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INTEGRATING ART AND MATHEMATICS

Artists from different times and cultures have been fascinated by mathematical concepts and have used them to create unique works of art. From Islamic tile designs to rose windows in Medieval churches, from **Amish quilts** to nonobjective paintings by Victor Vasarely, and from **M.C. Escher's** tessellations to **Buckminster Fuller's** geodesic domes, mathematical concepts have enthralled artists and architects. For all practical purposes, it is almost impossible to separate the artistic and mathematical concepts in such works.

There are particular mathematical concepts that may be best learned through experiences in art that directly correlate with math. By combining art and mathematics, students are provided opportunities to solve problems creatively and develop spatial understanding through the exploration of geometry in two and three dimensions. In addition, students are afforded experiences to understand number, measurement, and pattern concepts, use manipulatives and representations, work collaboratively, and make further interdisciplinary connections through writing about art and math.



Students at Oakhurst Elementary in Fort Worth, Texas create tessellations on the computer.

Problem Solving

Significant art and math activities present opportunities for students to develop and apply problem solving skills. Such activities also encourage curiosity and creativity and help students understand the application of mathematics in real-life situations and the world around them.

Geometry

Geometry offers the most obvious connection between art and mathematics. Both involve drawing, the use of shapes and forms, an understanding of spatial concepts, geometry in two-and three-dimensions, measurement, estimation, and pattern. To learn geometric concepts, students need to investigate, experiment, and explore the world of geometry through hands-on activities and everyday situations.

Students who develop an understanding of geometry are better prepared to develop spatial sense and learn number, measurement, and estimation concepts. The representation of geometric concepts through drawings or the use of two- or three-dimensional manipulatives promotes student understanding. Such practices may be particularly beneficial to the visual learner.

When students explore patterns and relationships through exploratory activities, they learn about the properties of shapes and forms and develop an awareness of spatial concepts. For example, folding two-dimensional shapes into three-dimensional forms promotes the development of spatial sense. The creation of tessellation patterns made with congruent tiles or mosaics, is another example of a significant experience that promotes understanding through both art and math.

Through other activities that combine art and mathematics concepts, students can explore bilateral and radial symmetry; practice using rulers, straight edges, protractors, and/or compasses; practice estimation using such terms as "about," "between," "a little less," or "a bit more"; and create complex patterns based on geometric shapes and forms.

Computers, Art, and Mathematics

Educational computer software for student use is becoming increasingly available. Paint and draw programs and specialized programs such as *Tesselmania Deluxe!* can engage students in problem solving strategies in geometry, measurement, fractions and decimals, and other mathematical concepts, while creating works of art on a computer screen. Though some programs offer too many ready-made images, others do encourage students to create their own work from start from scratch. Computer literacy and a good sense of design also become marketable skills on the Internet.

Working Collaboratively

Small group or entire class collaborations are beneficial to help students understand the necessity of working well together and to feel proud in their contributions to the group. Classroom paper quilts or painted murals are just two examples of art and mathematics projects that promote collaboration.

Art, Math, and Writing

Incorporating writing with art and mathematics activities provides experiences with additional communication skills. Students can keep journals, describe problems and solutions in sentence form, detail the steps of a process, and write their own stories about art and math.

Nancy Walkup and Pam Stephens

Reprinted from *Interdisciplinary Connections: Art and Mathematics*, a Take 5 Art Print set published by **Crystal Productions**, 1-800-255-8629

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SELF-TAUGHT ARTISTS OF THE 20TH CENTURY

The Amon Carter Museum and the Fort Worth Museum of Art are both hosting the exhibition, *Self-Taught Artists of the 20th Century: An American Anthology*, November 1, 1998 - January 24, 1999. This exhibition will survey for the first time the work of self-taught artists from the entire 20th century as we near the millennium. It examines the creative spirit and expressive capacity of artists without formal training and considers how they transform ideas, memories, fantasies, and obsessions into tangible form through their art.

The works in the exhibition were chosen for their high aesthetic content: their expressive power, graphic presence, and formal vigor. The artists featured use a variety of media and forms: painting, sculpture, tracts, installations, and built environments. Some of the artists featured are well-known, such as Howard Finster, Horace Pippin, Bill Traylor, and Grandma Moses. Others, such as Henry Church Jr., Edgar Alexander McKillop, and Leroy Person, are little known or completely unknown. Fort Worth is one of six American cities to host the exhibition. Call the Amon Carter (817-738-1933) and the Modern (817-738-9215) for dates and details of teacher inservices for the exhibition.

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NATIONAL STANDARDS FOR SCHOOL MATHEMATICS

The complete *Curriculum and Evaluation Standards for School Mathematics* are available from the [National Council of Teachers of Mathematics](#), Reston, VA.

