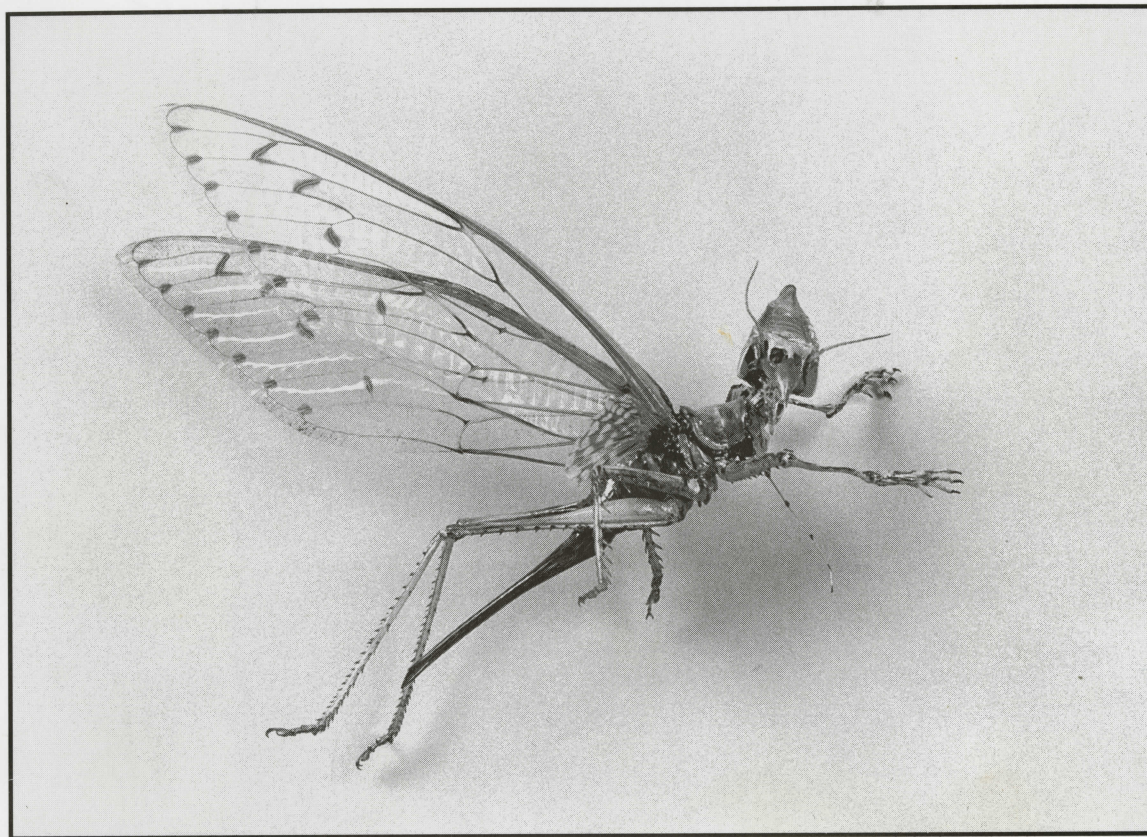


M U L T I P L E S

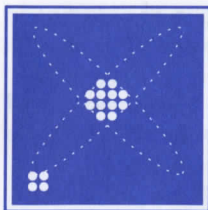
*THE SCIENCES AND ART*



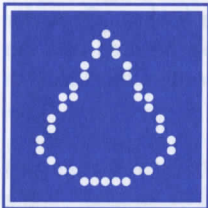
*A R T I S T S*

PAUL BERGER  
BILL BOWLER  
NANCY GOSS  
PEGGY GRUEN  
DEAN JOHNSON  
DANIEL MARTINEZ  
JIM RITTIMANN  
ROBERT TEEPLE  
CHRISTOPHER WATTS  
BILL WILL

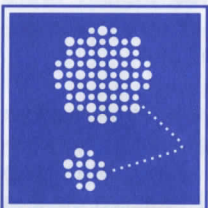




Symbolic representation of an ATOM of helium. Two electrons orbit a vibrating nucleus.



A revolving CONE is represented.



Nuclear FUSION. Two atomic nuclei fuse and release energy.



Optical illusion of depth occurs when an image of CIRCLES are animated.

**T**he *Sciences and Art* exhibition, workbook and videotape are created to stir creative and critical thinking and to encourage reflection and discussion. After looking at the exhibition, and considering the artists' ideas and creative processes presented in the video tape, viewers may notice that observing art, making art, and conducting investigations and experiments have a lot in common.

Many thanks to the ten artists who share their art and experiences in the exhibition; the author, Sheila Mullen, whose knowledge and spirit of fun inspires learning; the videographer, Terry Amadei; the exhibition designer, Deborah Rutherford; and students who inspired the project.

Abby Ehrlich  
Public Schools/Public Art Program Manager

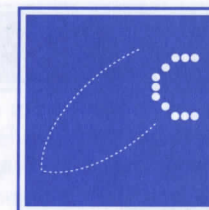
**P**ublic art has been placed in Washington's schools since the passage of innovative legislation in 1974. The current collection of over 2,500 works can be seen in the state agencies, colleges and universities, and public school buildings. Unlike any other state in the country, Washington elementary and secondary schools are seen as viable environments for placing the art of our time. Using the regional system of the Educational Service Districts, Washington Schools Art Collection moves between schools and reaches students and their communities in remote as well as urban areas.

Over the years, the Arts Commission and its partner agencies, including the Office of the Superintendent of Public Instruction, Washington State School Directors' Association, and local school districts, have worked to make collections accessible and to integrate art into everyday learning. The concept of multiple touring collections is the part of the program specifically established for sharing art collections among school districts.

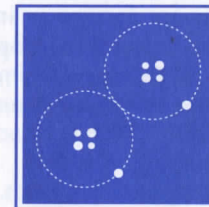
*The Sciences and Art* collection explores ideas and issues related to science. The collection offers different perspectives of artists looking at, thinking about, and using science in their work. Their speculations, investigations and discoveries ask students to relook at some of the assumed and widely accepted aspects of this subject.

Many thanks are due to those individuals and artists who participated, influenced and contributed to the many points of view in this collection.

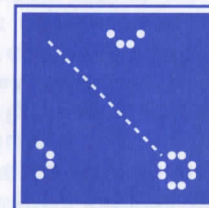
Sandra Percival  
Art in Public Places Program Manager



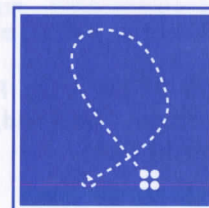
CENTRIPEDAL effect and the slingshot effect.



Two symbolic HYDROGEN atoms combine to form a molecule of H<sub>2</sub>.



Three objects ORBIT an unseen body.



Matter is sucked into a GRAVITY WELL.



## BILL BOWLER

Born: 1941, Boise, Idaho  
Lives: Moscow, Idaho

**B**ill Bowler's mixed-media artwork combines sculpture and electronically controlled light and sound. The light and sound sculptures at first appear to be magically changing, colorful, geometric forms. Hidden within the uncomplicated-looking sculpture is a compact laser disc player, colored light bulbs and an electric timer. As viewers observe, the subtly colored light changes and the form within the box appears to change shape.

Bowler experiments with the viewers perception of space. By making subtle environmental changes—light, color, sound—around a geometric form, he tests concepts of visual illusion vs. reality. The size and scale of the piece and the earphones invite viewers to have a personal, individual experience with the art.

### Titles of the Art

#### Field Series



### Observation Questions

- ◆ When you approach this artwork, which of your senses do you use first?
- ◆ How many different parts to the artwork are there?
- ◆ How would you describe the sculptural form inside the box before the light is activated? How many variations or phases do you see throughout the light cycle?

◆ What's causing the original form to change?

◆ Are the shapes you're seeing *real*? Why or why not?

◆ What part does the audio track play in the artwork? Why do you think the artist chose this music? Would it be different if you were listening to M.C. Hammer? How?

◆ Can you shut out your immediate environment when looking at this artwork? How do you do that? What does that do to the size of the sculptural form? What does that do to your size in relationship to it?

◆ How is seeing different from perceiving?

◆ Do you think everyone sees the same shapes that you do? What can make people see things differently?

◆ What things can you think of that try to hold your attention for a specific cycle of time?

◆ What do you think the artist studies or researches in order to prepare for his work?

◆ Can you imagine this artist working on a large scale? What might he do?

