ART TO ZOO

News for Schools from the Smithsonian Institution, Office of Elementary and Secondary Education, Washington, D.C. 20560

Winter 1984/85

Turning Dreams Into Reality– A Guided Tour

Is it possible to be in two places at the same time? To have eyes in the back of your head? To hear the softest whisper when you can't hear the loudest shout? To squeeze an entire orchestra into your living room? Or to stay under water for hours on end without coming up for air?

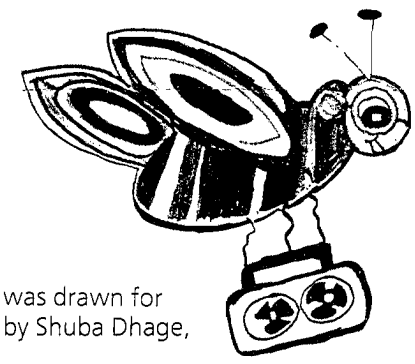
If you have a tape recorder, a mirror, a telephone, a radio, or an Aqualung diving tank, the answer to all of the above questions is yes. The one thing all of these have in common is that they once existed only in someone's imagination as intangible dreams. When dreams—ideas—are transformed from wishful thinking into tangible objects that produce results, the imagination has produced, created, or *invented*. An invention is the real object resulting from the dreams and ideas produced by the imagination. So, to paraphrase William Shakespeare, dreams are the stuff inventions are made of.

In this issue of *Art to Zoo*, we're going to get a guided tour of how dreams turn into the reality of inventions—from our guest writer Pamela Brooke.

Pamela writes and produces "Songs Jumping in My Mouth," a 13-program radio series with related classroom (or home) activities that has received the official endorsement of the National Education Association and is distributed throughout the United States by National Public Radio.* This unique series stars Hootenanny Granny, a 309-year-old owl whose favorite word is "why" and who refuses to die until she knows all there is to know, a musical one-elephant band named Ndovu, and a very small (he can hide on a wall) super spy fly named Fe-Fy-Fly, International Super Spy. (See page 4 for information on *How to Get Free Activity Guides* and audio cassettes of this program.)

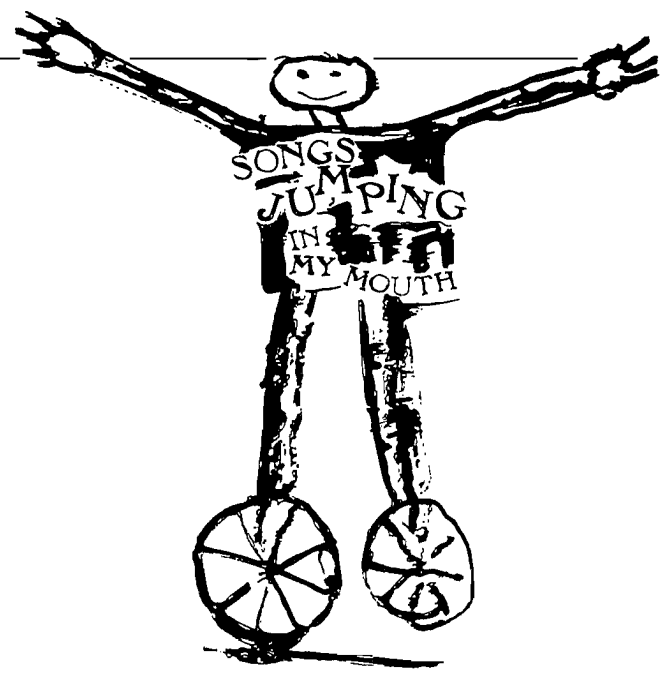
Pamela has won seven Ohio State Awards for programs for children as well as the George Peabody Broadcasting Award, broadcasting's most coveted recognition. Her philosophy is distinctly child-centered. "I always start with the individual when I work with children," she said. "First I find out what personal experiences children have already had, and then I look for their questions as a framework for adding new information. Encouraging children to cherish their questions and to pursue them until they find the answers that satisfy them is important. The questions asked by children are the same questions of function and meaning that great thinkers, artists, and inventors have always puzzled over. Children's questions can be the beginning of a lifetime of discovery, invention, and creation."

*To find out when the series will be broadcast in your area, call your local National Public Radio Station.



Fe-Fy-Fly was drawn for "Songs" by Shuba Dhage, age 8.

Program 10 in the series deals specifically with inventions and the questions of where inventions come from and how they come about. This topic, like the others in the series, expands on the theme of uniting children's fantasies and curiosities with the larger world of history, culture, and ideas. Pamela's text from the activity guide follows, and can be easily adapted to a number of curriculum areas—including history, science, and language arts. As Pamela points out, the inventions theme easily lends itself to a field trip to a local museum or other community resource center for some on-the-spot observation.



The "Songs" logo was taken from a child's question, "What if my feet had wheels instead of toes?" This capacity to imagine ourselves as something other than we are is both childlike and an important part of the inventive process. Artwork courtesy of "Songs Jumping in My Mouth"

Inventions Are Mechanical Extensions of Ourselves and the Natural World

by Pamela Brooke

Inventions extend our human powers and allow us to do more than we could otherwise do. The first tools were invented when prehistoric people learned that rocks and sticks of certain shapes could help them do things they couldn't do with their bare hands. They shaped the stones into knives, hatchets, and hammers. As civilization evolved through the Stone Age, Iron Age, Bronze Age, Industrial Age, and Space Age, people improved on old tools and invented new ones to meet the new demands of each new generation.