Standard 1: Mathematics as Problem Solving

Standard 2: Mathematics as Communication

Standard 3: Mathematics as Reasoning

Standard 4: Mathematical Connections

Standard 5: Estimation

Standard 6: Number Sense and Numeration

Standard 7: Concepts of Whole Number Operations

Standard 8: Whole Number Computation

Standard 9: Geometry and Spatial Sense

Standard 10: Measurement

Standard 11: Statistics and Probability

Standard 12: Fractions and Decimals

Standard 13: Patterns and Relationships



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**THE MANDALA:
A LESSON ABOUT RADIAL
SYMMETRY**

Students may explore concepts of geometry through an introduction to symmetry. Radial symmetry or balance

radial is a variation of balance in which the elements of composition are regularly arranged and radiate from a central point or axis. It appears both in nature and in human-made objects. One type of human-made radial symmetry design is the mandala. A mandala is a graphic and often symbolic pattern usually in the form of a circle, divided into four or more equal sections.

[View the mandala divided into sections](#)

Art and Mathematics

A lesson about mandalas provides a meaningful connection between art and mathematics. In this lesson, students will create an original mandala design using radial symmetry, and in doing so, will become familiar with geometric concepts of symmetry while practicing with tools such as the ruler, the compass, and the protractor. Students will also examine and discuss mandala designs from a variety of artists, cultures, and times. The making of reasoned judgments about mandalas will help guide students when creating their original designs.

Materials and Preparation

The materials needed for this activity are readily available and inexpensive. Each student needs one sheet of 12" x 12" white drawing paper or illustration board, pencils and erasers, masking tape, a ruler, scissors, and colored pencils or markers. The teacher needs to prepare 9" circle templates to share with the class and patterns for 1/4" and/or 1/6" circle wedges.

Resources

Good resources ensure a successful lesson. *ARTTALK*, a text by Rosalind Ragans, features some good mandala designs. Examples of radial balance from a number of cultures, slides and prints are also helpful. Assemble and display in the classroom both reproductions and actual examples of objects that show radial symmetry.

Motivation

Display and discuss the reproductions and objects you have brought to class. Have students list and describe additional examples of radial symmetry they observe in nature as well as human-made ones such as bicycle tires, car tires, the plates they eat from, and other sources. Discuss appropriate vocabulary, especially symmetry, radial symmetry, radiate, axis, mandala, kaleidoscope, and geometry.

Demonstrate the production procedures and stress the importance of repeating the same design and colors in each quadrant of the mandala to provide unity and balance, and ask students to take great care to guarantee accuracy when transferring their designs.

Procedure

The production procedure is simple, but must be followed carefully to be successful. Distribute the prepared patterns of 1/4 or 1/6 circle wedges to students. Have students draw, with a pencil, an intricate line design inside the wedge that completely fills the space. The design may be realistic or abstract, geometric or organic, but intricate designs work best when repeated through the radial symmetry of the mandala. Have students use colored pencil or markers to color in the design. Each student should have a colored design that looks like a wedge of pie!

For the next step, have students shade the back of the wedge with the flat part of a pencil, then cut out the pie wedge. Have students next use the 9" circle template to trace a circle in the center of a piece of 12" x 12" white paper.

Have students each align their "design wedges" with the circle and tape in place with small pieces of masking tape. To transfer the design, students should carefully trace over the lines in the design with a pencil, taking care not to smear the transferred design. Have students repeat the process by moving the wedge and re-tracing the image until the circle is complete (students may need to re-shade the back of design to ensure a good transfer).

Students should now color all of their wedges exactly the same, repeating the same colors, values, and textures in each wedge. Display the completed class work with examples of radial symmetry examined earlier in the class.

Extensions

Students can incorporate their names into the design (and challenge others to find it). Another possibility is to transfer the design to a clay slab, cut it out and decorate it using clay tools and glaze or paint. An interesting language arts extension involves incorporating words or phrases into the mandala design. Students can each also write an artist's statement about their work for exhibition.

Resources

The Mandala (Sacred Symbols), Thames and Hudson

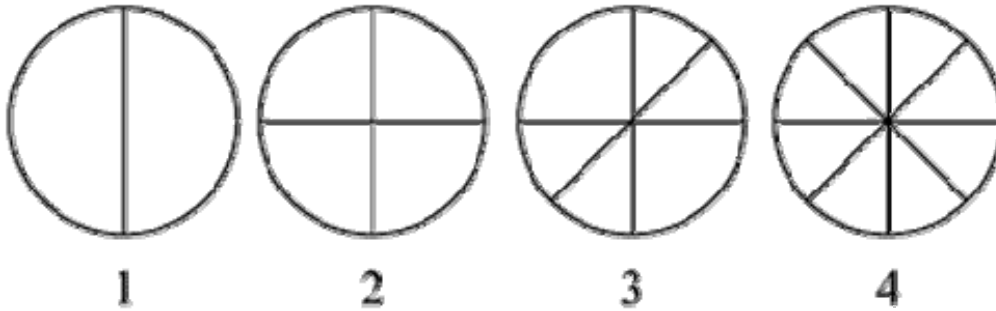
Creating Mandalas : For Insight, Healing, and Self-Expression by Susanne F. Fincher and Robert A. Johnson