### Investigations

**1** Make a list of things that require you to focus attention into a boxed environment (TV, pinball, computer games, movies). Record on a chart how many of them do the following: represent life to scale; require you to manipulate the image; utilize senses other than sight; encourage you to shut out the rest of your environment; give you the opportunity to make decisions; attempt to influence your thinking; use the craft of illusion. Why do you think Bill Bowler chose this format for his work?

**2** Take a 12" x 12" piece of paper and make four folds of your choice so that you have a three-dimensional form. Do a survey: Place the folded paper in front of 12 or more people, one at a time, and ask them to describe the shape they see. Record their descriptions. Note how many use geometric shapes to describe it, how many compare it to an object and how many think the task is too difficult. Observe what methods they use for observation: moving the form, walking around it, staring off into space, using their hands or something else. What are your thoughts about how people approach forms that do not have an obvious function?

REMOVED from  
"The Sciences and Art"  
Collection

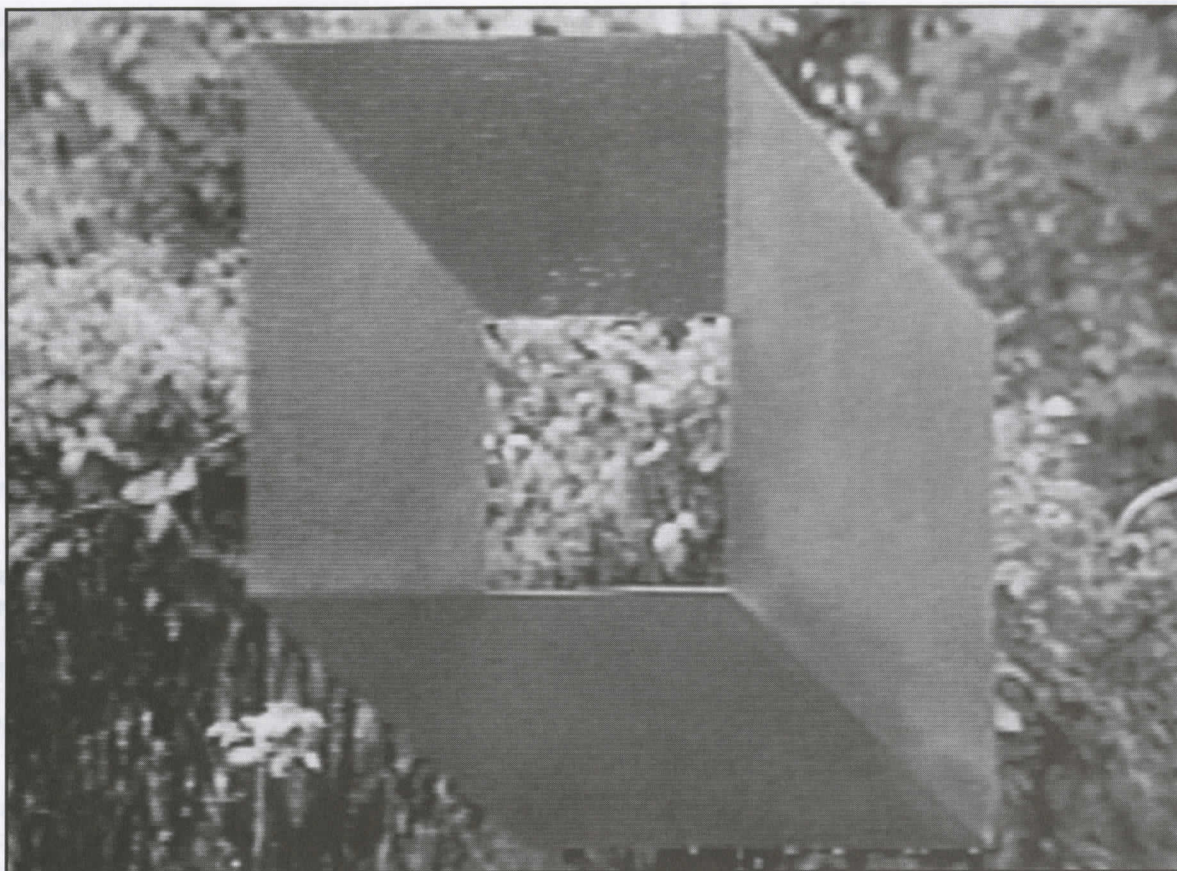


**3** Make a list of things for which changes in light intensity or color are necessary for the object to perform its *task* (sundial, camera, electronic image screens, movie screens).

**4** Stand in front of a mirror and turn out the lights in the room. Using a flashlight, experiment with its effect on your face as you vary the distance, angle and movement. Without changing your facial expression, record what you need to do to make your face look frightening, soft, big or flat. In your record book, suggest the appropriate music or sound effects to enhance each image.

**5** Select a simple object you can place on the table in front of you (book, lunch bag, sun glasses). Make a quick sketch of the object. Now sketch the object as you see it when: reflected in a saucer lid, seen through a prism or bottom of a thick glass, seen through a container of water as it's stirred. Has the object changed?

**6** Investigate the art of origami, the phenomenon of shadows, the science of holograms, the phases of the moon.



Cube

### Hypothesis

Artists often ask us to question the difference between what is real and what is our perception of what is real.

### Experiment

You are a nationally recognized artist who has been commissioned to create a new public artwork for the mall. You have determined that the theme will be *Reality or Illusion?* It is to be an interactive work with the visitors to the mall. Create a model or detailed sketch of your artwork proposal. Explain the idea to a committee of mall managers.

### Facts to share

■ As he works, the artist asks himself, "Can I have an object appear to change shape, for example from a pyramid to a trapezoid?" Often something unanticipated happens and leads to a new discovery.

■ Light and sound operate as two independent systems in the artwork. It is the viewer's mind that puts them together into a single experience.

■ Red, blue and amber colored light bulbs are the only sources for the many color changes in the artwork.

■ Bill Bowler is Associate Professor of Architecture at the University of Idaho.



# NANCY GOSS

Born: 1954, Columbus, Ohio  
Lives: Supulveda, California

**N**ancy Goss collects and photographs familiar images from fairy tales, comic books, science fiction movie posters, medical text books, natural history magazines and books of Old Master paintings she finds in old book stores and libraries. The scientific information Goss uses includes both current and outdated methods that were once science fiction, but now are scientific fact. Because her ideas are drawn from her interest in science, dreams, childhood memories and intuition, her work is easy to decipher, but mysterious to interpret.

Nancy Goss uses an unusual photographic technique to illustrate feelings that are difficult to express with words. Her photographs are printed with an enlarger on transparent sheets of film, similar to the technique used to produce overhead projector transparencies. She paints the backside of the film with acrylic paint and then strengthens it with cheesecloth and more clear acrylic film. Her unique artistry is in the way she places pictures side by side to create exciting compositions.



## Titles of the Art

Little Red Riding Hood, Hyde, Anima, Imago, Sweet Dreams, Fahrenheit, Illustrated Man, Ark, Dutch Masters, Siren

## Observation Questions

◆ Can you describe how your eyes moved through this artwork?

◆ Do you think the artist wants you to see the work in a certain order? Why or why not?

◆ Is there one image that draws your attention more than any other? Why?

◆ Do some images make you uncomfortable? Which ones? What emotion do they trigger? Why?

◆ If you studied the work before reading the title, did the title have

any connection with your sense of what the work was about? Do you think there needs to be a connection?

◆ Which images do you think are taken with the artist's own camera? Which images come from other sources? What sources might those be?

◆ How was this artwork created? Why did the artist choose transparent film for recording the images rather than photographic paper?

◆ At what point in creating the artwork do you think the artist used the process of experimentation? Why?

◆ This artist's ideas came from occurrences as different from one another as dreams, news stories, personal experiences and conversations with friends. What do you think might have inspired the work you're looking at?

◆ What are some things the artist might have considered when making decisions about the placement of images? (What goes where, and why?)

## Investigations

**1** Make a chart with the same rectangular divisions that you see in the artwork. Carefully study the images, one at a time. Consider all the possible resources for finding each original image (old medical journal, book about Leonardo daVinci, personal sketches). Record those resources in the corresponding divisions of your chart.

**2** List all the ways you can think of to manipulate or change a photograph.

**3** Select an object from your desk drawer. Go through an old magazine and clip out images that relate to that object's origin and function. Go through another magazine and clip out images that relate only to the object's form. Which images were more difficult to find? Why?

**4** Select a natural phenomenon such as thunder and lightening, the growth of a carrot, earthquakes, salmon migration or the eclipse of the sun. Write a myth that might have helped ancient man/woman explain the phenomenon.