From the wheel to sails and wings, from the magnifying glass to telescopes and moon rockets, inventions allow us to do things that once existed only in imagination. When we think of inventions, most of us think of the glamorous machines that have had enormous impact on how we live—engines, telephones, radio, television, cars, trains, airplanes, automatic household appliances, and computers. These are obviously complex devices that the majority of us use without any understanding of the way they actually work. These miracle machines are outstanding inventions that stand us in awe, but for that very reason we often shut ourselves off from understanding the inventive process and the full history of human inventions.

Imagine yourself buying a soda from a vendor and sitting down in a park to drink it. That simple act is made possible through hundreds of little inventions. For example, somebody invented the soda. Somebody else invented a way to make it fizz. Somebody invented the glass bottle it was in. Somebody invented bottlecaps. Somebody invented bottlecap openers. Somebody invented machines to get the soda into the bottles, and lots of people's inventions contributed to its transport from plant to consumer. If the soda was

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Pamela Brooke, creator of "Songs Jumping in My Mouth," is pictured working wth children in her radio production studio. Photo courtesy of "Songs Jumping in My Mouth"

"Robot-Do-All,"
by John Evangelista, age 10.

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in a can somebody invented the can. Somebody invented the printing process that allows the manufacturer to identify the product. Maybe your soda came in a paper cup full of ice and with a straw. Somebody invented paper. Somebody invented the waxed cup. Somebody invented the straw. Somebody invented making and chopping the ice.

From toothpaste to eggbeaters to aerosol cans, somebody had to invent it. Imagine life without buttons, zippers, paper clips, and staples. Who thought of these things? How did they think of them? Where do inventions come from?

Discussion, Reading, and Writing Activities

Inventions are taken seriously in our country because of our patent system that protects the legal rights of inventors and allows them to sell their inventions for profit.

Can children patent their inventions? The answer is yes! In 1963, a U.S. patent was issued to a boy named Robert Patch. He was 5 years old when he invented and patented a toy truck that can be easily assembled and disassembled.

What kinds of things can be patented? Gadgets and machines and objects with new methods and new processes for doing things. Children may be surprised to learn that patents are granted for simple devices as well as for complicated machines and processes. Not too long ago, a covered soap dish to be hung from a shower head was featured in a major metropolitan newspaper as a newly patented invention.

Inventions are exciting in that they allow us to do and experience new things. But there are consequences beyond the thrill of newness that are often unforeseen by the inventor. Inventions can change our life by altering our daily patterns of movement and work. To dramatize this, ask children to imagine themselves in a big city during a busy workday when suddenly there is a power failure. How many things that we do and depend on would be affected by this power failure? Everything from electric typewriters, copying machines, computers, and wall clocks to elevators, overhead lighting, and subways. We take our mechanical extensions of ourselves for granted, but we have only to imagine ourselves in the above situation to realize how dependent our way of living is on these inventions.

What Would Life Without Inventions Be Like?

Ask children to individually choose twelve things that are important in their lives. These things don't have to be big machines. They can be anything from pencils to indoor plumbing. Ask children to write a story describing a week of life without those twelve things in their neighborhood. The more interesting their choice of objects to do without, the more interesting their stories will be. Their stories should include the new devices or substitute methods they create to make up for the loss of the twelve things. For example, how do they contact their friends if telephones are one of the twelve things they are doing without? How do they get things clean if running water is one of the things they do without? And how do they amuse themselves if television is one of the items they give up? Do they invent new things to make up for the things they no longer have, or do they rearrange their lives to do without them?

Share with your students the background information and illustrations of past inventions in some of the books described in the bibliography at the end of this article. Let them discover through this sharing that inventions are simply mechanical extensions of ourselves. List the following body parts on the board, and see how many mechanical extensions of each the children can think of: feet, hands, eyes, and brain.

Wheels of all descriptions extend our feet: horse carts, bicycles, roller skates, and cars. Wheels are one way to extend our feet. Can you think of others? What about sleds and skis that allow us to transport ourselves over snow and ice? How about the things that allow us to "walk on water," such as floats, boats, and surfboards? What about shoes?

Pencils, typewriters, paintbrushes, dishwashers, baskets, fishing poles, mops, cooking utensils, hammers, lawn mowers, and hairbrushes are extensions of our hands. Eyeglasses, magnifying glasses, binoculars, microscopes, telescopes, and X-ray machines extend our eyes. So do cameras, video machines, and television sets which allow us to see things even when we aren't present as they occurred. Books, maps, clocks, calendars, calculators, and computers extend our brains. How many other things did your group think of that extend our feet, hands, eyes, and brain?

Brainstorm Ideas

In a group discussion, ask children to describe human body parts that are increased in capacity through these inventions: telephone, stethoscope, tweezers, ladder, clothes, mirrors, potato peeler, records, potholders, whistles, toothbrush, drum, wheelbarrow, radio, scuba tank, baseball bat, airplane. Ask children to describe the things in nature that are increased in power through these inventions: candles, refrigerator, flashlight, bathroom showers, garden hoses, street lamps, air conditioners, ovens, furnaces.

Ask your students to think about their own physical and mental abilities. What do they wish they could do with their own bodies or minds that they can't do? Is there a mechanical object that could help them? Is it the right object to meet their exact needs, or can they think of a better object that could be invented to do what they would like? For example, elevators, escalators and stairways will take you to the top floors of buildings, but is that the way you want to get there? Can you think of another way that could get you there more to your liking? Perhaps there's no existing mechanical device of any kind to fulfill the wishes children have to extend their own physical and mental abilities. What invention could they create that would? Ask children to think about different things in nature the same way and see what they might invent that would extend the natural things they enjoy.

