetic properties of music, poetry, and visual arts using quantitative measures.


Aesthetic standards for poetry that may be compared with aesthetic standards for mathematics.


Explores the importance of mathematical symmetry in modern science, especially physics.


Day-Lewis describes the role and responsibility of poets and poetry; his ideas also apply to mathematicians and mathematics.


Essays on symmetry in music, visual arts, mathematics, and the sciences.


Introduces the reader to many ways in which geometry underlies the creation of beautiful structures and serves as an intermediary between the harmony of the natural world and the humans who perceive it.


Wills, David, "Which is the most beautiful?" The Mathematical Intelligencer, Vol. 10, No. 4, 30-31.


Biographies/Autobiographies of Mathematicians


A historical novel about an early mathematician.


Mathematics and Display of Information (including mapmaking)

Dickinson, Carol, "Crossroads of art and science (the art of cartographer Hal Shelton), Southwest Art, Vol. 18 (September 1988). p. 44+.


Freudenthal writes about the nature of mathematics and of mathematical thinking; Chapter 1, "Measuring the world," and Chapter 5, "The art of drawing badly," include some of the mathematical ideas used in mapmaking.


Tufte designs displays of information in ways that help readers to understand and digest it. See also "Up from Flatland" by Phil Patton in The New York Times Magazine, January 19, 1992.


Mathematics and Humor


Collections of mathematical stories and anecdotes by an eminent geometer and historian of mathematics.


Magpie is a collection of essays, rhymes, and anecdotes, many of them amusing. Fantasia also contains a number of short stories.


Leacock, Stephen, Too Much College or Education Eating Up Life, New York, Dodd, Mead and Co., 1940.

Chapter IV — "Mathematics Versus Puzzles"


"Confessions of the World's Fastest Reader" by Clifford D. Owsley, 251-253.

"The Permanent Traffic Solution" by Harland Manchester, 161-162.

"60,000,000 Projections Can't Be Wrong," by Ralph Schoenstein, 279-281.


Quotations about statistics (452-3), logic (307-8), facts (187-8), education (172-7), knowledge (280-2), problems (408-9), science (436-8), and many other topics.


HMN Journal #8
An informal introduction to nonstandard analysis; uses humor.

Mathematics and Literature (fiction and fantasy)


A fantasy about life in two dimensions that explores the dilemma that human beings have when they try to imagine a number of dimensions other than three.

Asimov, Isaac.

Several science fiction stories by Asimov that include mathematical ideas are found in the collections of Clifton Fadiman and Rudy Rucker.


A sequel to *Flatland*; a fantasy about curved space and an expanding universe.


This book serves as a supplement to the 1960 edition.

For more by Gardner on Carroll as logician and mathematician see also *Scientific American*, March 1960, pp. 172-76.


Ten amusing tales, each embodying a mathematical question; written for children.

Doyle, Sir Arthur Conan, *A Study in Scarlet* and *The Final Problem*

Doyle's Sherlock Holmes mysteries contain a little bit of mathematics and many references to logic or "the science of deduction." See particularly *A Study in Scarlet*. In *The Final Problem* one meets Professor James Moriarty, "The Napoleon of Crime," described as an embittered and ruthless mathematical genius.


*Magpie* is a collection of essays, rhymes, and anecdotes, many of them amusing. *Fantasia* also contains a number of short stories.


A collection of readings that includes the works of mathematicians, letters, poems, and excerpts from plays and novels; attempts to give an historical outline of mathematical activity from ancient to modern times and to show the role that mathematics has played in culture.


A collection of stories, poems, and essays about science (including mathematics) and scientists.


Gives information about where to find what in Sherlock Holmes mysteries.


A children's story in which a Mathemagician shows Milo the way to wonderful worlds.


A straight lines learns versatility in the effort to win the affection of a dot who is hopelessly in love with a squiggle.


Knuth, Donald, Surreal Numbers, Reading, MA, Addison-Wesley, 1974.

A mathematical novelette "about how two ex-students turned on to pure mathematics and found total happiness."


Koehler features works in which mathematical ideas play a significant role in the content. Featured authors include: Jonathan Swift (A Modest Proposal), Robert Coates (The Law), Thomas Pynchon (Gravity's Rainbow), Jorge Luis Borges (Death and the Compass, The Garden of the Forking Paths, and The Library of Babel), Lewis Carroll (What the Tortoise Said to Achilles, Alice in Wonderland and Alice Through the Looking Glass), Douglas Hofstadter (Godel, Escher, Bach).

Lenz, Jerry, "Geometry and other science fiction," Math Teacher 66 (1973), 529.


"The Permanent Traffic Solution" by Harland Manchester, 161-162.

"60,000,000 Projections Can't Be Wrong," by Ralph Schoenstein, 279-281.


One of the characters explains why a mathematician cannot be a poet.


Mathematics and Music


Groups and musical scales and forms—Chapter 23; Groups and bell-ringing—Chapter 24.


Some insight into the search for scientific explanation of what is pleasing to the ear.


Gardner, Martin, "The arts as combinatorial mathematics, or how to compose like Mozart with Dice," *Scientific American*, Mathematical Games,


Gardner, Martin, "White and brown music, fractal curves and one-over-f fluctuations," *Scientific American*, vol 238, Mathematical Games, April, 1978.


Describes the physical and mathematical aspects of sound waves that underlie our experience of music and, beyond that, describes the psychoacoustics of musical sound.


Mathematics and Poetry


Aesthetic standards for poetry that may be compared with aesthetic standards for mathematics.


Day-Lewis describes the role and responsibility of poets and poetry; his ideas apply to mathematicians and mathematics.


An illustrated introduction to the mathematical uses of infinity in easy-to-read verse.

Millay, Edna St. Vincent, "Euclid Alone Has Looked on Beauty Bare," in *Fantasia Mathematica*, collected by Clifton Fadiman.


Neruda, Pablo, "Ode to Numbers," *Selected Odes of Pablo Neruda*, (trans. by Margaret S. Peden), University of California Press.


Section 2 of this book, "The Kingdom of Number," contains a number of poems that involve mathematical imagery.


Graphical description and enumeration of rhyme schemes in poetry.

Shaw, Mary Lewis, "Concrete and abstract poetry (the world as text and the text as world)," *Visible Language*, Vol. 23 (Winter 1989), 28-43.


An illustration of statistical testing of authorship.


Mathematics and the Visual Arts


About the meanings of words and the pictures they create; a complex book to be read many times to gain more meaning.


Bragdon, Claude F., A Primer of Higher Space (the fourth dimension), Rochester, Manas Press, 1913.


Symmetry groups — Chapter 17; Wallpaper and border patterns — Chapter 26.


Fomenko, Anatolii T., Mathematical Impressions, Providence, American Mathematical Society, 1990. See also The Mathematical Intelligencer, Vol 8, No. 2, 8-17.

Photographs of ink and pencil drawings by a Russian mathematician-artist.


Chapter 2 — "Klein bottles and Other Surfaces" Chapter 13 — "The Cycloid: Helen of Geometry" Chapter 24 — "Op Art"


