CHAPTER 14
Mathematics and Dance Bibliography

We often get requests from students and researchers looking for information on mathematics and dance. Unfortunately, not much has been published on these subjects, and so we hope that this working bibliography may help point interested people to helpful sources.

Some items are included even though we do not currently have complete bibliographic information for them, and some of the sources we have only seen referenced in other works. We would greatly appreciate any additional references or missing information; please send these to schafferkarl@fhda.edu. These references were compiled during 1997-2001, and included visits to the Lincoln Center Library for the Performing Arts in New York City, and the Laban Center library, also in New York. The Lincoln Library classifications are included, where known, to simplify access to those references.

For those unfamiliar with dance and dance notation, a number of the references relate to the work of Rudolf Laban, and his followers. Laban developed the most commonly used dance notation, Labanotation, based on a very scientific analysis of human movement.

At the end we will soon include our dances which include significant mathematical ideas or inspiration. We would appreciate any information on dances or performances readers know about with strong connections to mathematics.

References

Andrews, Angela Giglia. "Developing Spatial Sense — a Moving Experience," *Teaching Children Mathematics*, Jan., 1996, pp 290-293. Reston, Va.: National Council of Teachers of Mathematics. Activities which help young children develop spatial ability.

Arnold, Eric B., and Frances Trix. English Country Dance as a Living Tradition Viewed Through Symmetry and Symmetry Breaking. Lincoln Library.

Bartenieff, Irmgaard, with Dori Lewis. *Body Movement — Coping with the Environment,*. New York: Gordon and Breach Science Publishers, 1980 and 1988.

Blank, Carla, and Jody Roberts. *Live on Stage: Performing Arts for Middle School Teacher Resource Book*. Palo Alto: Dale Seymour Publications, 1997. Projects and activities that present a cross-disciplinary approach to teaching the performing arts,

Bradley, Elizabeth (elizabeth.bradley@colorado.edu), David Capps, and Andee Rubin. "Can Computers Learn to Dance?" *Proceedings of International Dance and Technology.* Tempe, AZ 1999. The use of computer programs in the analysis and creation of dance sequences. See www.cs.colorado.edu/lizb/chaotic-dance.html.

Bradley, Elizabeth (elizabeth.bradley@colorado.edu), and Joshua Stuart. "Using Chaos to Generate Choreographic Variations," *Proceedings of the Fourth Experimental Chaos Conference,* Aug. 1997, Boca Raton. Describes a method for using chaos theory to create variations on dance sequences. See www.cs.colorado.edu/lizb/chaotic-dance.html.

Bradley, Elizabeth (elizabeth.bradley@colorado.edu), and Joshua Stuart. "Using chaos to generate variations on movement sequences," *Chaos*, Vol. 8, No. 4, Dec. 1998. The use of chaos theory in creating and altering dance sequences.See www.cs.colorado.edu/lizb/chaotic-dance.html.

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California State Board of Education. *Visual and Performing Arts Framework for California Public Schools, Kindergarten Through Grade Twelve.* Sacramento: California Department of Education, 1996. California's state framework for arts education.

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Clements, Douglas H. and Michael T. Battista. *Geometry and Spatial Reasoning*, in *Handbook of Research on Mathematics Teaching and Learning,*

*e*dited by Douglas A. Grouws., pp420-464. New York: Simon & Schuster Macmillan, 1992. A scholarly overview of current knowledge on geometric and spatial reasoning.

Cook, Wayne D. *Center Stage: A Curriculum for the Performing Arts.* Palo Alto: Dale Seymour Publications, 1993. A grades 4-6 performing arts curriculum.

Del Grande, John, and Lorna Morrow, with Douglas Clements, John Firkins, Jeane Joyner. "Geometry and Spatial Sense," *Curriculum and Evaluation Standards for School Mathematics Addenda Series, Grades K-6*. Reston, Va.: National Council of Teachers of Mathematics, 1993. Includes some physical exercises for mathematical explorations.

Dell, Cecily. *A Primer for Movement Description: Using Effori-Shape and Supplementary Concepts*. New York: Dance Notation bureau Press, 1977. Presents the system of effort-shape, a scientific system based on Rudolf Laban's work, which is used to analyze dance and movement.