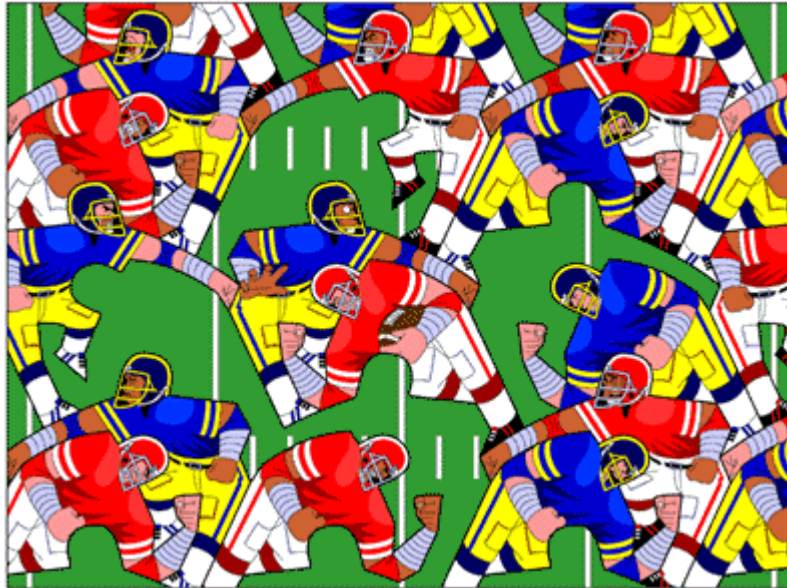
Art-O-Gram

Radial Symmetry Designs

Use the following illustrations as a guide to create a radial symmetry design. Begin by tracing a nine-inch circle (a paper plate makes a great pattern) on white drawing paper. Then, using a ruler, divide the circle in half, then into fourths, next into six parts, and finally into eighths. Draw a detailed line design in one "piece of pie," then repeat it exactly the same way in the other seven segments. Use colored pencils, markers, or paint to color each segment, again, exactly the same.

For a simpler design, use only four sections.





ESCHER BOWL
JIM McNeill

The Art

Action abounds throughout *Escher Bowl* as members of two opposing football teams block and tackle across a shallow playing field. Clusters of players push into each other, pumping arms and grimacing as they participate in this contemporary form of urban battle. In the center of the field, framed by the surrounding action, two players--one from each team—face each other in a skirmish for the football.

The red player protectively bends over the football to cradle it while simultaneously his stiff right arm punches up into the blue team player. The posture and facial expression of the blue player show that he reacts to the hit with surprise. His eyes are opened wide, the palm and all of the fingers on his right hand are fully exposed, unlike all the other players whose eyes are squinted and whose hands are in fists.

As the drama unfolds at midpoint in the image, the playing field itself acts as a gridded, smooth backdrop for the tumbling action. Divided predominately into four vertical sections by white yardage markings, the shallow green field provides a sharp contrast to the bright colors of the players' uniforms. Encircling and offsetting the two central characters, the green areas create a focal point that highlights the most important action. Upon closer observation, four negative green shapes define the playing field. These green shapes, or "field pieces" as McNeill calls them, are the same repeating silhouettes as those that are used to outline individual players, or "figure pieces." The field pieces serve as the background plane while the figure pieces all occupy the same foreground plane (in math, a plane is a two-dimensional, flat surface that is infinite).

The Artist

Born in 1967 in Rahway, New Jersey, graphic artist Jim McNeill grew up in Edison, New Jersey, and began drawing before he entered kindergarten. Using the backs of his father's old business stationery, McNeill began to draw at about the age of three. He has continued to draw throughout his life, although he is quick to add that he has upgraded to better art supplies than those with which he began as a young boy.



Photograph by Maura Krupp

Among the first artistic influences upon McNeill were classic 1940s Warner Brothers cartoons that he watched every morning on television. After watching the cartoon shows, McNeill would attempt to draw the characters he had just seen. All through his childhood, McNeill continued to draw. He drew not only cartoons, but also often copied images from movie posters and album covers. In 1990, McNeill graduated with a Bachelor of Fine Arts degree from The School of Visual Arts in New York City. While he attended The School of Visual Arts, McNeill majored in illustration and concentrated upon oil painting as his primary medium. After graduation, McNeill worked as a graphic artist for a small New York magazine. It was while working for the magazine that the artist was first introduced to the Apple Macintosh computer and desktop publishing. Soon mastering electronic illustration, McNeill compiled a portfolio and began a career as a freelance artist.