Illustrate your myth with the kinds of symbols you would have used in your cave drawing of that occurrence.

**5** If you keep a journal, spend one week recording incidents or ideas that made you stop and think or formulate an opinion (a crime in your community, a dream you had, a law you think is wrong, a chance meeting with an amazing person). After one week, study your list and think about the sources of the things you've recorded. How many started with conversations with friends? How many from reading something? How many from time alone, thinking? Does your list tell you anything about yourself?

**6** Investigate the technique of printing on high contrast sheet film, the psychology of color, the artwork of Robert Rauschenberg or James Rosenquist, the photography of Edward Weston, haiku poetry.

## Hypothesis

The positioning of images in relationship to one another can enhance or change the original meaning of the images.

## Experiment

You are a creative architect of the 22nd century. You have an opportunity to design a three-story city office building that houses nine major government offices: *Crime, Housing, Transportation, Food, Dress, Family, Education, Taxes, and*

*Entertainment.* You have been told the outside of the building must reflect all nine departments and still appear as one government. Technological advances make all techniques and materials available to you. Create the drawing that will convince the city council to hire you.



Illustrated Man

## Facts to Share

■ Ear piercing, tattoos and scarification are three ways that people from different cultures change and decorate themselves to fit their societies' ideas of beauty. The piece *Illustrated Man* shows examples from all over the world.

■ G-force is the pull or force of gravity on matter within a force field. The picture of the distorted man's face in *Hyde* (for Dr. Jekyll and Mr. Hyde) was taken in a G-chamber that has tremendous gravitational pull. G-chambers are used for scientific research, and testing and training for pilots and astronauts.

■ The image of *Mona Lisa* by Leonardo da Vinci appears in the composition *Anima*. The name *Anima* comes from a psychological term meaning inner personality and the feminine part of a man's personality.

■ Two details of Rembrandt's painting *Anatomy Lesson of Professor Tulp* appear in *Dutch Masters*.

■ The piece entitled *Imago* refers to the last or perfect state of an insect, usually the winged stage after metamorphosis.

■ A vortex is a spiral force that occurs in nature, for example in whirlpools. The vortex image and others of undersea life in *Sweet Dreams* comes from the poem *Rime of the Ancient Mariner* by Samuel Taylor Coleridge (1772-1834).

■ There are five medical doctors in the artist's family.

■ According to the artist, her dog, a great friend and watchdog, always keeps her company in her studio at night no matter how bored she gets or how late it becomes.



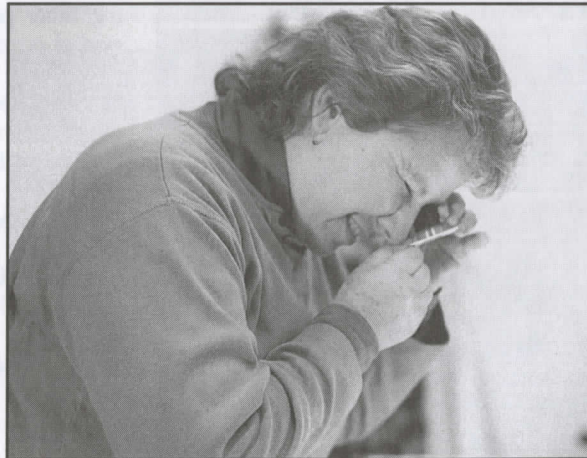
## PEGGY GRUEN

Born: 1944, Los Angeles, California  
Lives: Spokane, Washington

**P**eggy Gruen's brilliantly colored artwork grows from an early love of photography and a more recent interest in computer graphics. She has developed a method of combining a photographic image with a computer-generated background. The artist selects boldly shaped elements from nature, such as sea creatures, shells, plants and flower blossoms, to photograph. She uses a computer, much like a palette full of paints, to create colorful designs and patterns for the backgrounds. She then blends the realistic images from nature with computer-generated abstract backgrounds. These prints are cibachrome photographic compositions.

### Title of the art

**Murmur from Afar, Three Tulips, Orbiting Shell 1, Color It Red, Neon Jungle, Fan Shells, Starfish, Separation, Half Leaf, Snail Shell**



### Observation Questions

- ◆ How many *layers* of visual information do you see?
- ◆ What tools were used to create this work? In what order was it pieced together?
- ◆ Describe the shapes you see. Is one shape stronger than others? What about the colors? Is there a suggestion of texture?

◆ Is there a background and foreground? Where do they meet? Did the artist do anything to blend their intersection?

◆ This photograph is two-dimensional, yet some of the images and shapes appear to be three-dimensional. What visual elements create that illusion?

◆ How do you know if you're looking at a real

space or an illusion of space?

◆ If you look closely at the photograph with a magnifying glass, what happens to the images?

◆ What's your definition of illusion? Who uses that skill in their work?

◆ What are some other examples of creating new backgrounds for objects and people, then re-presenting them to an audience (TV weather reports, theater sets, aquariums)?

◆ What other objects from nature can you imagine this artist working with? Why?

◆ What could this artist do for a living if she decided to take a break from making art?

◆ What other artist in this exhibit uses photography and computer imagery in the same composition? How are their techniques similar? How are they different?

### Investigations

**1** List all the things you encounter in one 24-hour period that are created by a computer. Is the list longer or shorter than you thought it would be?

**2** Close your eyes and *picture* a friend. With your eyes still closed, make quick visual changes so that the background you see them in changes from hot to cold, peaceful to chaotic, fun to serious.

**3** You are a photographer for the National Enquirer. Using magazine images, create five *fantasy photos* in which you have combined foregrounds and backgrounds taken at different times and locations. Write headlines for your *recreated* photographs.



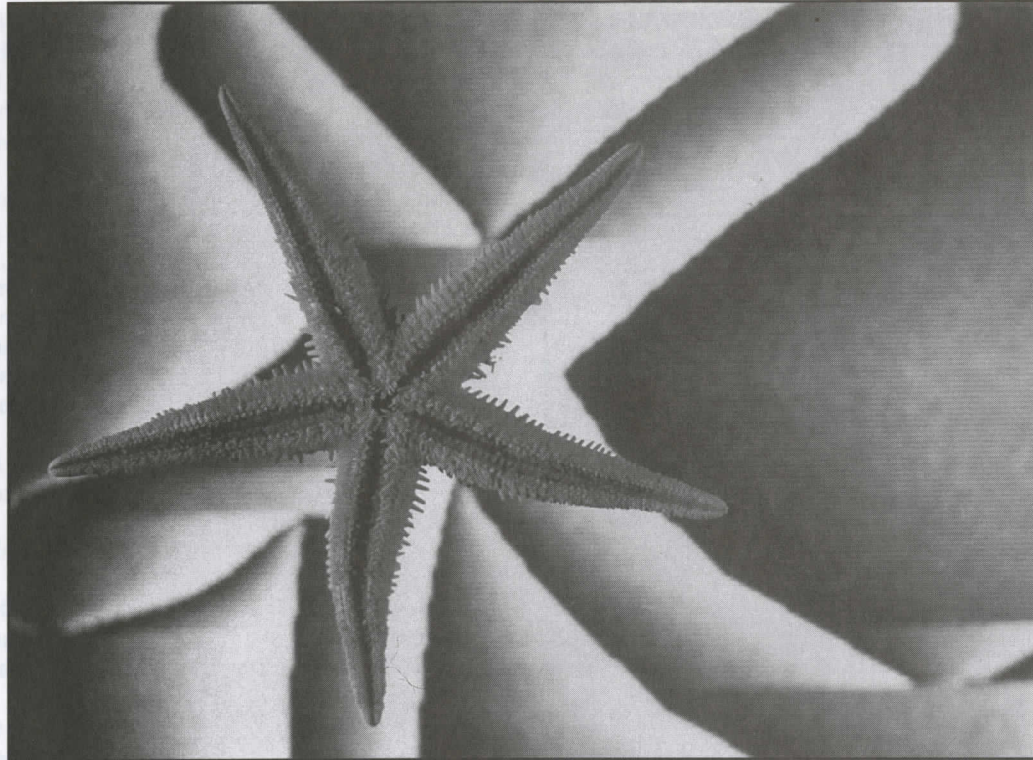
**4** Select an object of importance to you (shoe, ring, photo). Using an empty box of appropriate size, create a display case for the object. Pay special attention to the environment you create and how well it shows off your *center of attention*.