Dennison, Paul E. and Gail E. Dennison. *Brain Gym, Teachers Edition,* Revised. Ventura, CA: Edu-Kinesthetics, Inc., 1994. A series of exercises put together by the Dennisons in efforts to deal with Paul Dennison's dyslexia and visual problems, and incorporating work in curriculum development and psychology.

Flatishhler, Reinhard. *The Forgotten Power of Rhythm*. Mendocino, CA: LifeRhythm, 1992. Essay on the use of rhythm in world music.

Gardner, Howard, *Frames of Mind, The Theory of Multiple Intelligences*, New York: Harper Collins, Basic Books, 1985. Lays out the theories of multiple intelligence, including the kinesthetic.

Gilbert, Anne Green. *Teaching the Three R's Through Movement Experiences, A Handbook for Teachers*, see section on Mathematics, pp83-146. First published by Burgess Publishing Company in 1977, republished by Prentice-Hall, Inc. Available from www.creativedance.org. Many, many ideas for movement activities, somewhat oriented toward primary grades, but adaptable to others.

Greeley, Nansee, and Theresa Reardon Offerman. "Now & Then, Dancing in Time and Space," *Mathematics Teaching in the Middle School*, Vol. 4, No. 3, Nov.-Dec. 1998, pp 192-199. Reston, Va.: National Council of Teachers of Mathematics. Having a mathematical background could be helpful to the teaching of dance and drama.

Guest, Ann Hutchinson, *Dance Notation: The process of recording movement on paper*, New York: Dance Horizons, 1984.

Herbison-Evans, Don. "Symmetry in Dance." Imprint, Technical Report 329, Basser Department of Computer Science, University of Sydney, Australia. (8 pages). Philosophical overview of symmetry in dance. (Lincoln Center Library, don@socs.uts.edu.au).

Hall-Marriot, Natalie Louise (nataliem@mosaix.com.au), and Don Herbison-Evans (don@socs.uts.edu.au). "A Computer Interpreter of Classical Ballet Terminology." Imprint, Technical Report TR264, Basser Department of Computer Science, University of Sydney, Australia. Description of a project to develop a classical ballet interpreter to turn the written language of ballet into computer animations of the ballet.

Hanna, Judith Lynne. *Partnering Dance and Education: Intelligent Moves for Changing Times.*. Champagne, Illinois: Human Kinetics, 1999. Examines trends and issues in dance education, while arguing for inclusion of dance in public education.

Hannaford, Carla. *Smart Moves: Why Learning Is Not All in Your Head.* Alington, VA: Great Ocean Publishers, 1995. The role of the human body in learning and thinking, presented in a scientific and readabe manner. She discusses the Brain Gym activities of Paul and Gail Dennison.

Herbison-Evans, Don (don@socs.uts.edu.au). "Dance and the Computer: A Potential for Graphic Synergy." Imprint, Technical Report 422, Basser Department of Computer Science, University of Sydney, Australia. (5 pages). (Lincoln Center Library).

Holt, Michael, and Zoltan Dienes.*Let's Play Math*. New York: Walker Publishing Company, 1973. Includes a chapter on movement activities for dance, for younger children (ages 5 to 7 approximately.)

Hughes, Lanston. *The book of Rhythms.* New York: Oxford University Press, 1995. Originally published as *The first book of rhythms,* New York: F. Watts, 1954. A delightful exploration of rhythm in language, art and life, and a good source for movement ideas.

Humphrey, Doris. *The Art of Making Dances*. New York Grove Press, 1959. Contains the proclamation that "symmetry is boring!". By this she seems to mean mirror symmetry. Humphrey was one of the seminal figures in Modern Dance and this book is a compendium of her craft.

Jamison, Robert E. "Rhythm and Pattern: Discrete Mathematics with an Artistic Connection for Elementary School Teachers," *Discrete Mathematics in the Schools*, ed. by Rosenstein, Joseph G., Deborah S. Franzblau, Fred.S. Roberts. DIMACS Series in Discrete Mathematics and Theoretical Compute Science, Vol. 36., published by the American Mathematical Society, 1997, pp203-222. An overview of how symmetry activities and the arts may be used in teaching mathematics. Movement ideas inspired by the movement form eurythmy, taught in the Waldorf Schools.

