

Symmetry and Patterns, A Natural Phenomenon Across Centuries and Cultures

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INTRODUCTION

As we observe the world around us, we see patterns and symmetrical combinations relating to line, space, color and design. Everywhere we look, there is evidence of symmetry. This symmetry is overtly present in plants, animals, insects, crystal structures, in decorations and architecture. Symmetry is subtly included in the structure of musical phrases, poetic forms, and literary works. Symmetry is not only a property of natural phenomenon, but also a form of visual and physical representation produced by man which in turn produces feelings of comfort and satisfaction within the viewer.

The study of symmetry spans hundreds of years and encompasses two separate disciplines-mathematics and design. Geometric principles describe decorated form, which must consist of regularly repeated patterns, the parts being moved in rigid geometric motions. These repeated designs are regulated by the formal rules of symmetry. Symmetries restrict the kinds of pattern arrangements possible. They form a "grammar" and this "grammar" of repeated designs is universal. These repeated designs, called patterns, are either planar, one-dimensional infinite described in bands or strips, or, they appear as flattened, two-dimensional overall patterns in a plane.

In order to be a pattern, there are certain requirements that must be met. A motif may be a design in itself but in relationship to a pattern, the motif is one of the units, which makes up the repeat pattern. Shapes and spacing are essential elements of patterns.

According to Phillips and Bunce, there are eight categories of patterns, including:

- | | |
|-----------|-------------|
| *animals | *geometrics |
| *enigmas | *novelties |
| * figures | *scenics |
| *florals | *texture |

Patterns link cultures. Pattern structures play a vital role in ornamentation; the structure and order being particularly critical elements. The primitive peoples had no written language; therefore, they expressed their feelings or thoughts about life with shapes and symbols. Prehistoric man created both geometric and naturalistic motifs, now used in art and architectural designs.

Imagination has always been a characteristic of mankind. Those who have studied and collected examples of patterns reproduce examples of imaginary or composite forms in texts.

It is possible that the author and illustrator of the Dr. Seuss books obtained ideas for some of the story characters from the hybrid figures of the unicorn, the griffin or the phoenix. The animals and birds may have been inspired by the drawings of Bosch-like creatures from Flanders, dated 1550-1575.

The world of the past and the present are brought closer together today with the advent of modern transportation and television, and yet the immediate context of knowledge and experience in which we live within our cultures, determines how individuals "see" a "scene".

In these lessons, the meaning of symmetry and patterns will be approached as a non-scientist, in a non-technical manner, and within the context of the divergent ethnic groups within the classes. The students' cultural and religious customs, the historical and political structures of their nations, their languages and aesthetics will affect the interaction with the ideas, resources and materials, which will be utilized for the projects.

Rather than spend precious time on a formal study of the rules or "grammar" of symmetry, emphasis for the lessons presented herein will provide students with the opportunity to recognize the natural phenomenon of symmetry present in our world and become familiar with the many ways that people around the world express their culture. Perceptions from specific cultures determine what the individuals "see".

This unit is being written in association with the Houston Teachers Institute at the University of Houston, 1998-1999, and is developed according to the guidelines and under the auspices of the program director, Dr. Paul Cooke, Department of Political Science, and the seminar leader, Dr. Michael Field, Department of Mathematics.

The topic, Symmetry, Patterns and Chaos, is quite technical in nature and more specifically addresses the field of mathematics; however, the concepts are also directly related to the field of fine arts.

The Texas Education Agency has prescribed what is known as Essential Elements for Education in the various disciplines. The following elements have been chosen in preparation of this presentation. Not each or all of these elements will be fully explored in the plans developed for the beginning highschool art classes.

1. Awareness and sensitivity to natural and humanmade environments.
 - 1A Examining a variety of objects.
 - 1B Exploring art elements (line, value, texture, color, form, and space).
 - 1C Applying art principles (unity, emphasis, balance, variety, movement, and proportion).