As a freelance artist, McNeill became intrigued by the ability for computers "to treat lines and shapes as independent, free-standing objects that could be cloned and repositioned with a couple of mouse clicks." To McNeill's way of thinking, the computer's ability to duplicate lines and shapes seemed to echo the concepts found within the graphic work of Dutch artist M.C. Escher. The conceptual similarities between his own ideas and those of Escher led McNeill to create a series of computer-generated tessellations. *Escher Bowl* is from this series. Besides tessellated designs, McNeill continues to work as a graphic designer and has written and illustrated a book for children entitled *Dream Patrol*.

Tessellation Unit Summary

Objectives

Students will:

1. View and discuss the tessellations of artists Jim McNeill and M.C. Escher.
2. Identify, collect, and discuss examples of tessellations found in everyday life.
3. Create a tessellation that is an example of a translation, a transformation of a tessellation that involves a slide of a figure without rotation.
4. Write an illustrated explanation of how the tessellations were created (optional).

Materials and Preparation

- Examples of tessellations in everyday life and in artwork
- Four-inch squares cut from index cards or tag-board, one per student
- Pencils
- Scissors
- Scotch tape
- White drawing paper, 12" x 18"
- Colored pencils, markers, or tempera paints

Resources

- A reproduction of *Escher Bowl* by Jim McNeill, Crystal Productions (800-255-8629), Take 5 print set, *Interdisciplinary Connections: Art and Mathematics*
- Reproductions of tessellations by M.C. Escher
- Examples of tessellations in everyday life

Content Base/Motivation

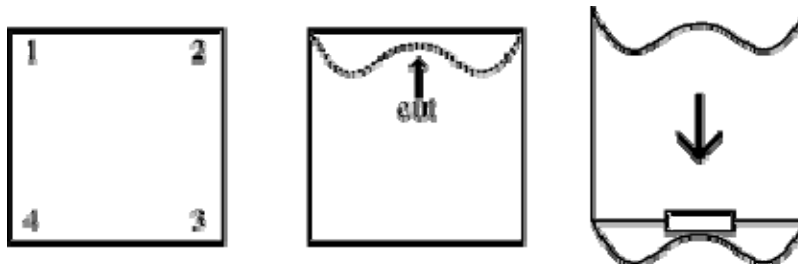
Introduce the concept of tessellations, repeating patterns made using congruent shapes - shapes that are exactly alike in size and outline. Display and discuss examples of tessellations and congruent shapes found in both natural and human-made environments. Introduce and discuss the tessellations of Jim McNeill and M.C. Escher. If possible, also include examples of Islamic tessellating patterns often found in patterned walls, floors, and other architectural elements. Carefully demonstrate all the procedures necessary to create a tessellation, then distribute four-inch squares, pencils, scissors, and tape.

Vocabulary

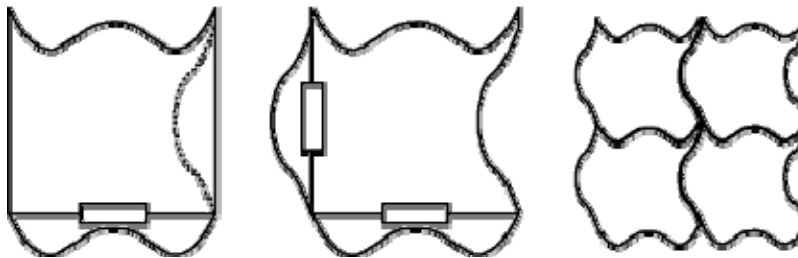
- Congruent: the exact same size and shape
- Pattern: a design composed of a number of elements in a regular manner
- Tessellation: a tiling of a plane without any gaps or overlaps, by a pattern of one or more congruent shapes
- Tiles/tiling: synonym for a tessellation or mosaic
- Translation: a tessellation transformation involving the slide of a figure without rotation

Procedure/Production

Number the corners of a four-inch square 1, 2, 3, and 4, beginning with 1 in the upper left side. Next, draw a simple wavy or zigzag line from corner 1 to corner 2. Cut along this line to separate the square into two pieces. Slide the shape that is cut free to the opposite and outside edge of the square. Tape it in place, matching the two straight edges of the two shapes. The shapes should fit together side-by-side, with no overlap.