**5** Keep a sketch pad in which you record the outline of objects you encounter that are nature-made (shell, tree branch, dog paw, pinecone). Select ten different outlines from your records. Through the use of repetition, overlap, changing of size, varying thickness of line and color, create a wallpaper design for your room.

**6** Look into the technology of movie special effects, the paintings of Giorgio de Chirico, the photographic process of cibachrome printing, the craft of theater set and design.

### Hypothesis

How we feel about an object or person is often affected by the environment in which we see them.



Starfish

### Experiment

Select a clear photograph of yourself or someone you know well. Make five photocopies of that image (you may need to enlarge or reduce the image to a workable size). Using only the abstract elements of texture, color, line, form and

pattern, create five different backgrounds for the photocopied subjects that convey:

- 1** mystery
- 2** control
- 3** comfort
- 4** fear
- 5** joy

With your subject adhered to the background, photocopy each composition, merging foreground and background. Swap your set of experiments with someone else, see if you can guess which of the five environments is which. Evaluate what visual clues were most successful.

### Facts to share

■ The characteristics of a cibachrome print are intense color and a luminous, long lasting image. They can be made from slides only, not negatives.

■ The artist was surrounded by visual artists as a child. Her mother was a toy and furniture designer, and her father was an architect.

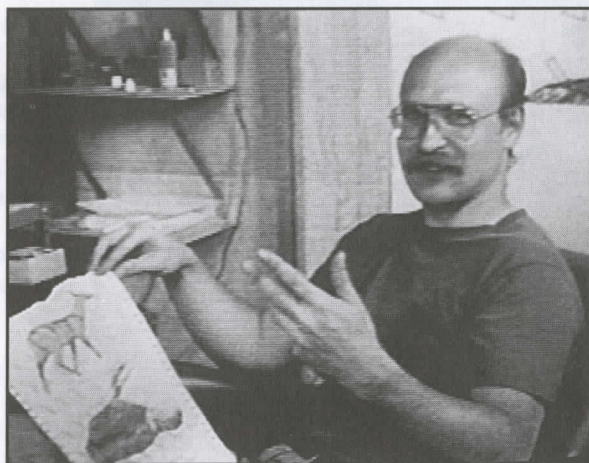
■ The artist has loved photography since she was quite young and developed her own photograph for the first time when she was nineteen years old.



## DEAN JOHNSON

Born: 1956, Minneapolis, Minnesota  
Lives: Cheyenne, Wyoming

**I**n his sculpture, Dean Johnson is exploring the concept of measurement as it applies to memories. He asks us to think about the differences and similarities in how science and art record memories. Presented with this question, viewers may also question whether values can be measured and compared.



### Title of the Art

### The Value of Memories

### Observation Questions

- ◆ What was the first thing that came to mind when you saw this artwork? Is that because of something you've seen before? If so, what visual clue triggered that memory?
- ◆ What made you flip the picture panel? When you did, was there any connection between the two images for you? How important was it to make a connection? What did you do to *figure it out*? Did the artist give you any clues?

◆ How many different materials did the artist use? Which are the simplest and which are the most complex? Why did the artist use both in the same artwork?

◆ How important do you think memories are? How has the computer age changed the way we remember?

◆ Which memory is more accurate, the computer's or your own? Why? Do you and the computer specialize in certain memories? What can you record that the computer can't?

◆ Why do you think the artist chose this design for presenting his work, and why this particular photograph?

◆ What does the concept of measurement have to do with this artwork?

◆ What do you suppose the artist would like you to think about? What would you like the artist to know about your response to the work?

### Investigations

**I** Find an old photograph from your past. Set aside fifteen minutes and think back to the time it was recorded. On the top of a piece of paper, write the five senses: *Touch, Taste, Sight, Smell, and Sound*. Under each of those headings, fill in what you can remember (my sister was

squeezing my hand too hard, my cousin smelled like cherry bubblegum, the TV was on in the background). What helped you to remember (staring at the photograph, staring into space, closing your eyes)? What was your greatest memory block?

**2** Investigate the concept of measurement. Interview people from five different occupations (teacher, computer operator, bus driver, dancer, homemaker). Talk to them about what they most often have to measure. How do they record those measurements? What tools do they rely on, and how accurate do they think those measurements are?

**3** Make a list of things whose value, you believe, cannot be measured.

**4** Look carefully at the photograph in Johnson's artwork. As though you were one of the people in the photo, tell the story behind the photograph. Recount the same story as though you were a computer programmed to record the event.

**5** Make a survey of your home and room. How is the past recorded, stored and/or displayed? Make a research list:

- a** Types of events recorded (birthdays, accomplishments, acquisitions)
- b** Method of recording (photo, stories, video, scrapbook, journal)
- c** Tools for preserving (frames, boxes)
- d** Methods of display (picture wall, refrigerator door, bulletin board)

Based on your observations, describe how your family records its history. Consider the need for personal vs. collective memories and the value of any preservation effort.



**6** Imagine yourself at age 90. Make a drawing of the things on top of your television set that you look at every day and want people to see when they visit. Diagram and label the objects. Put the drawing someplace safe so you might happen upon it when you're 90 years old.

**7** Find out who writes your current history text book. Write and enquire about their methods of research.

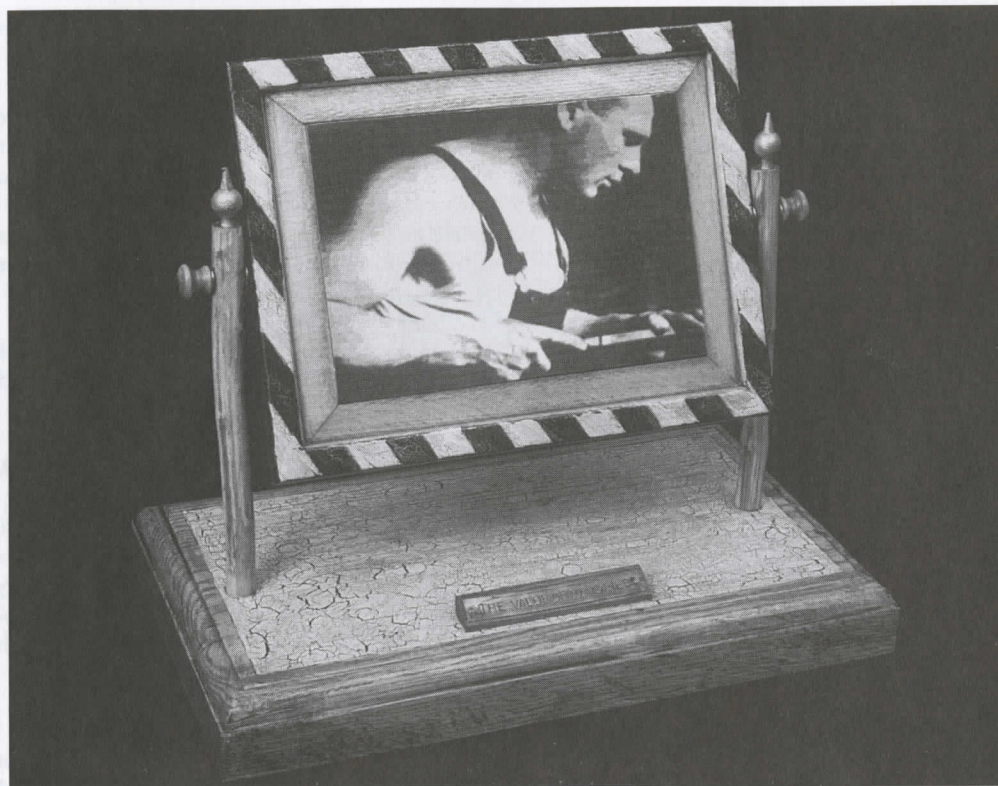
**8** Investigate the cave paintings of Lascaux, the Vietnam Memorial in Washington, D. C., the early computer inventions of John Vincent Atanasoff, the photographs of Edward S. Curtis, long-term vs. short-term memory, the writings of Robert Graves and the songs of Bob Dylan.

## Hypothesis

The collective memory of humankind is kept alive, in part, by the number of options we have for recording memories.

## Experiment

Choose an event in our country's past (the attack on Pearl Harbor, Womens' Liberation Movement, Civil Rights Movement, Boston Tea Party, Cuban



**The Value of Memories**

Missile Crisis, Watergate, Prohibition, The Great Depression, The San Francisco Earthquake). Select a method of a personal accounting of the event from the following:

- ✧ painting
- ✧ oral history/story
- ✧ dance
- ✧ newspaper/magazine report

- ✧ poem
- ✧ statistics
- ✧ radio news account
- ✧ psychological analysis
- ✧ commemorative sculpture
- ✧ song
- ✧ scientific inquiry

Select a different point of view to the account and re-record the event using an appropriate method. Tie the two memories together into one visual or verbal presentation.