Miracles Come from Our Imaginations

The presence of mechanical, man-made objects in our lives is something most of us take for granted. By doing so, we overlook the fantastic and sometimes miraculous achievement involved as human imagination becomes reality. Inventions are the product of skill and often painstaking labor, but can begin with amusing fantasies or wishful thoughts. Share stories of fantasy machines with children, such as *Danny Dunn and the Homework Machine* by Jay Williams (listed in the bibliography). Children can write a story of their own about a fantasy machine that would make some of their wishes come true.

Today's science fiction can be tomorrow's invention. We know that because much of yesterday's science fiction is today's reality. As early as the 19th century, science fiction writer Jules Verne predicted space travel, the submarine and the ability to go around the world in 80 days. Ask your students about science fiction stories they've read that describe either inventions that have become reality or inventions that they wish were real. Children can write a science fiction story of their own describing a future world that is different from ours because of the different inventions that have altered the way people live.

Ask your students to think of ways people accomplished tasks before machines extended their physical and mental abilities. Share pictures of early inventions with them so they can see for themselves how different tools and machines evolved. (We've pictured several inventions from the Smithsonian collections on page 3 which you can post on the bulletin board.) Share pictures of inventions that were patented, but never mass produced, such as those in *Weird and Wacky Inventions* by Jim Murphy (listed in the bibliography). Children can find out more about the history of inventions and creative problem solving *through the following activities.*

Collect Gadgets from the Past

Many people are fascinated by gadgets from the past and enjoy learning about history through collecting those objects and researching their origins. These objects vary from old-fashioned versions of current machines, such as early foot-operated sewing machines, to early cameras, radios, or kitchen gadgets. Museums are institutional collectors of gadgets from the past. A visit to a local history or technology museum would offer children the experience of a variety of man-made objects from our past.

A visit to an antique store or junk shop could also produce several examples of this. Some people enjoy trying to find objects whose function is not immediately obvious so they can try to figure out what it was used for. Most homes have a few objects from the past in kitchens or basements—or even displayed in places of honor. Ask children to look around their own houses for a gadget from the past. They can play a mystery game with their classmates by bringing the object to the group and keeping its function a secret until someone in the group has guessed it. Some examples of an object they might find at home that would be appropriate are: an old wood and tin washboard, a wooden coffee grinder, an old tin foodmill, an eyecup for washing your eyes, a razor strap.

Research an Invention

Have you ever wondered how different inventions happened and exactly who and what made them happen? Ask each child to make a list of inventions he or she would like to know more about. Encourage them to include items that are not commonly included on lists of big inventions. When they have a list of

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Concepts to Be Discovered

- People create inventions to maximize and extend human abilities or natural processes.
- Inventions often begin as fantasy or wishful thinking.
- Inventions are generally the end product of a problem-solving process.
- Not only machines, but also common things like pockets, buttons, zippers, and safety pins are inventions.
- Inventions bring about change in lifestyle and values that require human adaptation.

Follow-up Activity Objectives

- Children will be able to recognize that inventions are mechanical extensions of human powers or natural processes.
- Children will be able to recognize the inventive origins of everyday objects.
- Children will be able to recognize that there are many new inventions yet to come, perhaps from them.

Brush Up Your Edison

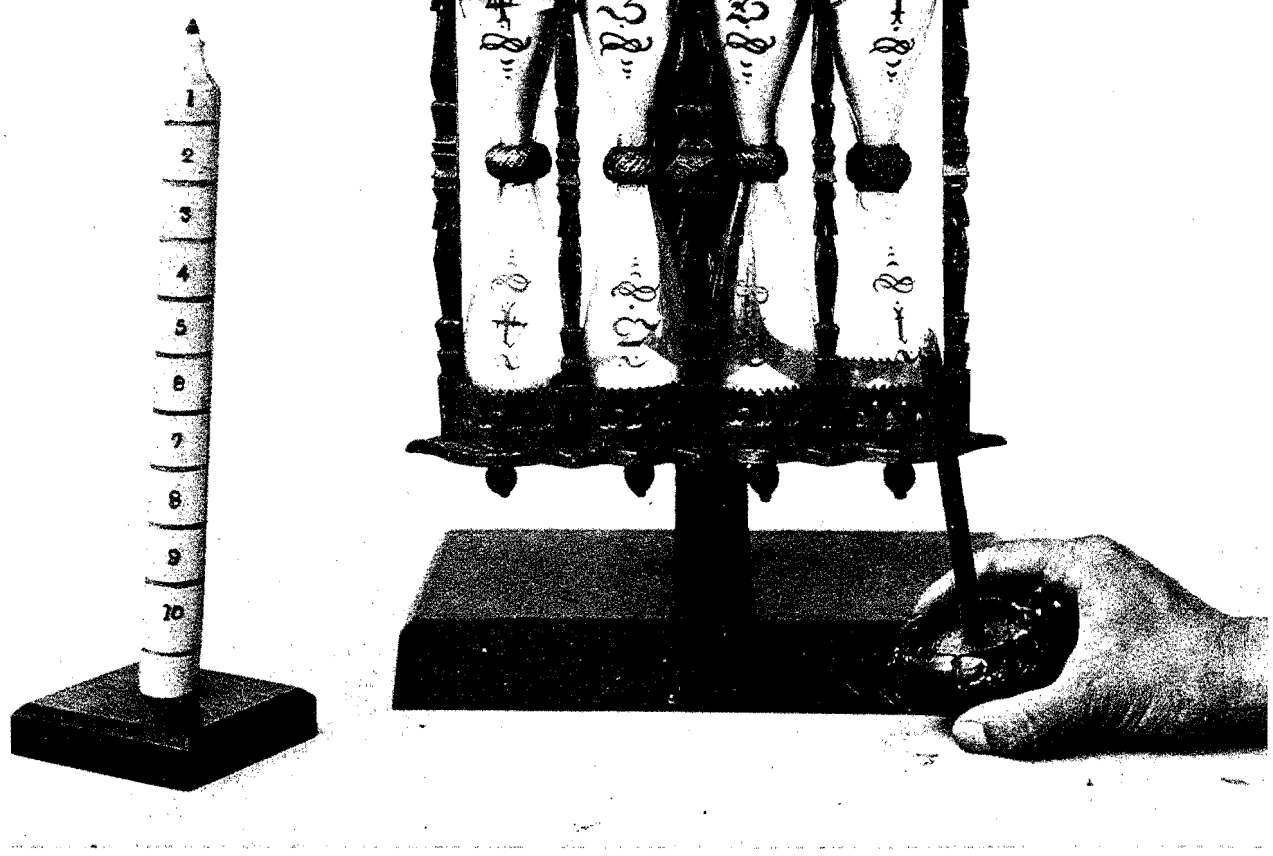
Once the children have done their research on inventions, a refreshing adjunct to the usual reports and posters would be to have them act out an invention.