Next draw a wavy or zigzag line from corner 2 to corner 3, then cut along the line. Again slide the cut shape to the opposite and outside edge of the square, align the straight edges and tape the two pieces together. This process creates a tessellation "tile" or pattern piece. When the same shape is repeatedly traced without leaving an gaps between the shapes, a repeat pattern is created which is congruent—all the shapes in the pattern are exactly alike



To fill a paper with the tessellated pattern begin by tracing in pencil the perimeter of the "tile" next to both edges on the upper left corner of a piece of 12" x 18" white drawing paper. Fit the tessellation pattern next to the first tracing and trace again. Repeat this process, moving from left to right and top to bottom, until the paper is filled with congruent shapes. Look carefully at the design created to see if it suggests a face, animal, or object. If desired, add details such as eyes, a nose, mouth, or other feature, repeating the same process in all the tiles. Use tempera paint or colored markers to complete the tessellation (fluorescent paint looks great on black paper).

Evaluation/Outcomes

To what extent did students:

1. Recognize and discuss tessellations in their environment?
2. Verbalize thoughtful responses to the tessellations of artists McNeill and Escher?
3. Correctly follow the directions to create successful tessellations?
4. Exhibit imagination and creativity in their tessellations?

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M. C. ESCHER: A BIOGRAPHICAL SKETCH

*"We live in a beautiful and orderly world, not in a chaos without norms,
even though this is how it sometimes appears."*

Dutch graphic artist **Maurits Cornelis Escher**, better known as M.C. Escher, became widely known and acclaimed during his lifetime for his highly complex [drawings](#), linocuts, and [woodblock prints](#). Escher's images are easily recognizable, often presented in the form of *tessellations* (repeating, reflecting, or reversing shapes), *optical illusions*, or *impossible constructions*.

The Early Years

Born in Leeuwarden, Holland, and the son of a civil engineer, M.C. Escher—whose friends and family called "Mauk"—showed little aptitude for formal education and consistently produced poor grades in his studies. Although he excelled in art classes, especially in drawing, Escher nonetheless failed his final drawing exam in secondary school and never officially graduated. Later, at the age of 20, a military deferment provided Escher additional time and opportunities to pursue his education.

Accepted and enrolled at the Higher Technology School (Delft), and subsequently at the School for Architecture and Decorative Arts (Haarlem), Escher quickly abandoned classroom studies for private art lessons with graphic artist Samuel de Mesquita. Private study (particularly in woodblock printing processes) in conjunction to extended trips in Italy became the catalyst that set Escher and his work in motion. Escher loved southern Europe. In this environment he filled sketchbooks with landscape drawings that included pictures of cacti, olive trees, and small animals. These drawings often populated his subsequent prints.

Escher's first solo art exhibition was held in August 1923 in the city of Siena. A few weeks later Escher proposed to Jetta Umiker; she accepted and they were married within a year. Following a wedding trip through southern Europe they purchased a home in Frascati, a small town outside of Rome. The popularity of Escher's artwork, which mainly exacted Italian landscapes, soared. In testimony to the respect that they had for the artist and his artwork, when M.C. and Jetta's first son was born in 1926, both Benito Mussolini and King Emmanuel attended the baby's christening. Throughout the 1920s, Escher continued to have his works of art shown. In 1929, he had no fewer than five solo exhibitions.

Tessellations and Impossible Realities

The 1930s and 40s brought many changes for Escher, both personal and professional. With the rise of the Fascist Party in Italy, the Eschers left their beloved Italy and relocated to Switzerland. Later, the family immigrated to Brussels and then a few years later to Holland.

Within a year of immigrating to Switzerland, Escher undertook a journey to Spain where he visited the Moorish palace, Alhambra. This visit proved to be fortuitous for the artist. Captivated by the geometric-patterned tile mosaics of the palace, Escher made numerous sketches of the mosaic patterns, returned to Switzerland, and changed his artistic focus from realistic landscapes to artwork of his own invention. Impeccably drawn and printed with precise detail, Escher's tessellations and impossible realities or constructions soon became the hallmark by which he is now best remembered. Indeed, more often than not, the orderly and perfectly world drawn in Escher's prints seem to challenge our senses and force us to question what is and is not real.

Many of Escher's complex drawings show the same object from a variety of oftentimes conflicting views of space, dimension, or infinity. To assist himself with visualization of the diverse points of view, Escher often created small models from clay or wood that often remained with him long after their original intended use. For example, a plasticine and wood model of a crocodile-like creature that the artist carved as a model for his print *Reptiles*, 1943, became a favorite object that remained a part of the artist's own collection and was displayed on his desk.

In the early 1950s, Escher began to gain wide recognition in the United States. Although he often complained about the number of orders he was receiving for prints, because of a strong work ethic and dedication to his craft, he always seemed pleased to fill them. The artist frequently gave lectures not only to groups of accomplished artists, but scientists and mathematicians as well. In further recognition, a seemingly endless number of articles and books were written to explore the complexities of Escher's work. During this time Escher was also knighted in Holland, an honor that he shunned. Because of ill health that had plagued him throughout most of his adult life and much preferring to work on his prints "day after day like a hermit," Escher took a respite from the lecture circuit and returned to his drafting table.