## Facts to Share

■ The numerical chart on the artwork represents how a computer interprets and records the tonal value of pixels in the image (for example: 15 = white, 0 = black).

■ The artist is interested in the texture of materials. This series includes five different kinds of wood: oak, lilac, birch, pine, and plywood.

■ Dean Johnson originally studied engineering in college, but changed plans to pursue work in sculpture, painting and computer-generated graphics.

■ A long-time inventor and tinkerer, as a child the artist made all sorts of things and took others apart to see how they worked.



## JIM RITTIMANN

Born: 1951, San Antonio, Texas  
Lives: South Prairie, Washington

**J**im Rittmann's artwork is the embodiment of a fascination and appreciation of how nature works—from the smallest parts of tiny insects to the interrelationship of living things in the environment. His sculptures are made of real body fragments from dead mammals, amphibians, reptiles, birds and insects which he finds along the roads around his rural home and during his travels. He also receives donations from family and friends, natural history buffs and his cat, O.P. (for Old Paint). The animals are cleaned by his crew of beetles, the same method used by natural history museums. The painstaking assembly of reconstructed creatures requires surgical precision and creative imagination. The art invites viewers to observe very closely and question what is natural and what is the result of the artist's hand.



### Title of the Art

### Reconstruction Series

### Observation Questions

- ◆ How many different insect/animal parts do you see?
- ◆ Is there anything about this work that makes you uncomfortable? What? Why?
- ◆ What tools/materials do you think the artist needed to create this?
- ◆ How do you suppose he finds the parts for his work?

◆ Why didn't he use colored paints to change the surface colors?

◆ How many different textures would you feel if you were able to touch it? Is there a mystery texture that is not identifiable by your eye?

◆ Can you imagine his studio/workspace? What does it look like? How does he store the parts? (see video tape)

◆ What clues are there to show you where one insect/animal part meets another?

◆ Based on what you see, what would you call this new creature? What insect/animal phyla would it fit in or would you have to create a new category?

◆ If this creature did exist, where would it live? Where would you find it if you wanted to observe its habits? How would it move? What sounds would it make?

◆ What skills would you need to create these artworks (powers of observation, patience, precision)?

◆ What's the greatest threat to the safety of this artwork? What steps have the artist and display designer taken for its safety?

◆ What tasks have you undertaken that required as much attention to detail as this artwork?

◆ What are some other examples of man/woman reordering their universe?

◆ Why is this an artwork and not a museum specimen?

### Investigations

**1** Make a list of other jobs or tasks that require as much close observation and precision as the creation of these works of art.

**2** Select an object you come in contact with every day (radio, calculator, CD cover, your shoe). Spend at least 10 minutes carefully looking at the object until you can write down 10-20 things about it that you didn't notice before. Consider what made this task easy or difficult. What was required (no distractions, a magnifying glass, convincing yourself it was worthwhile)? Why don't we do this more often?

**3** Divide a piece of paper into three columns. In the first column list examples of natural construction (seeds, volcanoes), in the second list examples of destruction (fire) and in the third list examples of reconstructions. How did you define *reconstruction*? Now do the same thing for man/woman-made examples. Compare your lists. Do you think nature or man/womankind is better at reconstruction? Why?



**4** Interview someone who does detailed work, requiring patience and manual dexterity. What are the rewards? Drawbacks? What skills do they need? What skills do they have? What skills do they wish they had more of? Does it require special tools? Do certain personality traits help? What kind of an environment do they need when creating the work (lace making, model making, computer chips)?

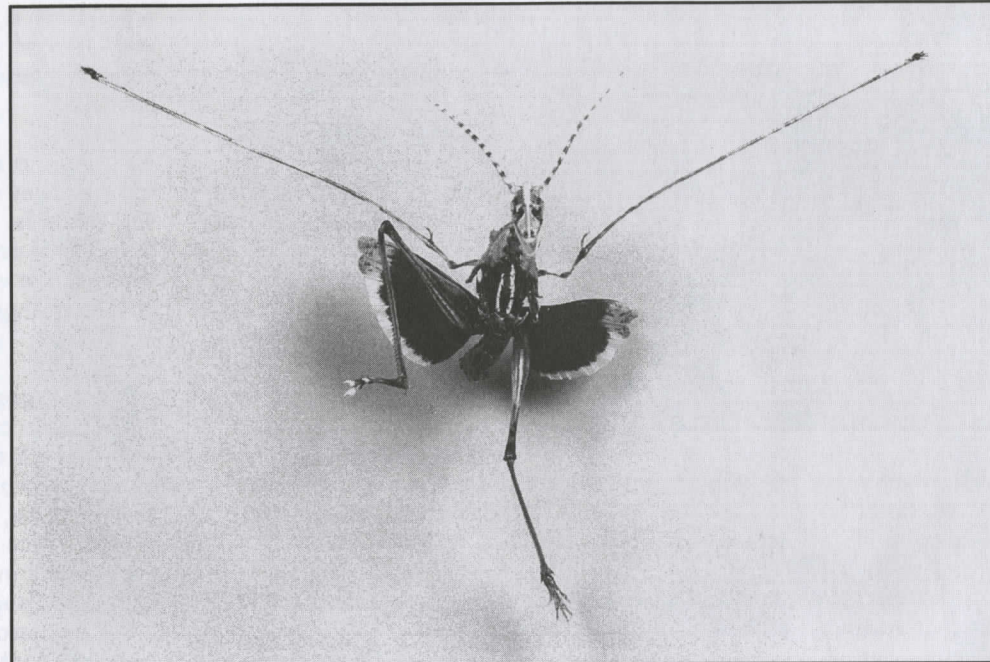
**5** Take time to go through an art history book and identify works that are examples of *reordering*. Are there other examples in the exhibit? Keep a list of things in your own environment that you consider to be examples of *reordering*. If the task is difficult, examine your definition of *reorder*. Is it too broad? Too narrow? Too unclear?

**6** Put these items on a plate: a hair from your head, a paper clip, a piece of lint, a blade of grass, a hole from a paper punch, a piece of a potato chip and a seed. Pretend that these items are the tools of your trade. You will need to collect, store and manipulate them into reconstructions. Fill in the following graph:

	LOCATION	COLLECTION METHOD	STORAGE	PRESERVATION
HAIR				
GRASS				
LINT				
CHIP				
PAPER HOLE				
PAPER CLIP				
SEED				

What did you use as sources of information?

**7** You are a scientist receiving a major award for the discovery of this new life form. Give an oral or written acceptance speech that recounts how the discovery was made, what the creature's habits and habitat are, what this discovery means to the scientific community and how you predict it will effect your life.



**Reconstruction Series**

**8** Investigate the paintings of Hieronymous Bosch, the drawings of Leonardo daVinci, the the artwork of Yves Tanguy.

## Hypothesis

This is a creature that has evolved through a series of adaptations to our physical, technological and social environment.

## Experiments

As a group, brainstorm a list of defined environments: under your bed, a plastics factory, the school cafeteria, a mud puddle, inside your refrigerator. Assign each person an environment. Beginning with the same body unit, a potato, create the life form that has adapted to the assigned environment. At an imaginary science and art conference, present your discovery to the press.

## Facts to Share

■ A dermestid beetle colony can clean a small skeleton in one to three days.

■ The artist works for three to six weeks on each sculpture. He collects and saves hundreds of tiny skeletons, wings, and fragments to use in future works of art.

■ Jim Rittmann is an exhibition designer at the Henry Art Gallery at the University of Washington. He was a professional rodeo rider in Texas before he moved to Washington. His interests include paleontology.



## ROBERT TEEPLE

Born: 1941, Detroit, Michigan  
Lives: Seattle, Washington

**R**obert Teeple's electronic artwork animates symbols and diagrams through changing light patterns. Many of these animations (which, like cartoons, give an illusion of movement) illustrate scientific principles and reveal how things work.



The artist built 16" x 16" grids and arranged 256 lights (L.E.D.s or light emitting diodes) within them. When the viewer touches the switch, he or she is selecting one of 32 possible sequences of off and on, all of which have been programmed by the artist into two memory chips. The chips function as the artwork's brain, much like our own brain which responds to specific instructions when our switches are activated.