In addition to providing your students an opportunity to participate in dramatic arts, acting out an invention helps sharpen your students' powers of observation and fosters cooperation. And, of course, they will need to think through and understand how their invention works and then work together with the other members of their group before they are able to act it out.

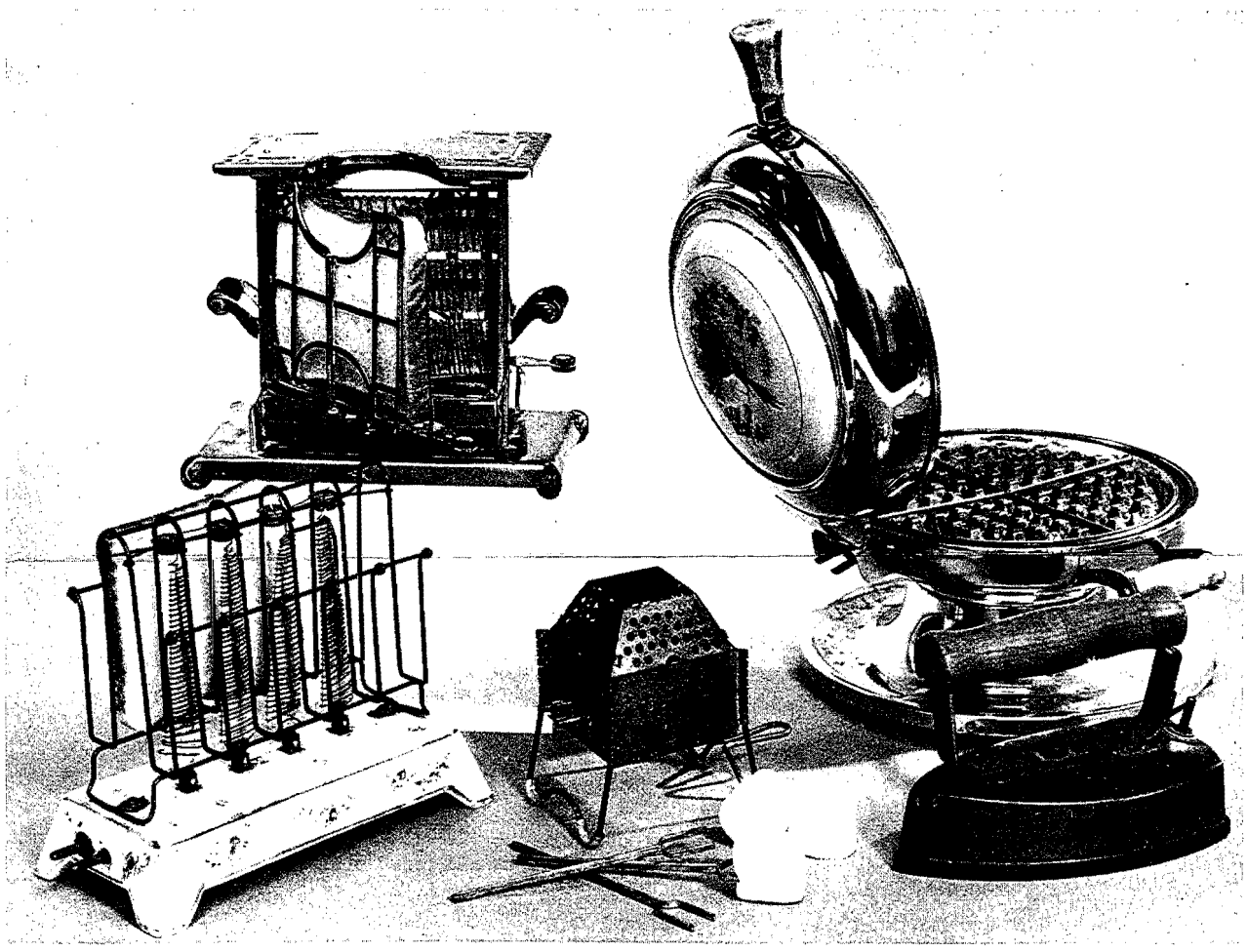
First, divide the class into groups of four or five students each, and ask each group to select a particular invention to act out. The invention they choose must have moving parts. Then explain to the children that they are to act out the moving parts of the invention they have chosen. The idea is to do this so well their classmates will have no trouble guessing what their invention is. Then leave the rest to them.