Jetta was never happy in Holland and moved back to Switzerland in 1968, where she lived the remainder of her life. Escher stayed in Baarn, Holland, immersed in his work. His final graphic, completed in 1969, was *Snakes*. Following a series of frequent hospital stays and surgeries, M.C. Escher died in 1972 in Baarn. Escher's graphic art remains as popular today as it was during his lifetime and he continues to be honored with articles, books, and web sites that explore his life and work.

Pamela Geiger Stephens

INTERNET RESOURCES ABOUT ESCHER

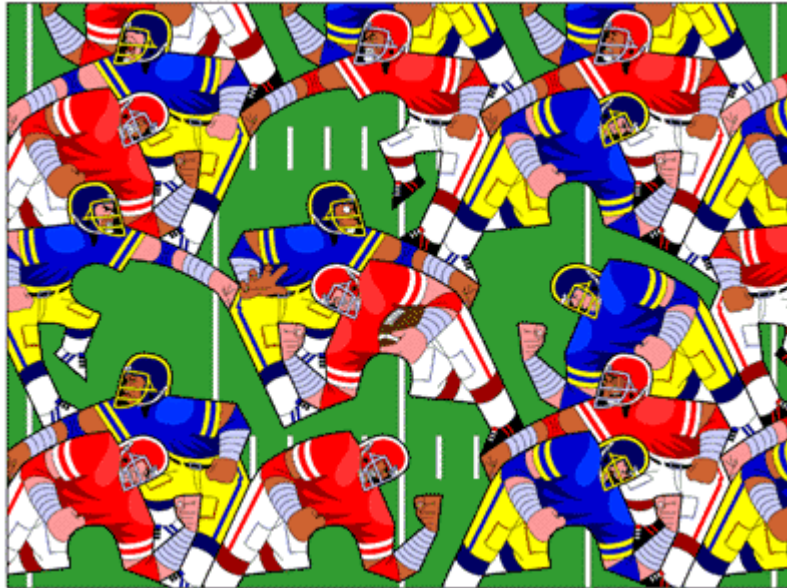
[M.C. Escher Brief Biography](#)

[**M.C. Escher**](#)

[**M.C. Escher: Mathematics and Visual Arts**](#)

[**World of Escher**](#)

Student Reproducible Page



Escher Bowl
Jim McNeill, American, 1967

About the Artist

Jim McNeill was born in Rahway, New Jersey in 1967. When he was about 3 years old, he first started his art career. His first original drawing was of a man petting a bird. Jim later moved to Edison, New Jersey. During high school, his band teacher gave him some advice: "Your talent is your obligation." Since he had been sketching throughout his childhood, he realized at this point that art was his obligation. Jim's earliest works were inspired by Warner Brothers cartoons and comics found in Mad Magazine.

Mr. McNeill admires several artists ranging from classic artists such as Rembrandt, to present day cartoonists Bruce Timm and Paul Dinni, creators of the Batman Animated Series. Besides creating tessellation art, his other love is playing the Chapman stick. It is a twelve string instrument that combines the playing skills of a piano, guitar, and bass. He loves playing the Chapman stick, but his lifelong career goal has always been to be a professional artist. Jim believes, "the greatest thing about art is that it enables you to communicate something about the way you are at the moment you are creating it."

Jim McNeill spends most of his time working as a free lance artist in Iselin, New Jersey. This has allowed him the time to work on creating his own Web site, explore tessellations, and to write a children's book.

About the Art

As part of his tessellation series, McNeill created *Escher Bowl* in 1996. McNeill says that most of his inspirations for art happen when he is otherwise preoccupied. He could spend hours with his sketchbook and not have any ideas, but then they come to him as a brainstorm while vacuuming.

Escher Bowl started as loose, hand-drawn sketches based upon silhouettes. The drawing of the silhouettes was the most time-consuming aspect of this process. These silhouettes were eventually scanned into a computer where Jim was able to manipulate the silhouettes, turning the indentations of the players until they formed a perfect fit. If you look closely, he uses the negative space of a player to create the field.