### Titles of the Art

#### Scope

### Observation Questions

- ◆ When you first saw this artwork, what did you think it was? How would you describe it now?
- ◆ Is this something you can read? Why or why not? Would you deal with it differently if it was words?
- ◆ How many different light symbols were you able to activate? Which one(s) stands out in your memory? Why do you think the artist chose these images?
- ◆ Is there a difference between universal symbols and personal symbols? What are some examples?

- ◆ Why do you think the artist selected the color red for the screen? What would change if the screen was white?
- ◆ Where else have you seen this type of communication?
- ◆ Can you visualize the layers of *mechanics* behind the surface of the artwork? What do you think they are?
- ◆ Are the symbols actually moving? What makes you think so? Is there some element of illusion working here? What is it? What do this artwork and an animated cartoon have in common?

### Investigations

- 1** Activate the animated symbols. Make a quick sketch of the first five you see and record what you think the artist intended to represent. Now record what that symbol might represent if you were: a cat, a space alien, and the president.
- 2** Make a list of things in which *reading* a pattern of dots or dashes is required (morse code, Chinese checkers, star constellations, flow charts).
- 3** Talk to someone who works with electrical systems or parts. Find out what a light emitting diode is. Ask if they can show you a circuit board that controls an L.E.D. display. Find out what a light emitting diode has to do with being able to change channels on your TV without touching the set.
- 4** Use graph paper or pencil and ruler to create a 16"-square x 16"-square grid (as with Teeple's display). Pretend there is a lightbulb in each of those squares. By turning on the bulbs one at a time, you are able to make it appear that a simple face is being drawn with light. Number the squares in the order in which they should be turned on (sequence instructions). Enlarge your grid if necessary. Consider what you would need to do to create the illusion that the face was talking. (*see video tape*)
- 5** Make a list of ten things people tell you to do on a regular basis (pick up your clothes, turn down the radio, pay attention, etc). Create a visual symbol for each of those requests. Show the symbols to others and evaluate which best communicate your message. Write a brief set of directions for creating effective *universal* symbols.



**6** Put your favorite pair of sneakers on a sheet of paper. Trace around the soles. Using only dots, design new sole patterns that will leave a personal message when running on soft ground.

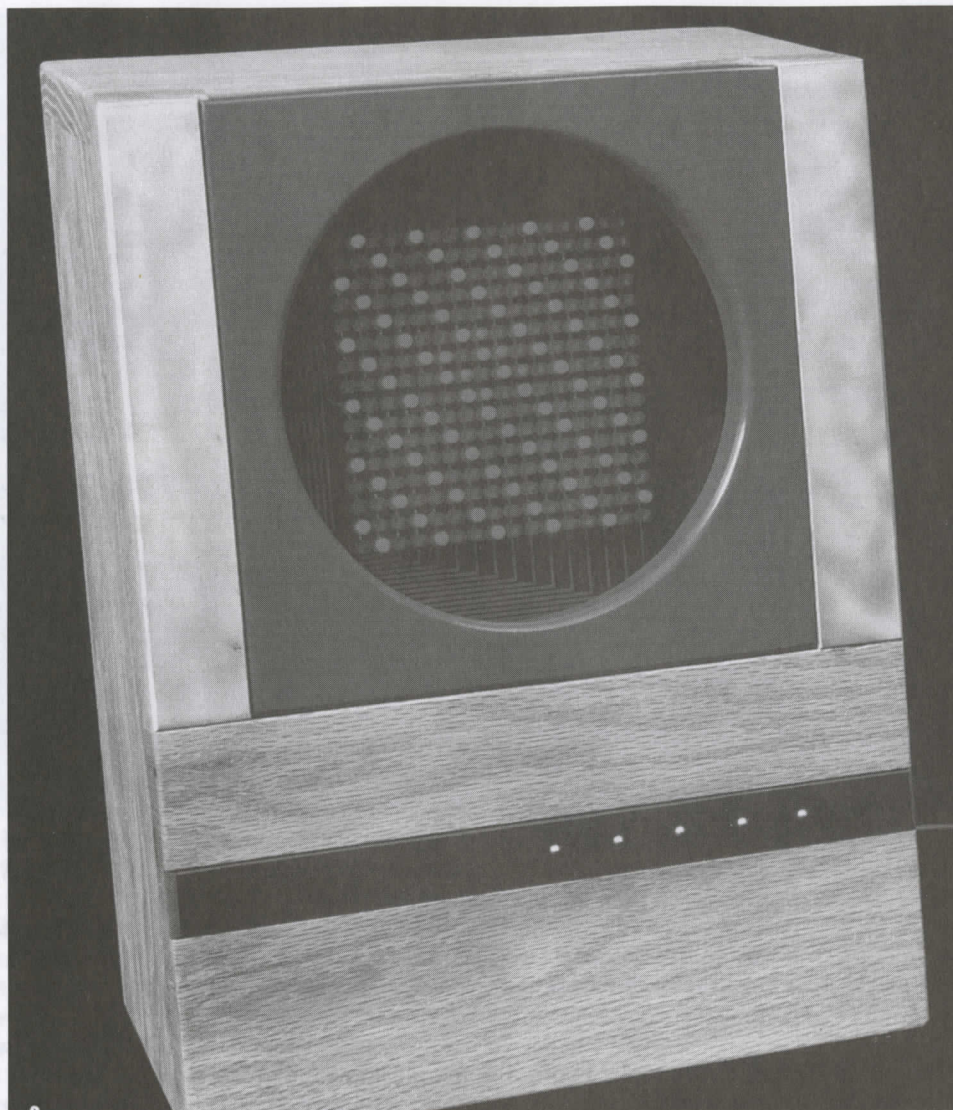
**7** Investigate the photography of Edward Muybridge, the mapping and naming of constellations, the diagramming of electronic circuitry, the art of animation and the concept of implied movement.

## Hypothesis

When our eyes encounter similar, but physically unconnected visual information such as a sky full of stars, our minds have a need to connect that information into recognizable forms (the big dipper, Taurus the Bull).

## Experiment

Place a good sized piece of white paper or matboard on the floor. Sitting in front of it, toss a dozen dried beans onto the surface. Quickly give a descriptive name to the configuration. Repeat the toss, record a new name. After ten such tosses, look at your list of titles. How many are names of abstract concepts (mess, noise) and how many are recognizable objects (open box, truck)?



Scope

Repeat the experiment using separate pieces of paper. This time, after creating a title, connect the beans with a felt tip line. Using five or more of your *implied forms*, create a composition that incorporates these shapes and their written titles.

## Facts to share

■ Look for Robert Teeple's work in the Metro bus tunnel at the University Street station in downtown Seattle. It includes 28 displays consisting of 10,000 light emitting diodes. It is programmed to show over two million different pictures and word phrases.

■ The electronic images in Scope are similar to cartoon animation: each *moving* sequence is actually 1,024 still images which flash on and off in rapid succession.

■ As part of his study of animation the artist observes and times things in motion. He also studies animation in films.

■ A chart of the phenomena represented by the animated sequences accompanies the artwork. Some of the sequences appear in the foreword of this workbook.



## CHRISTOPHER WATTS

Born: 1947, London, England  
Lives: Pullman, Washington

**C**hris Watts creates visual puzzles. Like many scientists, he is intrigued by the relationship between random and controlled order. He studies numerical sequences and arrangements and creates sculpture that illustrates these relationships.

By experimenting with grid size, number sequences, spaces between numbers and color assignments, the artist creates an overlapping of mathematical formulas and artistic design. The work can be appreciated as a colorful relief sculpture, a code to unravel or, in the artists words, a *contemplative starting point for further enquiries*.

### Title of the Art

#### Intertwined Formation of Four Spirals



### Observation Questions

- ◆ Approach this work from across the room. What is the first thing you see? Pretend you are a set of human binoculars, what is revealed to you as you move closer?
- ◆ What words come to mind when looking at the work? What other images do you think of?
- ◆ What areas of study do you think the artist calls on to create the work?

◆ Do you think the artist creates with a set of rules? Why or why not?

◆ Is there anything about his work that makes it mysterious? What? Do you think he intended that?

◆ If this artwork were a person, what kind of personality would it have?

◆ What are the number/color/size clues in

the work? Can you decode the formula?

- ◆ What are some levels of understanding/appreciation for this work (from the most simple color to the most complex number formula)?
- ◆ What tools/media did the artist need to create this work?
- ◆ Do you think mathematics is the artist's only concern? What else do you think he's interested in?

◆ What, if any, is the difference between a grid, a pattern and a matrix?