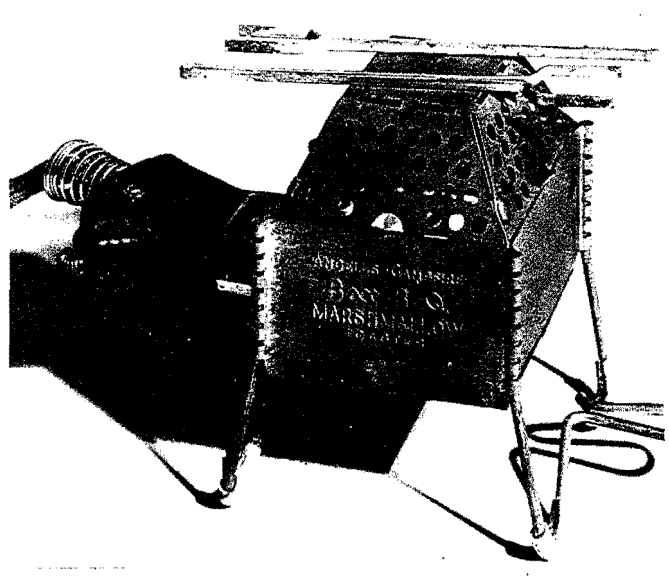
After all groups have had a chance to perform, you may want to invite other classes or parents in and perform for them.

Inventions From the Smithsonian Collections



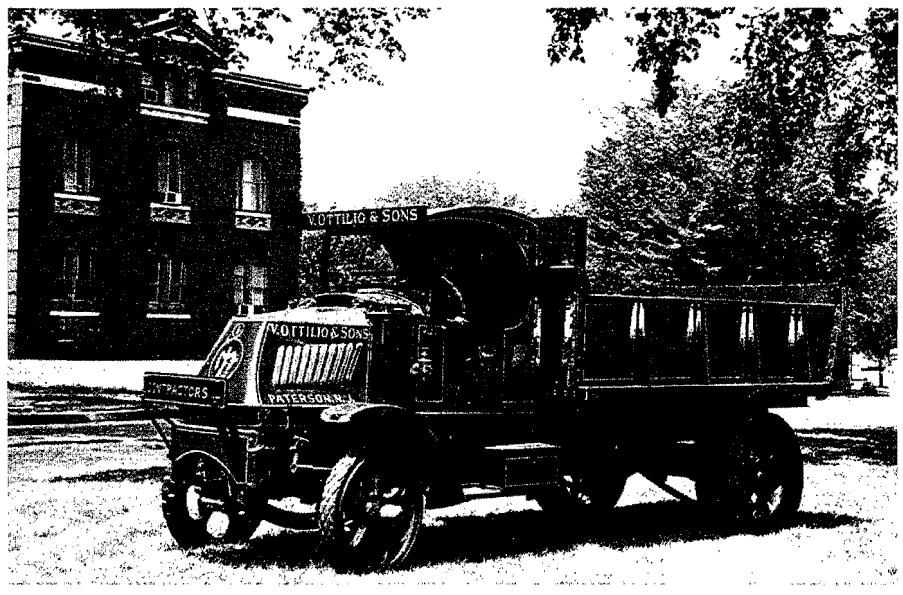
Before clocks with faces or digital displays were invented, a number of devices to measure time were used. Shown here (*left to right*) are: a King Alfred candle, a German sandglass set, and a Chinese punk. These devices "worked" because it would take, let's say, an hour for a candle to burn down to the next mark, for sand to drain through to the other glass, or for punk of a predetermined size to be totally consumed.





The discovery of electric current in the early 1800s led the way for later inventions that helped make everyday activities easier. The small electrical appliances pictured are from the Smithsonian collections and date from the early 1900s. The two items on the left are toasters, and on the right is a waffle iron and a clothes iron. And what's that in the middle? If you guessed it's an electric marshmallow toaster, you're right! And no, it's not for sale.

At the end of the last century two new inventions joined together—the bicycle and the hand-held camera. In the 1890s, bicyclists formed clubs and went on regular outings. They wanted to remember where they visited during their outings, and so the newly invented simple, hand-held cameras became very popular. Often the cameras were carried in protective cases secured to the bicycle. When parked, the bicycle served as a steady base from which to take a photo.



The invention of horseless carriages included "work horses," too. This dump truck is a Mack Truck. It dates from the early 1930s and is as powerful as it is large. When your parents or grandparents felt ill with aches or pains, you may have heard them say they felt as if they were "hit by a Mack Truck." Do you suppose that meant they felt pretty awful? The building shown behind the Mack Truck is the Smithsonian Institution's Arts & Industries Building, where *Art to Zoo* is written.

Unless otherwise noted, all photos in this issue of *Art to Zoo* are from the Smithsonian Institution collections. Back issues of *Art to Zoo* dealing with transportation inventions which you may want to display along with the photo essay on this page are: "Trains and Railroads," September 1984, and "Airplanes and Airports," March/April 1982. If you do not have copies of these issues, you may request them by writing: *Art to Zoo,* Office of Elementary and Secondary Education, Room 1163, Arts & Industries Building, Smithsonian Institution, Washington, D.C. 20560.

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several things that they'd like to know more about, let them see what information they can find, starting with books in the bibliography or other books and encyclopedias available in school and public libraries. Children can orally share with the group information they find. Information they might uncover could include things like the story of motion pictures which were invented to win a horse bet, or the story of the telephone invented during the search for a cure for family deafness. Children may discover that inventions often take decades to perfect. They will also learn that many inventions we depend on each day were originally laughed at by the inventor's own contemporaries.