Jensen, Eric. *Teaching with the Brain in Mind.* Alexandria, VA: Association for Supervision and Curriculum Development, 1998. Integrates latest research on learning and the brain with techniques for the classroom. See chapter 9 Movement and Learning.

Julesz, B. *Foundations of Cyclopean Perception*, Chicago Univ. of Chicago Press, 1971, pg57. Referenced in Herbison-Evans, contains data on studies showing human abilities to perceive various kinds of symmetries.

Kaproff, Jay. *Connections: The Geometric Bridge between Art and Science*. New York: McGraw-Hill, Inc.1991. A wide-ranging introduction to pattern and design in art and science.

Kluger-Bell, Barry, and the School in the Exploratorium. *The Exploratorium Guide to Scale and Structure: Activities for the Elementary Classroom.* Portsmouth, NH: Heinemann, 1995. "Body Balance," pp 97-99 has students explore with a partner the way bodies balance. The book compiles activities for the classroom that involve building and scale.

de Laban, Juana. Dance Index, Vol. 5, No. 4, 1946, referenced in Thie, gives a description of a number of dance notations from ancient to present.

Lakoff, George, and Rafael E. Núñez. *Where Mathematics Comes From, How the Embodied Mind Brings Mathematics Into Being.* New York: Basic Books, 2000. A philosophical treatise on how mathematical ideas originate in everyday bodily experience.

Lambdin, Diana V., and Dolly Lambdin. "Connecting Mathematics and Physical Education through Spatial Awareness," *Connecting Mathematics across the Curriculum*, 1995 Yearbook of the National Council of Teachers of Mathematics, edited by Peggy A. House and Arthur F. Coxford, pp. 147-151. Reston Va.: NCTM, 1995. Espouses mathematical explorations in physical education.

Longstaff, Jeffrey Scott. *Moving in Crystals: A Continued Integration of Polyhedral Geometry with Rudolf Laban's Choreutics, Towards its Use as a Choreographic Tool*, Master of Science Thesis for Department of Dance and the Graduate School, Univ. of Oregon, June, 1988. (Laban Center Library, New York).

Maletic, Vera. *Body – Space – Expression, The Development of Rudolf Laban's Movement and Dance Concepts*, New York: Moton de Gruyter, 1987. Theoretical underpinnings of Laban's work.

Milligan, J.G. *Won't You Join the Dance*, Paterson, London, 1976, pg 11. referenced in Herbison-Evans, with respect to symmetry in Scottish dance.

National Council of Teachers of Mathematics (NCTM), *Curriculum and Evaluation Standards for School Mathematics*, Reston, Va.: NCTM, 1989, revised in 2000. The reform standards for mathematics teaching, which include copious suggestions that mathematics education be more closely tied to human activites.

Peterson, Ivars. "Dancing Chaos," *Ivars Peterson's Math Trek*, online column at www.maa.org, Jan. 11, 1999. Wash. D.C.: Mathematical Association of America. An account of the use of chaos theory to generate movement sequences. See also articles by Bradley, et al.

Phillips, Richard. "Jumping at Mathematics," Micromath, Summer 1989, pp 37-39. Complete reference temporarily lost. Describes the use of electronic mats which count the number of steps taken on them for classroom math activities.

Piaget, Jean, and Bärbel Inhelder. *The Child's Conception of Space*. Translated by F. J. Langdon and J. L. Lunzer. New York: W.W. Norton and Company, 1967. First published in France in 1948.

The groundbreaking study of the development of spatial thinking in children.

Piaget, Jean, Bärbel Inhelder, and Alina Szeminska. *The Child's Conception of Geometry.* Translated by E.A. Lunzer. New York: W. W. Norton and Company, 1981, originally published in 1960 by Routland and Kegan Paul. The development of geometric measurement ability in children.

Rogers, Laurence. "A Surprising Sensor," *Micromath*, Summer 1989, pp 41-42. Complete reference temporarily lost. Describes the use of motion detectors in classroom math activities.

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Salvadori, Mario. *The Art of Construction: Projects and Principles for Beginning Engineers and Architects.*. Chicago: Chicago Review Press, 1990. Originally published as *Building: The Fight Against Gravity*, Atheneum, 1979. Contains many ideas for using the body to illustrate architectural and engineering principles.