◆ What technological advances have helped us visualize and create complex patterns?

◆ Who in your class is wearing something that shows repetition of pattern? What other work in this exhibition is organized in a specific pattern?

◆ The artist says he is interested in *exploring limits*. What do you think his *limits* are?

### Investigations

**1** List the things you can think of that have a pattern to their purpose (morse code, crystals, quilts, fish scales). Divide your list into natural and human-made patterns. Which side has more? Why? Are there human-made patterns on your list that are influenced by natural patterns?

**2** By reading, questioning or interviewing, find two different ways in which early people used a system of marks for counting, before our number system was developed. Would this artwork have been possible using one of those systems? If so, how would it have changed the final image?

**3** In a television interview, explain to the public how you unraveled the code.

**4** Talk with an artist. Find out what rules they choose to follow and what rules they choose to break. If an artist is not readily available, select two different artworks from an art history book and make a thoughtful guess where rules were followed and where rules were intentionally ignored or changed.



**5** Using a tic tac toe form, assign a color to x and a color to O. Create as many different patterns of the form as you can by varying the placement of the x's and O's.

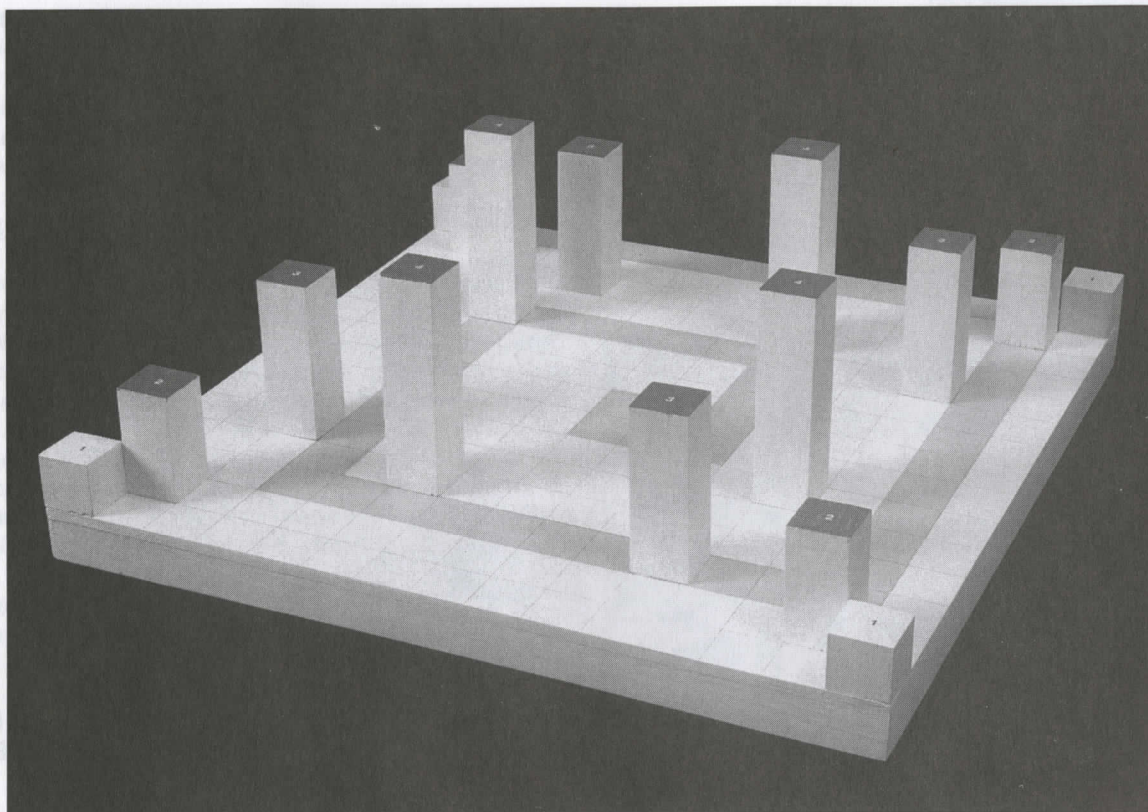
**6** What do *tapatan*, *yut*, *tanagram*, and this artwork have in common?

**7** Make a list of the games you can think of that utilize a grid or pattern development as part of the game (hopscotch, board games). Create one of your own.

**8** Survey the closets of the members of your family. Describe the way in which they have organized their things. Make up a descriptive label for each organizational method.

**9** Consider the rooms in your school where there is a mass of chairs or desks. Diagram the pattern of seating as it now exists. Create another diagram that shows what the placement of chairs would look like if random seating were left up to the students. What do these two diagrams tell you?

**10** Investigate the artwork of Piet Mondrian and Victor Vasarely, the geodesic architecture of Buckminster Fuller, the craft of



**Intertwined Formation of Four Spirals**

bricklaying, floor plans of the great cathedrals and mosques, the mapping of molecular structures, the scientific concept of chaos and the designing of circuit boards.

### Hypothesis

Artists use both a repetitive and random set of guidelines when creating works of art.

### Experiment

Create two large grids of at least 100 units each (chalk on sidewalk, butcherpaper and paint, grid paper and pen). Select six colors. Assign each color a number from one to six, as in, red=5, blue=1, black=2. With the first grid, determine the colors for each space by a roll of a dice, for example, roll a 5, color that square red. Continue until the grid is complete. For the second grid, develop an original number pattern, enter those numbers in the squares then fill in with the corresponding colors.

### Facts to Share

■ Nature is full of examples of numerical patterns and spacing. Examples can be found in the tiny, perfectly proportional spacing inside a nautilus shell, the peas in a peapod, or the periodic rise and fall of the surface waters of the oceans, caused by the attraction of moon and sun.

■ The artist has taken his artwork to public school classes who use them in math games.

■ Chris Watts is the head of the Fine Arts Department at Washington State University.



# BILL WILL

Born: 1951, Tacoma, Washington  
Lives: Portland, Oregon

**B**ill Will's artwork is an example of creative problem solving. In his abstract concepts, he calls on skills used by both artists and scientists. Experimentation, trial and error, humor, research and resourcefulness all play a part in the creation of his sculptures. His work encourages us to think without taking science, art or ourselves too seriously.

His materials include all kinds of *found objects*—from clocks and meters to motors and mannequins. Often his multi-media artwork includes soundtracks and moving parts, inviting viewers to experience kinetic art with a sense of playfulness and mock-purposefulness.

## Titles of the Art

**Brainstorm, Gastronomical Model, Hot Potato, How Much? Let Sleeping Boxes Lie, Not So Still Life, Other Fruit Would Do, Optinium Optical Opportunity, Some Art is Hot Air, This Machine May Art At Any Time**



## Observation Questions

◆ Did you have any surprises after your first encounter with the artwork? How many different materials did the artist use? How many different techniques for assembly?

◆ How did the artist get your curiosity's attention?

◆ How often did you *activate* the work? Did your thoughts about it change as you continued to study it? How many senses did you use?

◆ What scientific principles or observations are being illustrated? What are your clues?

◆ If this artist were to write a science textbook, what would it be titled? Would you want to take the class?

◆ Where do you think the artist finds his materials? What would you envision his studio to look like?

◆ What do you think Albert Einstein would think about this artwork? If Bill Will and Einstein had a conversation, what might Einstein ask Will?

◆ How do you think this artist would describe himself?

◆ Do you think trial and error play more important roles in science or art? Why?

◆ Why is imagination, or the ability to create mental images, important in scientific study?

◆ Why is there a need for research and experimentation in the creation of art?

◆ What do you think the artist was like at your age? Who do you think might have influenced him?

◆ Is there a place for humor in the problem-solving process? Why or why not?

## Investigations

**1** Bill Will is going to take up residency in your community for the purpose of creating a work of art for a public space. Make a list of resources you would give him for supplies.

**2** Survey a science textbook for a diagram of a scientific phenomenon. Re-diagram it for the purpose of attracting interest and curiosity.

**3** Write a dialogue between Sir Isaac Newton and Bill Will about the new concept of gravity.

**4** You've recently discovered a new scientific theory to rival relativity, molecular bonding and electromagnetism. You have the opportunity to present your theory at an international science exposition. Create the display or visual aids you will need to assist you in the presentation of your paper.

**5** You're living in the land of *Rational thought*. You've been commissioned by the governor to *make sense of art*. Begin by selecting a famous sculpture or painting and diagram or recreate it so that it is more easily understood by a population of *how does it work?* minds.