Find Out Where Inventors Get Their Ideas

Some inventions have been inspired from things observed in nature. Some inventions are new uses of old inventions. Some inventions are inspired by the necessity to solve a problem. Ask children to find pictures of a mosquito, a bird, a duck, a dragonfly. See if they can discover the inspiration for hypodermic needles, airplanes, boats, and gliders from these examples in nature. Share with them how the steam engine was inspired by a teakettle or how the printing press was adapted from a grape press. See how many examples of different inspirations for inventions children can find through their own observations and research.

Invent a New Solution to an Old Problem

Inventions fill a need, but that same need could be filled by other inventions. The example of a stairway, elevator, and escalator demonstrates several solutions to the same problem of how to get from one floor of a building to another. Give children several old problems, and see what new solutions they can think of on their own. For example, children could invent a replacement for the knife, spoon, and fork combination we now use to eat with. Children could invent a new way of fastening clothes to replace buttons, laces, hooks, snaps, zippers, and Velcro, or children could invent a new method of keeeping clothes tidy to replace coat hangers. All of us see what is, but an inventive mind can see what isn't.

Invent a Solution to an Unsolved Problem

Can children think of simple things they do everyday that could be done faster and easier with some inventive help? Are there foods they eat that they could prepare or eat with more ease if they had a gadget to help? Could they get dressed faster in the morning with some mechanical help? By listing the different tasks and movements they do each day, children may find a number of problems that could use solutions.

Invent Something from Nothing

The activities in this article have been brainstorming, illustrating, and describing imaginary inventions. Children can now try to put their inventive ideas into action. Provide an assortment of materials and see what happens. Be sure to include lightweight wire for bending and twisting into models. You'll also find the following items useful: toothpicks, straws, paper clips, corks, pipe cleaners, tongue depressors, string, rubber bands, aluminum foil, plastic wrap and paper of every description, and a hole puncher. Empty cardboard containers such as cottage cheese, milk and egg cartons, along with paper cups, paper plates, empty thread spools, feathers, marshmallows, wooden dowels, balloons, buttons, and cardboard tubes will all help to make things interesting. Anything can happen (from automatic nose wipers to ghost traps) and children should be encouraged to reach for the fantastic in their inventions.

Make a Movie of Your Invention in Action

Drawing and constructing models of inventions is one way to test your creative ideas. Another way is to make a movie of your invention in action, and children can do this without cameras or fancy equipment. All they have to do is gather up a few simple materials similar to the ones suggested above and start making use of some of the ideas of past inventors who created things like "zoetropes" and "phenakistoscopes." These are paper movie machines that can be easily constructed. Through multiple drawings wheels can turn, things go up and down, move forward and backward, and even grow from little to big to little again as the inventor wishes. It's a lot of fun. Complete instructions with delightful, informative illustrations are available in an inexpensive paperback book, *Paper Movie Machines* by Budd Wentz, from Troubador Press, 385 Fremont Street, San Francisco, California 94105.

Patent Your Invention

If children want to know more about how to patent inventions, that information is available by sending $3.00 to the Government Printing Office in Washington, D.C. 20401, and requesting the pamphlet, *General Information Concerning Patents.*

Smithsonian Offers Summer Course for Teachers

You don't have to live in Washington to study at the Smithsonian! "Using Museums to Teach Writing," a special one-week course, will be offered by the Smithsonian Institution this summer for elementary and secondary school teachers living more than 75 miles outside the Washington, D.C., metropolitan area.

The course is accredited by the University of Virginia. Tuition and materials fees will total approximately $200. No scholarships are available.

"Using Museums to Teach Writing" will survey ways in which teachers can use local museum exhibits and community resources as tools for teaching writing. In addition to working on formal and informal exercises, participants will interview several Smithsonian Institution staff writers to learn about various approaches to writing.

The course, worth three graduate credits, is open to full-time classroom teachers of grades five to twelve, school librarians (media specialists), and curriculum specialists. Interpreters for hearing-impaired individuals can be provided for all class work.

Classes will meet July 5–13 in Washington, D.C. Specially priced housing may be available in a conveniently located college dormitory. Participants will arrange their meals.

Enrollment is limited. Smithsonian staff members will select among the applicants to assemble a group with varied experiences and interests. Applications must be postmarked no later than April 5, 1985. Notices of acceptance will be mailed by April 30, 1985.

For an application form, including complete information, write to National Seminars, Office of Elementary and Secondary Education, Arts & Industries Building, Room 1163, Smithsonian Institution, Washington, D.C. 20560.

How to Get Free Activity Guides for "Songs Jumping in My Mouth"

An activity guide and 21-minute stereo soundsheet are available free to educators and parents by writing: Songs, WETA, Box 2626, Washington, D.C. 20013. The activity guide covers all 13 programs in the series. (Cassettes of the entire series are available from the same address for $75 plus shipping costs. Individual program cassettes may be available through your local National Public Radio station.) The activity guides have been produced and distributed with funds provided by the Corporation for Public Broadcasting.

Discovery Theater Presents Stage Adaptation of "Songs"

Classes in the Washington, D.C., area may want to attend the Smithsonian Discovery Theater adaptation of "Songs Jumping in My Mouth" which will be presented March 5–23, 1985. Geared for grades K–4, it will feature Hootenanny Granny and her crazy family tree. For further information, write to: Smithsonian Discovery Theater, Arts & Industries Building, Washington, D.C. 20560.