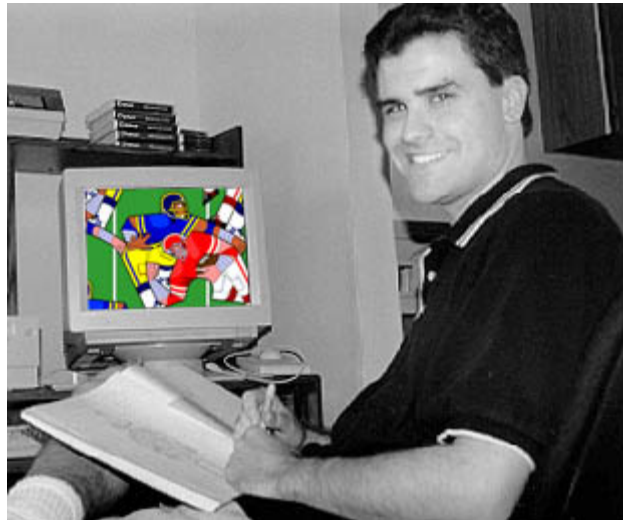
Each player was also given common facial expressions and gestures with exception to the two players in the center. Interior details of the two players include open eyes in surprise to a hit, as well as the other player protectively carrying a football. Although there were no individual football players that inspired *Escher Bowl*, Jim McNeill has loved the sport all his life, particularly the New York Giants.

Activities

1. Congruent means having the same shape and size. How many different congruent shapes are used in *Escher Bowl*? Pattern is a design that repeats in a regular manner. What patterns of congruent shapes are used in *Escher Bowl*? How do the patterns of congruent shapes create a sense of movement in the tessellation?
2. Color is also repeated in *Escher Bowl*. What pattern is created by the use of color in this tessellation? Why is the pattern of color important?
3. Negative space is the empty space within or around shapes or forms. What areas in *Escher Bowl* would be considered negative space? How did the artist create the negative space? Why is negative space important in *Escher Bowl*?

Online interview of Jim McNeill and article by Mitchell Elementary Fifth Grade students under the direction of Suzanne Wilson and Angie Zarvell

PORTRAIT OF THE ARTIST, JIM McNEILL: ONLINE INTERVIEW



McNeill: It's my pleasure to answer the students' questions. Believe me, I'm thrilled that there are people in the world who are actually that interested in my opinion about things! I don't know how in-depth you want me to get with the answers, so if you need more than I give you, don't hesitate to ask for clarification about anything. The only trait every artist in the world shares is not being able to shut up about themselves, so it will NOT be an inconvenience!

Students: *Is it hard to think of an idea or theme for an original artwork?*

McNeill: Great ideas are a lot like pens: they're all over the place when you're not looking for one, but the minute you need one (like when you're on the phone and you need to take a message) you can't find one anywhere!

I've noticed that my best ideas for a new piece of art come to me when my mind is on something that has nothing to do with art. There have been days when I would sit with a sketchbook in front of me for hours and wouldn't be able to think of a single thing to draw. The next day I would be vacuuming my apartment and I'd have a brainstorm!

There are also times when I may have come up with an idea for a new piece but I can't figure out how to actually create it on a computer or a piece of paper. This happens a LOT with the tessellations I make! *Escher Bowl* is a great example: I knew I wanted to make a tessellation with football players, but I couldn't figure out how to fit them together so two opposing players would be facing each other. It took me a couple of really FRUSTRATING weeks just to come up with the two outline shapes. Once I was able to figure out that part, filling them in was easy.

Students: *Who is your favorite artist?*

McNeill: There isn't a single artist I could pick out as my favorite. There are too many ways to make art and too many great artists making it.

Some of my favorite painters (in no particular order) are Rembrandt, Velazquez, Gustav Klimt, Egon Schiele, Francis Bacon, George Tooker and Jack Levine.

The Warner Brothers cartoons of the 1940s (Bugs Bunny, Daffy Duck) were what made me want to become an artist in the first place. They were made by great animators like Chuck Jones, Friz Freleng, Tex Avery, Bob Clampett and Robert McKimson. I think some of the cartoons being made today are pretty cool, too. I think Bruce Timm and Paul Dinni did a great job on the character designs for the *Batman* Animated Series. I LOVE the way Bruce Timm draws anything! He's fantastic. The Silver Surfer is good, too. They did a great job combining computer animation with standard hand-drawn animation. Galactus always looks so HUGE!!

I've also always loved comic books (I had a subscription to *Mad Magazine* for years until I was about thirteen!) There were some really great artists working for *Mad* in those days, like Mort Drucker (who would be the greatest caricaturist on the planet if it wasn't for Al Hirschfeld, who I also love!) and Jack Davis. *Mad* was published by William Gaines, whose publishing company, EC Comics, created the greatest comic art I've ever seen. Alex Toth, Reed Crandall, Bernie Krigstein and Wally Wood (my favorite of the bunch!) were all artists for EC in the 1950s. Those guys could DRAW!! Even though those comics first came out before I was born, they've recently been reprinted so I've had a chance to buy them. I'm glad I was around for the reprints!

I'm sorry I've thrown so many names at you all at once, but I think they're all worth checking out. It's taken me thirty years to get to them all!