2. Inventive and imaginative expression through art materials and tools.
 - 2A Exploring individual directions through the design, development, and creation of original artworks.
 - 2B Selecting from art areas (drawing, painting, ceramics, printmaking, fibers, appreciation/history, sculpture, jewelry, commercial art, photography/filmmaking, and electronic media).

3. Understanding and appreciation of self and others through art culture and heritage.
 - 3A Appreciating contemporary and past artworks and examining art history.
 - 3B Exploring art and artists through visuals and visitations.

4. Aesthetic growth through visual discrimination and judgment.
 - 4A Evaluating artwork (students and major artists).
 - 4B Applying aesthetic judgments and art criticism.

The majority of the students are Limited English Proficient, therefore, the introduction and study of the appropriate vocabulary is an integral part of the lessons. As, or more importantly, is the inclusion of "real life" and/or visual representations of the subject matters. Since it is impossible to know which students understand or even correctly interpret the verbal intent, the visual clues are essential. Giving limited examples and brief instruction seems to promote more creative interpretation than requiring that specific and extensive directions be followed.

As in any class, each student enters with his/her own store of knowledge and skills; however, this particular setting is very exciting due to the diverse ethnic mix. The majority of students are Hispanic, having been born in the following countries, and having immigrated to Houston, Texas, within the present year or past several years: Mexico, Belize, Honduras, Salvador, and Guatemala. Nations in South America represented in the classrooms are Colombia and Brazil. The continent of Africa has enriched the environment with students from Ethiopia and Somalia. From

the Far East to Europe, we enjoy the cultures of Vietnam, Thailand, India, Pakistan, Iran, Iraq, and Bosnia. Sharing language learning is one of the primary interests of the students; although, seldom an integral part of a planned activity.

The most effective strategy is cooperative learning. Demonstration techniques are essential coupled with the instructor's encouragement of continuous interaction among the students.

OBJECTIVES

1. The students will practice recognizing symmetry and patterns in the physical world, known to them either through objects or pictorial representations and become familiar with the "language".
2. As examples of symmetry and patterns are gathered and studied, the students will read and discuss assigned materials.
3. Students will reproduce or produce symmetry and patterns combining line, shape, space, and color.
4. Students will use various media to produce projects representing symmetry and patterns. The products will be utilitarian or decorative.
5. Students will first produce realistic representations and then graduate to stylized or abstract images.
6. Students will listen to musical selections from the various ethnic groups during their classes.
7. The students may, at any time, interject thoughts or make suggestions appropriate to the lessons.
8. The students will express freedom of choice for their own projects within the assigned topic.
9. Each student will complete the assigned projects within the maximum allotted time.
10. Students will practice assessing their own learning and criticize all work according to the elements and principles of art.

The objectives within the Texas Assessment of Academic Skills in the areas of written communication, reading, and mathematics will be integrated.

STRATEGIES

1. Questions/Answer Sessions
2. Demonstrations
3. Readings and Discussions
4. Videos, CD Roms, Slide Presentations
5. Illustrations, Pictures, Objects
6. Use of Multi-Media

MIRROR SYMMETRY or BILATERAL SYMMETRY

FOCUS: The symmetrical nature of our world

OBJECTIVE: The students will read and discuss the following material, and after, study and discussion, produce a symmetrical design in either planar or line form.

INSTRUCTION AND DISCUSSION

The above two expressions are interpreted in the same manner and are familiar to most people even though they may not be aware of the terminology or even of the existence of such in "real" life. Most animals have bilateral symmetry. They have a top and bottom, a back and a belly, and, in addition, a head and a tail. The head develops to lead the way, lateral appendages provide balanced propulsion from the sides, and a tail brings up the rear.