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Art to Zoo brings news from the Smithsonian Institution to teachers of grades three through eight. The purpose is to help you use museums, parks, libraries, zoos, and many other resources within your community to open up learning opportunities for your students.

Our reason for producing a publication dedicated to *promoting the use of community resources among students and teachers nationally* stems from a fundamental belief, shared by all of us here at the Smithsonian, in the power of objects. Working as we do with a vast collection of national treasures that literally contains the spectrum from "art" to "zoo," we believe that objects (be they works of art, natural history specimens, historical artifacts, or live animals) have a tremendous power to educate. We maintain that it is equally important for students to learn to use objects as research tools as it is for them to learn to use words and numbers—and you can find objects close at hand, by drawing on the resources of your own community.

Our idea, then, in producing *Art to Zoo* is to share with you—and you with us—methods of working with students and objects that Smithsonian education staff members have found successful.

We are especially grateful to PAMELA BROOKE, originator of "Songs Jumping in My Mouth," WETA, Washington, D.C., for her generous assistance in preparing this issue of *Art to Zoo.* Special thanks also to ANN BAY, Director, Office of Elementary and Secondary Education, Smithsonian Institution, for her counsel and help.

Pull-out Page

ART TO ZOO—Winter 1984/85

From Smile to Snapshot— How One Invention Developed

Every year it's the same old thing. Line up, march in, sit down. "Smile!" says the school photographer. And when you get the pictures back, it's the same old chorus: "Ugh! Look at that! My eyes are half-closed." "Gross! My hair is sticking up!" "What an expression!"

Modern cameras and film take pictures so fast they sometimes "capture" little details we'd rather they didn't. This is what leaves you looking like your old aunt Nellie's bulldog.

As bad as that is, however, did you know that it once took as many as 15 to 20 seconds of sitting ABSOLUTELY STILL to get a clear photograph?

Ask a friend to time you for 15 seconds. Then smile and "hold it." Don't blink. Can you imagine having to do that every time you have your picture taken? But "holding it" that long is just what people had to do 140 years ago.

In spite of the lengthy time needed to pose, these early photos were considered miracles. As a matter of fact, the process that produced these photos—PHOTOGRAPHY—was considered "the most miraculous discovery of the age."

Photography itself is the result of two separate inventions: a method to form an image in a light-tight box *(called a camera obscura)*, and a method that makes the image permanent.

The *camera obscura* had been in use for

Thomas A. Edison is pictured here demonstrating his tinfoil phonograph in April 1878. The cylinder was turned by hand and a needle indented the sound vibrations in the tinfoil on the cylinder. Eventually, Edison gave up on phonographs, and later models were all made by other inventors. (This photo of Edison was taken by Matthew Brady, who became famous for his photographs of Abraham Lincoln and of scenes of the Civil War. Brady had to carry his entire developing studio with him wherever he went, because small cameras and film that could "wait" to be developed hadn't been invented.)

hundreds of years. It was simply a box with a hole in one side. Light coming through the hole formed an image on the opposite side of the box. To understand how this works, look at the illustration of How a Camera Captures Images.

Then in 1839 a Frenchman named Daguerre invented the chemical process that made permanent the images inside the camera. His pictures, called *daguerreotypes*, used special copper plates that were treated with a chemical process to preserve the image.

As miraculous as Daguerre's method was, there were some problems with it: it took too long, it was expensive, and it could produce only one image at a time. In the 1850s two cheaper methods to "record" images were invented, but these still made only one picture at a time. Then a method was discovered by which multiple copies of an image could be printed onto paper much more inexpensively. The copies were made from an original image recorded on a glass plate. Now many more people could afford to have their pictures taken—and they did. Soon the photo album was invented as a place to keep photographs of family and friends.

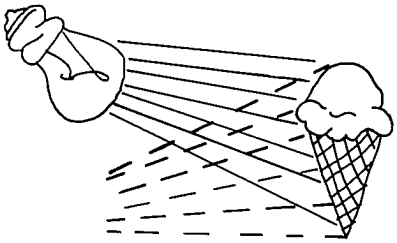
Even though photographs were so popular with everyone, photography was strictly an activity for professionals. The cameras were big and heavy, and the plates on which the images were formed needed to be developed immediately.

Photography only became possible for everyone when a small, hand-held camera was invented (about fifty years after Daguerre's miracle discovery). Because this small camera held a roll of film that could take as many as 100 photos, both professional and amateur photographers could easily take pictures anywhere they went. The film could be developed much later by sending it to a developing studio. For the first time since photography was invented, anyone who could press a button and turn a handle (that's all it took to operate that first hand-held camera) could take a photograph.

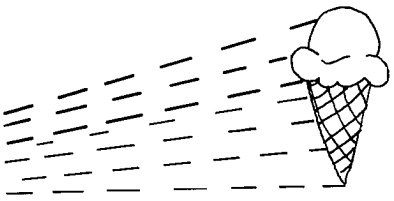
Since that time, photography has improved a lot. Some improvements include better film and even smaller cameras, color film instead of just black and white, cameras that focus themselves, and even computerized cameras that "talk."

The next time that school photographer says "Smile!" think of all the inventions that have come together to bring photography to where it is today. And if, when you get your pictures back, you're tempted to say, "I could do better than that!", better start thinking. You probably can.