**6** How-To-Be-Smarter Toys is sponsoring a competition for new products. The rules are:

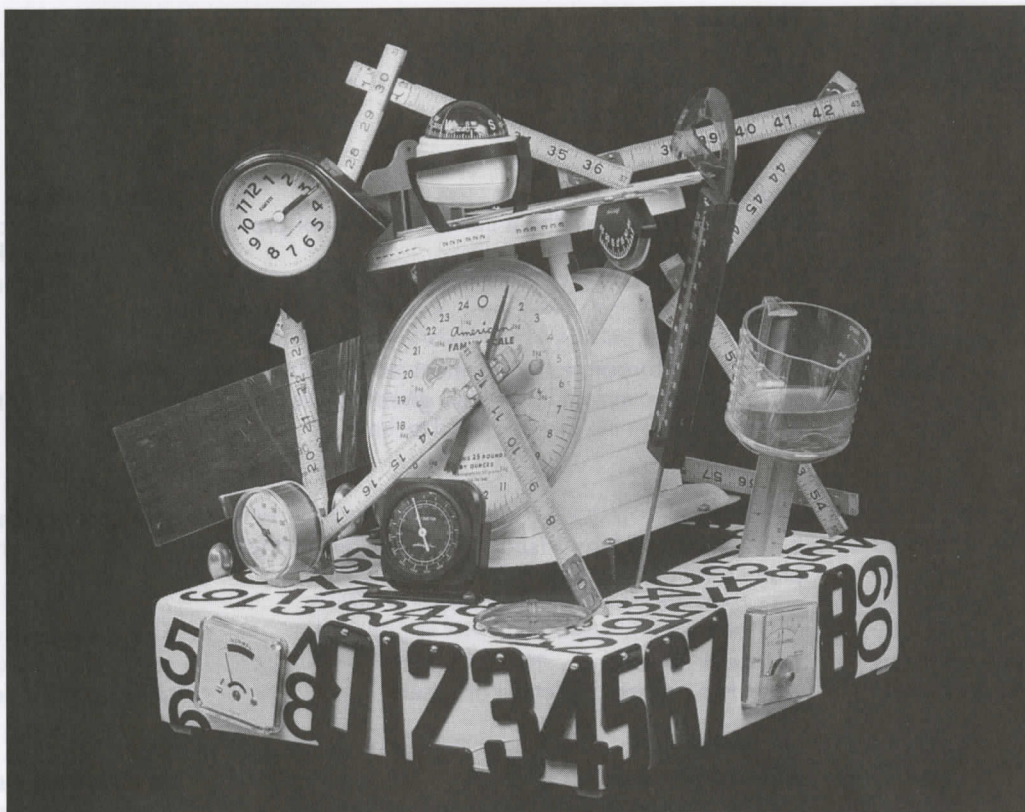
- 1 It must be contained in a cardboard box.
- 2 It must teach people something.
- 3 It should invite people to interact with it.
- 4 It must include *found materials*.
- 5 It should ask people not to take themselves too seriously.

Enter the competition.

**7** Investigate the images and stories of Ben Franklin and his lightning conductors, the inventions of Rube Goldberg, the artwork of Max Ernst and Marcel Duchamp, and the writings of Lewis Thomas.

### Hypothesis

The ability to visualize and create images that illustrate abstract concepts is a skill shared by artists and scientists.



How Much?

### Experiment

Select one of the following headlines from recent Science News Journals. Utilizing your imagination, sense of humor, inventiveness and ability to experiment, create a visual illustration of the concept.

- ◆ Plants Bite Back
- ◆ New Evidence of a Heavy Neutrino
- ◆ Vision System Puts Eyesight in Blind Spots
- ◆ Fracture Formula Yields Volcanic Forecasts
- ◆ Evidence for Buried Quasars Unites Galaxies
- ◆ Deep-sea Denizen May Tell of Ocean's Past
- ◆ Cracks in the Cosmos
- ◆ Progress in Designing Magnetic Polymers
- ◆ Of Mice and Men: Sharing Locator Genes

Through questioning and investigating, attempt to find out more about the actual story behind the headline.

### Facts to share

■ Kinetic art was first popularized by French artist Alexander Calder with his mobiles in the 1930's.

■ Science News Journal is a weekly magazine published in Washington, D.C.

■ The artist looks for materials to recycle and use in his artwork in old shops, garage sales and other out-of-the way places; he once bought 540 used alarm clocks.



# GLOSSARY

## **catalyst**

one that causes a process or event

## **composition**

putting together parts or elements to form a whole; combination of elements in a work of art so that they are satisfactory to the artist

## **conceptual art**

art which is created according to one or more of the following principles: 1. that art consists in the basic idea, which does not have to be embodied in a physical form. 2. language becomes the basic material of art. 3. artistic activity becomes an enquiry into the nature of art itself, and any result or embodiment must be regarded simply as an interim demonstration of the general conclusion reached by the artist

## **format**

size and proportions of a piece of paper, canvas, or other two dimensional work of art

## **graphics/graphic art**

a form of art in which a statement is made, through emphasis on lines, marks, or printed letters. It includes drawing through printmaking of all kinds

## **illusion**

a mistaken perception of reality, for example, the illusion of three-dimensional space in a two-dimensional painting

## **intuition**

the act of knowing without the use of rational processes; acute insight

## **kinetic**

art which incorporates an element of mechanical or random movement, or which gives the illusion of movement by the use of optical techniques

## **medium**

a material used by visual artists Media is the plural form of medium

## **mixed-media**

when two or more materials are used

## **perception**

insight, intuition, or knowledge gained through the senses

## **perspective**

the method of representing a three-dimensional object, or a particular volume of space, on a flat or nearly flat surface. Also, a means of representing distance and recession in a painting

## **pixel**

the smallest element of a graphic image that can be individually processed in a video display terminal

## **photomontage**

a pictorial composition made by covering a sheet of paper with fragments of photographs or overlapping photographs

## **process**

a series of actions, changes, or functions that achieve an end or result

## **quantification**

measurement or expression of how much

## **transparent**

see-through; capable of transmitting light so that objects or images can be clearly perceived

## **translucent**

diffusing light so that objects beyond cannot be clearly perceived

## **valuation**

process of assessing value; an estimate of worth, merit, or character



**MULTIPLES: THE SCIENCES AND ART** is a collection of one hundred works of art, ten each by ten artists. Ten similar minicollections are circulated to public school districts. This exhibition workbook and a video about the artists accompany the traveling exhibitions.

The Sciences & Art workbook was produced by *Washington State Arts Commission's Art in Public Places Program* in partnership with:

- ◆ Washington Public Schools
- ◆ Office of the Superintendent of Public Instruction
- ◆ Washington State School Directors' Association
- ◆ State Board of Education

Funding for these ten traveling exhibitions, workbook and video tape was provided through *Washington State Art's Commission's Art in Public Places Program*. For permission to reproduce any parts of this workbook, write or call *Washington State Arts Commission*. All rights reserved, 1991.

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Art in Public Places  
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### Special thanks to:

Terry Amidei  
Ruth Bare  
Cheryl Bayle  
Dorothea Basile  
Judith A. Billings  
Catherine Bock  
Carl Chew  
Samuel R. Cohen  
Dr. Dennis Couch  
Jacque Crist  
Frank Deebach  
Larry Dvorak  
John W. Firman  
Karen Kamara Gose  
Thelma Jackson  
Lonny Kaneko  
Izumi Kuroiwa  
Carolyn Law  
Helen Lessick  
Peggy Lewis  
Betty Lukins  
Gina May  
Dr. Charles Marshall  
Alberta Mehring  
Dennis Morrison  
Sheila Mullen  
Sandra A. Percival  
Rob Prout  
Lisa Russell  
Deborah Rutherford  
Beth Sellars  
Dr. Monica Schmidt  
Glenn Simonsen  
Esther Stefaniw  
Dr. Larry Swift  
Katie Szurek  
Sonnet Takahisa  
Ruben Trejo  
Ed Trujillo  
Carol Washington  
Beverly Watt  
Mary Watland  
911 Media Arts Center  
Jack Straw Foundation  
Artech Fine Art Services



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**Design** Vikki Leib

**Photography** Terry Amidei

**Front Cover Artwork** Jim Rittiman

**Back Cover Artwork** Bill Will

**Cover Photograph** Colleen Chartier

**Printed by** Consolidated Press, 2228 1st Av, Seattle, WA 98121

**Photographic Prints by** Moonphoto, 431 Westlake Av, Seattle, WA 98109