If the environment on one side of a bilateral creature differed from the environment of the other, the creature might develop a completely asymmetrical form. There is a joke about grazing sheep that always circle a hill in the same direction so that their legs on the downhill side grow longer than those uphill. To catch them you need only approach them from the front, so that when they turn to run away, they roll down the hill. A uniform environment produces a living form with a high degree of symmetry a differentiated environment produces an asymmetric form, the flounder being such an example with both eyes peering from the same side of an otherwise symmetric body.

Certain flowers, starfish, sea urchins, jelly fish and sea anemones display rotational or radial symmetry. The diatoms, small water borne animals have spherical symmetry. They bob and spin in the waves oblivious to gravity and unconcerned with directions of up, down, and sideways and they have no need for ends, sides, tops and bottoms.

Some living forms attach to a surface and they distinguish up and down. These creatures develop identical appendages in all directions and have radial symmetry. They have no sense of forward, backward, right and left. No matter how the following design is moved the motif rotates about a fixed point.

A second two dimensional symmetry group consists of patterns which stretch in a line.

The third group encompasses repetitive patterns that spread uniformly across the plane.

Whether in painting, weaving, sculpture or architecture, nearly every artist adopts the strategy in which he makes one part echo another around developed centers of attention. Each repetition precisely duplicates the others, and the centers are rotocenters around which the entire pattern revolves. Repetitive patterns achieve variety and interest through the immensely complicated interrelations of their parts.

ACTIVITIES

The students will create repeat designs with colored pens on 9 x 12 or 12 x 18 paper in any of the above described symmetrical forms in

- bilateral symmetry
- Rotational or radial symmetry
- Two dimensional line pattern
- Repetitive pattern across a plane

Each design must be completed with the balance being evident in line, shape and color.

SOURCES

1. Texts
2. Films
3. Slides
4. Photos
5. Natural objects

EVALUATION

The students will present their own product. The assessment will center on the groups' levels of understanding of the patterns of symmetry incorporated by each student in his/her work.

AFRICAN DESIGN

FOCUS: The many "faces" of Africa in relation to art and design.

OBJECTIVE: The students will expand their knowledge of African art and design in relation to cultural influences.

*Prior Knowledge will be explored through a question and answer discussion followed by videos and slides.

*Independent research will be carried on in the school and/or public libraries in order to extend knowledge.

QUESTION AND ANSWER SESSION

What do you think of when you think of African art or design?

Each student will write as many descriptors as possible for one or two minutes. Then each student will team with another person, compare lists and extend ideas for three minutes. Each team will then share ideas with the entire class.

Answers might include: (write on board or flip chart)

- *wooden masks and figures
- *drums
- *feathers
- *semi nude bodies
- *geometric patterns
- *pyramids
- *fancy rugs
- *dark colors
- *Black or "Negroid" features
- *primitive looking animals
- *floral patterns
- *wild animals
- *carved wooden bowls and figurines

Student Questions:

Is Africa a country? No, it is a continent of many countries.

How many countries can you name?

Do you know someone from Africa? If so, from which country?

Does anyone in the classroom have on anything or anyone have anything at home which appears to be of African design?

What or whom do you think might have influenced art objects of Africa?

INSTRUCTION

The early native art was not influenced by Europeans until the seventeenth century. The tribes made simplified wooden figures and boxes that held the skulls and bones of village leaders or slain enemies.

Masks, mostly abstract design, were used to drive out wizards and witches. Bieri boxes protected families and healed the sick, as did the fetishes. Certain tribes

decorated masks with glass beads, feathers, copper, hair, cloth and cowry shells. The masks were used in initiation rituals and were thought to bring good luck for hunting in the jungles and swamps.

With the political and religious influences of the Europeans, there was a decline of the traditional secular art that served a religious function. Today, it is difficult to get the authentic artwork because it was made mostly of wood or fabric which were easily destroyed by damp climate and insects. During the sixteenth century, the artists began producing metal sculptures.