Students: *When did you start your website? Why?*

McNeill: I started my website about four years ago. I first started my website to train myself to use HTML, the computer language of the World Wide Web. It turned out that I didn't need to: they were coming out with software programs that would help you make a web page without using a single line of HTML about a week after I started my website! You can never keep up with technology!

I think my website is a really great way to have a place to show your work to the rest of the world. I don't think art is really art unless somebody is out there appreciating it. It's so great to get e-mail from somebody who just happened to be "browsing" by and ended up seeing and liking my work. Since it's on the America On-Line Web server, my site is available to anyone in the world with Web access, 24 hours a day, 7 days a week. It's like showing my work in a gallery that NEVER closes!

Students: *What steps did you follow when you drew the football players in Escher Bowl?*

McNeill: Sometimes it takes me so long to make a tessellation that I think it would be faster to talk about the steps I DIDN'T take! Well, let me give it a shot anyway:

I started out with the idea for a football theme and started to make very loose sketches in my sketchbook. This step is to get a very general idea of what the outside edge, or silhouette, is going to look like. At this time the drawings looked pretty much like regular cartoons of football players, though I'd go back over the outside edge carefully to see where its bumps and indentations were and how they might serve to make bumps and indentations on another player right next to it.

Once I came up with silhouettes that seemed to work, I started working with graph paper, a pencil and a VERY large eraser! I drew a rectangular grid whose rectangles seemed to be roughly the same dimensions as the silhouettes in my sketchbook sketch. I then drew slightly more defined silhouettes in each of these rectangles to see if the silhouettes would fit together on paper as well as they did in my mind. Some areas of the silhouettes seemed to work better than others. I realize that I'm using the word "seemed" a lot, but at this stage the final silhouettes are in a pretty rough form.

I scanned my graph paper sketch into the computer and traced over it with Adobe Illustrator. This enabled me to get an outline that I could stretch around like chewing gum or duplicate as many times as I needed. This step further refined the outside edges, but I had to start adding interior details to the silhouettes to get a clearer idea of what the final characters were going to look like.

I printed out a copy of the computer silhouettes and started drawing inside them with a pencil (I kept the eraser around, too!), adding the arms, legs, etc. I noticed I was going to need some more leg room for one character, so I had to take some leg room off the other one. I scanned this new drawing back into the computer and made the corresponding adjustments, also adding the interior details that would be common to all the players except the 2 in the center.

I then printed out a number of copies with everything in them but the faces. I added these with a felt tip pen and scanned them back into the computer. Once the line work was established I added the color and the rest, as they say, is art history (at least that's what my mother says!)

Students: *Which sports players inspired Escher Bowl?*

McNeill: It's going to take a lot of guts to admit this to Dallas Cowboy fans, but I've been a long-time Giant fan! You're booing, aren't you?!

I've always lived in New Jersey and it's almost a law that you have to like football (and love the Giants!) when you live here! I don't know if there are any particular players that inspired me in creating *Escher Bowl*, but I've loved the sport all my life.

Students: *We were told that you play a Chapman stick. What is it? Why do you like it?*

McNeill: A Chapman Stick is a 12-string music instrument played by tapping on the strings like a piano rather than plucking them like a guitar. I love it because it seems like it's a cross between three instruments I've always wanted to learn how to play: the guitar, bass and piano. I'd studied percussion (drums, timpani, xylophone, etc.) for 10 years before playing the Stick, and it seemed like it would give me the opportunity to play all those other instruments (guitar, bass, piano) more or less at the same time. Since relatively few people play the Stick, I've had the chance to come up with my own sound on it without being too influenced by what other musicians have done with it. I tried playing the guitar for a couple of years but could never stop wondering if the world really needed another guitar player. There already seemed to be so many great ones! There are already some great Stick players, but only enough to inspire me rather than overwhelm me!

Students: *Are any of your relatives artists?*

McNeill: I'm the only artist in the family so far. My nephews, Matt and Mike, are pretty good with their crayons, so we'll have to wait and see. They're five right now (twins), so I figured I'd give them a few years to practice!

Students: *What is your lifelong career goal?*

McNeill: It may sound strange, but I'm achieving what I set out to do in kindergarten! I always knew I was going to be an artist, so I feel I've been one my whole life. My goal was to be able to do it professionally, so it's nice to know I can make a living at it now. As far as the kind of work I'd like to do is concerned, I find myself being pulled away from making computer art and gravitating more towards comics. The greatest thing about art is that it enables you to communicate something about the way you are at the moment you're creating it. I couldn't tell you what kind of art I'll be making even five years from now, because those five years of experience will have made me a different person (and artist!) from the one I am today. Who knows? I might even be playing the Stick at Carnegie Hall!

Thanks for the great questions! They were a lot of fun to answer and really made me think about what I do in a different way.

Jim McNeill

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