Schmidt, R.A. *Motor Skills*,. New York: Harper and Row, 1975, pg 45. Referenced in Herbison-Evans, showing that motor skills improve with repetition, even after millions of repetions.

Shillinger, Joseph. "The Mathematical Basis of the Arts." Referenced in Thie, classified arts according to "length, breadth, height, time, and means of perception." Apparently most interested in music.

Siegel, Marcia. Math. "Mac, and the Music," *Dance Ink*, Vol 4, #2, Summer 1993, discussion of uses of computers in music and dance.

Slocum, Jerry, and Jack Bottermans, *The Book of Ingenious & Diabolical Puzzles*, New York: Random House, Times Books, 1994. Contains a short history of tangrams, and. This and other books by Slocum and Bottermans describe a variety of mathematical puzzles which may be made into entertaining dance props.

Stewart, Ian. "Dances with Dodecahedra," in Sep. 1999 *Scientific American*, Vol. 281, Number 3. Article about Karl Schaffer and Scott Kim's dances with polyhdral string figures.

Thie, Joseph A. *Rhythm and Dance Mathematics*,. Minneapolis: published by Joseph Thie, 1964 (once available from the Dance Mart, Box 48, Brooklyn, NY 11229.) Applies the mathematical technique known as correlation analysis to sequences of dance steps. Includes some analysis of dance and mathematics with a larger scope. This book is available in the Lincoln Center Library and in the Dance Collection of the Birmingham Public Library, in Birmingham, Alabama.

Thurston, William P. "On Proof and Progress in Mathematics," *New Directions in the Philosophy of Mathematics: An Anthology.* Revised and Epanded Paperback Edition, ed. by Thomas Tymoczko, pp337-355. Princeton, New Jersey: Princeton University Press, 1998, originally published in 1986. Thurston has some interesting things to say about the role of kinethetic experience in mathematical thinking.

Warkentin, Don R. "Finger Math in Geometry," *The Mathematics Teacher*, vol 93, No. 4, April 2000, pp 266-268. Reston, Va.: National Council of Teachers of Mathematics. The use of finger and hand gestures in the math classroom.

Wechsler, Robert. "Symmetry in Dance," *Contact Quarterly*, vol. 15, #3, Fall 1990, pp 29-33, Northhampton, MA. Examines various ways to use symmetry in choreography.

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Yakimanskaya, I.S. *The Development of Spatial Thinking in Schoolchildren*, vol. 3 of Soviet Studies in Mathematics Education, translated by Robert H. Silverman. Reston, Virginia: National Council of Teachers of Mathematics, 1991. Originally published in 1980 by Pedagogika, Moscow, as *Razvitieprostranstvennogo myshlenlya shkol'nikov.* Scholarly work on the development of spatial thinking and its relationship to mathematics education.

The learning guide â€œDiscovering the Art of Mathematics: Danceâ€ lets you, the explorer, investigate connections between mathematical ideas and concepts and dance related ideas and patterns. Moving in symmetry will lead to classifying types of symmetry and Frieze patterns. Dancing Salsa Rueda allows you to explore combinatorial ideas, while Contra Dancing will link with group theory and permutations. You will discover topological ideas while playing with different positions in Partner Salsa Dancing and use Maypole dancing to investigate fundamental domains and create beautiful geometric patterns Dance and Mathematics, Teaching Dance for Interdisciplinary Understanding, Interdisciplinary Dance Practice, Dance and Cognition. Dancing Brains Dance as a key motivator for success in mathematics. A growing body of research supports the notion that dance enhances cognitive function as well as providing an enjoyable means of learning, as evidenced by recent news items and experiments such as that of Professor Michael Duncan of more.Â In this paper, therefore, I will explore the notion of an equal interdisciplinary partnership of dance and mathematics that increases motivation and enhances learning in both subjects. Save to Library. Download. by Kathryn D Pugh. â€¢ 4. Interdisciplinary learning through dance, Dance and Mathematics Bibliographies on Mathematics, part of the Collection of Computer Science Bibliographies.Â Bibliographies on Mathematics. You can add bibliographies and references to this collection! Emphasis is on computational mathematics. Query: in.