The Africans do not see art as a separate activity unrelated to their everyday lives; therefore, practical, functional items are produced-for example-stools, chairs, spoons, hair combs and ceremonial canes. Both weaving and sculpture are widespread crafts. The sculpture is considered as one of Africa's greatest contributors to the world's cultural heritage. It inspired the development of Cubism in Europe in the 20th century.

The sculptured figures reflect the cultural concepts rather than realism. The head is enlarged to indicate its importance as the center of reason and wisdom. Their sculpted figures were usually of power figures or ancestral figures. The beaded decorations also denoted power and wealth.

In our present world, African culture has influenced the world of art and design. Galleries and shops around the world specialize in African art. The motifs are evident in evening wear jackets and other clothing, chinaware, wallpapers and bedclothes. There are parallels between sculptured forms of African and modern curvilinear furniture.

Even though "Africa is a vast continent with a melange of cultures, ecological systems and creative perspectives, there are commonalities that transcend into many internal borders. Functional integrity, the graphic use of spiritual symbolism, and a focus on organic elements are constants, from Niger to South Africa and from Morocco to Tanzania." The colors of textiles woven by Ethiopian men in East Africa or Berber women in Northern Africa hold social and ritual significance.

Today across the world, African art is in every aspect of homes-the textiles, surfaces, furniture, windows and walls, beds and bathrooms, kitchens and gardens. The objects have both free style and an asymmetrical quality. The colors range from pastels to primaries and earthtones. Each region, as elsewhere in the world, offers unique expression of design. We all tell our stories through the objects and spaces that we create.

In addition to the use of nature in design, African artists often used geometric patterns for rugs and textiles and ceramic tiles for floors, walls, and stairs.

Activities

Students will be able to choose from these three activities:

1. Tile craft
2. Copper tooling
3. Mask Making

In each case, the design chosen must express the motifs present in African art.

SOURCES

1. Library books
2. Films
3. Slides

EVALUATION

The students will present their products and the discussion will center around the design, color, technique and execution.

TILE CRAFT

Project: Produce a geometric design-line and/or color measured so as to fit a metal or wooden base. Choose color combinations which are associated with African art and are combinations of the color wheel. Measure and create the design on paper first. Use crayon or label the area tiles with color names or letters to represent chosen colors.

Supplies Needed:	Tiles	Spoon
	Metal or wooden base	Grout container to mix
	White glue	Newspaper
	Tile grout	Wet cloth to cover
	Sponge	

Directions:

1. Using a variety of tiles and tile colors, artist is to create a balanced pattern. Keep the space as tight as possible. Tiles should be no more than 1/8" apart.
2. Glue the tiles down using white glue.
3. Mix tile grout as directed on the package.
4. Pour the grout onto the tile. Smoothe with a squeegee.
5. Tap the tile form to release air bubbles.
6. Wipe the tiles clean with a damp sponge. Do not get too much water into the tile form. It will weaken the tile grout.
7. Let form dry at least 24 hours.
8. Clean tile with water or a window cleaner. Scrape off excess grout with an x-acto knife or with a razor blade.

COPPER TOOLING

Project: Copper Tooling

Supplies needed: 1 - 6" x 9" copper foil sheet
soft pad (magazine covered with paper)
stylus = pointed and flat wooden stick and flat wood pad
liver of sulphur mixture and container
newspaper
rinse tub
varnish
brush

Directions:

1. Draw your pattern to size on a 6" x 9" paper. Keep the subject large and simple.
2. Tape pattern onto the copper sheet. Warn students that the corners are sharp.
3. On top of a soft pad, trace pattern onto the foil. Use a ball point pen. Pattern can be seen on the reverse side of the foil.
4. Using a wooden stylus, emboss the pattern slowly and lightly. Do not push your metal as you are actually stretching the metal.
**to emboss = to raise or lower the surface of the metal by using the wooden stylus.
**to raise the surface=press with the flat end of your stylus from the backside.
**to lower the surface=press with the flat end of your stylus from the topside.
5. Remember, you must outline with the point of the stylus everytime you emboss an area.
6. Rotate the areas where you are embossing and you must always outline the shape you created.
7. Once your pattern is embossed, you must flatten the background. Use the one-inch flat stylus and run the stylus down. Go vertically, then in a horizontal direction.
8. Outline for the last time.
9. Line work area with paper. Clean your metal with a dry steel wool pad. You are removing the dirt and fingerprints from your foil.
10. Brush on the stain quickly. Rinse off the excess and let dry.
11. Clean off the stain you do not want with a clean steel wool pad. When finished, rinse under water and let dry.
12. Spray or brush on a clear varnish.