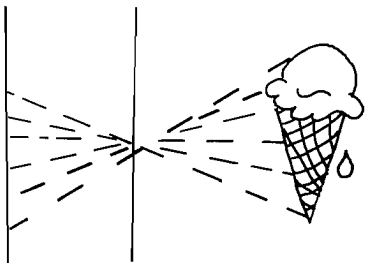
How a Camera Captures Images



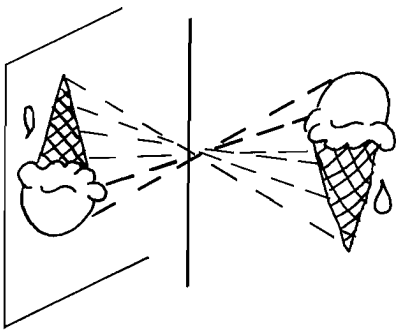
Light strikes an object and bounces off in straight lines.



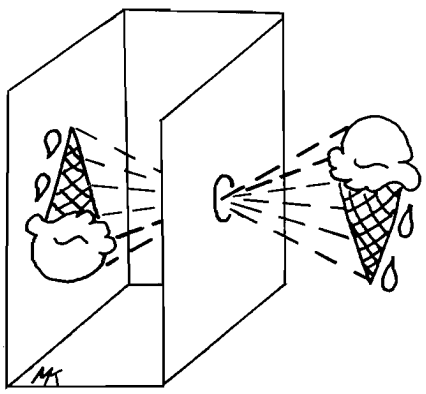
Some parts of the object send back a lot of light, and other parts send back only a little light.



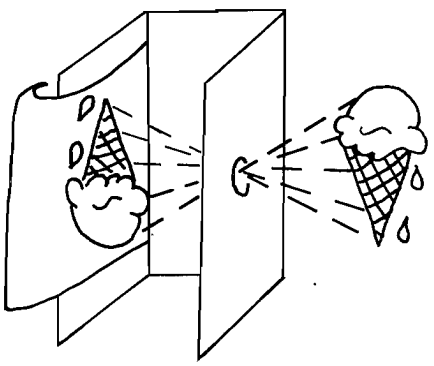
If some of the light rays sent off by the object go through a small hole into a box (a camera obscura), they will cross and light up the opposite wall of the box.



Some areas of the wall will have less light than other areas, and this is how a picture of the object is made. Because the rays crossed when they went through the hole, the picture will be upside down.

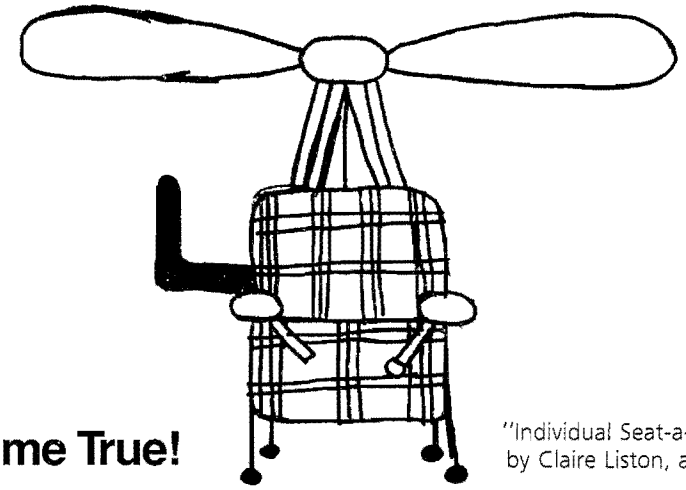


If you put a glass lens in the hole in the box, the light rays will be focused, resulting in a sharper, brighter picture.



If you put film along the opposite wall of the box, you will have a camera—and you can keep the picture made by the light rays.

Drawings by 8th grade art student Mary MacEoin.



"Individual Seat-a-Copter," by Claire Liston, age 10.

Make a Wish Come True!

Is there something you can't do that you wish you could do? Could a new invention make your wish come true? How many different working parts would you have to invent? Is there an animal that can do what you would like to do? How is that animal's body different from yours? Could you make a machine that could work like your animal's body? What would it look like? How would it work?

What Did You Invent?

The program "Songs Jumping in My Mouth" wants ink drawings and color paintings of children's inventions. Every child who sends a drawing or painting will receive a "Songs" Listener Club kit consisting of an activity newspaper, membership card, and logo button. Each drawing should have your full name, complete home address, and age. Drawings and paintings should be accompanied by a short paragraph explaining how the invention works. Mail these to: SONGS, Box 2626, Washington, D.C. 20013.

With What Invention Could You

(1) be in two places at the same time?
(2) squeeze an orchestra into even the smallest living room?
(3) breathe even though there's no air around you?
(4) have "eyes in the back of your head"?
(5) hear a tiny kitten's heartbeat?
(6) write faster than you thought you could?
(7) hear the softest whisper when you can't possibly hear the loudest shout?
(8) see through walls?

For answers, turn page upside down.

(1) Tape or video recorder. (2) Radio or TV. (3) Aqualung underwater breathing tank. (4) Mirrors. (5) Stethoscope. (6) Typewriter. (7) Telephone. (8) Windows.

SITES Board Game on Inventions Available

Bright Ideas, a SITES board game on inventions, includes a game board printed on cardboard (51 × 51 cm), 4 sets of markers, 60 "idea" cards, and 12 "patent" cards. Game instructions are printed on the storage envelope.

Up to 4 players collect points and patents, moving their markers around a lightbulb to keep score—a tribute to Thomas Alva Edison, the subject of the SITES exhibition for which the game was invented.

The Smithsonian Institution Traveling Exhibition Service (SITES) is a Smithsonian Institution program activity that organizes and circulates exhibitions on art, history, and science to institutions in the United States and abroad. To order *Bright Ideas,* write SITES, P.O. Box 1949 Washington, D.C. 20013. Specify item #08102 ($3.50).