MASK MAKING

Project: Mask making

Supplies needed: Newspaper or newsprint
Large foam plates and scissors
Papier Mache mix
Large plastic cups
Tempera paint and brushes
Beads, feathers, yarn, etc..any desired decorative items

Directions:

1. Place newspaper on desk/table.
2. Cut foam plate to desired shape.
3. Stuff with paper.
4. Mix papier mache to desired consistency.
5. Place light to medium base coat on the foam plate.
6. Form brows, nose, mouth.
7. Dry overnight. Continue forming desired shape.
8. Dry for 5 - 7 days.
9. Paint faces using African designs.
10. Add hair, ears, decor, as desired.

VIEW LIST FOR STUDENTS/CLASSES
Available through Reservations
Museum of Fine Arts, Houston, Resource Center Catalogue
713-639-7300

SLIDES

(Black)

Black Art: Ancestral Legacy

The African Impulse in Africa-American Art

Cat. # #Mins #Slides Text Audio Prints

617 12 x

VIDEO

617 28

The African Art Collection at the DeYoung Museum

663 20 x

African Art

015 86 77 x

Masks of Africa

626 15 x

(Latino)

Contemporary Mexican Photography

318 20 x

Latino Art and Culture, Bilingual study guide

608 14 10

VIDEO

608 29

Pre-Columbian Art

600 40 x

Hispanic Art in the United States: Thirty Contemporary

309 x

Painters and Sculptors

(Asian)

Out of the East Horizon/Seattle Museum

615 60 16 x x

The Chinese Past: 6,000 Years of Art and Culture

043 58 48 x(2)

Arts of Asia: China, Korea, Japan

627 16 x

Spring Blossoms, Autumn Moon, Japanese Art

614 60 20 x x

VIEW LIST FOR STUDENTS/CLASSES

VIDEO

	Cat. #	#Mins	#Slides	Text	Audio	Prints
Salvador Dali	78					
Georgia O'Keefe	655	59				
Kindred Spirits: Contemporary African-American Artists	670	30				
The Mexicans: Through their Eyes	660	60				
The Mythology of Ancient Mexico	768	19				
Frida Kahlo	680	62				
The Emperor's Eye	839	58				

CD ROM

Escher Interactive	615					
Picasso	616					
Nile: Passage of Egypt	611					
Annabel's Dream of Ancient Egypt	612					

READING LIST

Ragans, Rosalind. Art Talk, Second Edition. Columbus, Ohio: MacMillan/McGraw-Hill, 1994

Assignments for topic.

Escher, M.C. The Graphic Work, Introduced and Explained by the Artist. Czech Republic, Benedikt Taschen Verlag GmbH, 1992.

STUDY PRINTS

Latin American Images	601	15	x		x
Mexico: Splendors of Thirty Centuries	604	8			x

MULTI-DISCIPLINARY RESOURCE CURRICULUM KIT

Video featuring 4 Texas artists and others SP314
32 posters, manual with lesson charts, art-making
lessons plans, and information on the works of art.

ART-TO-GO POSTER SET

24 laminated posters, labels, signs, glossary, activities, SP312
information on each poster. 2-4 weeks.

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3. Algotsson, Shame, and Denys Davis. The Spirit of African Design. New York: Clarkson Potter Publishers, 1996.