



An exhibition exploring the playful side of invention and the inventive side of play •



July–December 2002



Smithsonian
National Museum of American History

Lemelson Center for the
Study of Invention and Innovation

Welcome to Invention at Play

Photo by Fred R. Conrad, courtesy of Hoberman Associates



Chuck Hoberman with his Hoberman Sphere

This exhibition takes a new look at invention by exploring its relationship to play in the past, present, and future. *Invention at Play* investigates the role of play—the ordinary and everyday “work of childhood”—in the creative impulse of both historic and contemporary inventors.

Through play, children gain important creative-thinking abilities, physical skills, and knowledge of tools and materials. And although tools and materials change over time, the habits of mind fostered by play have persisted in the work of inventive adults throughout history.

Krysta Morlan demonstrates how her Waterbike works.



Photo by Dan Auber, courtesy of Kathy Morlan

Play a **NEW WAY** with the **Everyday**

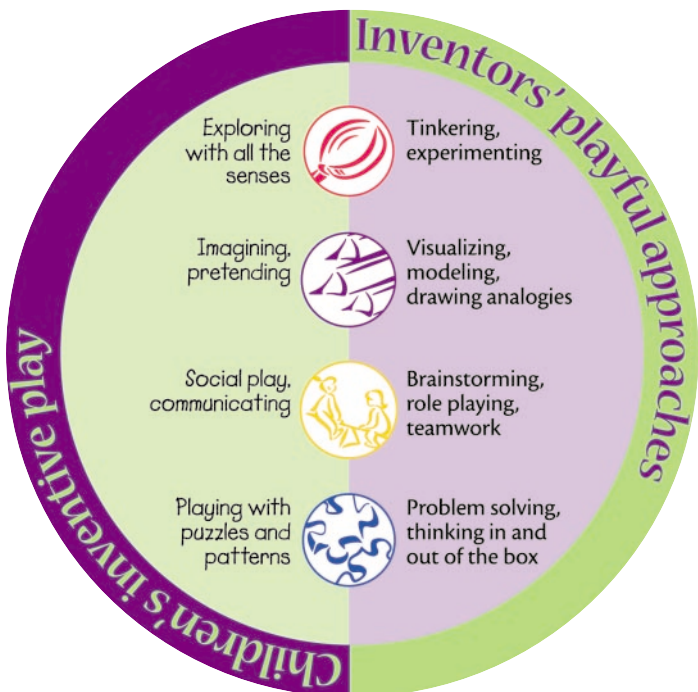


Magnetized kitchen utensils can form a face.

Play is something most of us, especially children, engage in naturally, wholeheartedly, and as often as possible. Though deeply satisfying, play is not always “fun”; it can sometimes be arduous, frightening, and time-consuming. Research in many fields indicates a vital evolutionary link between play and development. This is true of all species whose members are born helpless and have a relatively long period of growth.

When asked what inspired them to become inventors, many adults tell stories about playing as children. Among their most frequently cited childhood play experiences are: mechanical tinkering, fiddling with construction toys, reflecting about nature, and drawing or engaging in visual modeling. There is something about the skills fostered by play that inventors value and keep using as part of their working lives.

The playful approaches cited by creative adults form an interesting parallel to the four kinds of children’s play that child-development experts identify as more or less universal.



Playful INVENTORS

The abilities humans develop through play—curiosity, persistence, imagination, communication, problem solving—have been and continue to be an important part of the inventor’s tool kit.

Diaries and notebooks of 19th- and early-20th-century inventors and their colleagues and families provide historical evidence of the role of play in the invention process. Interviews and oral histories of contemporary inventors add to this record.

The exhibition contains colorful banners that provide clues to some playful approaches to invention, such as “Borrow from Nature” or “Recognize the Unusual.” Under the banners are stories of a wide range of inventors, both famous and little-known, whose creative habits of mind began in childhood play and resulted in a variety of useful contributions.

Photo courtesy of Newman Darby



BORROW FROM NATURE

“We are all too much inclined to walk through life with our eyes shut. There are things all around us, and right at our very feet, that we have never seen; because we have never really looked.”



Alexander Graham Bell
Telephone Inventor

A burr clinging to clothing, the sight of birds soaring in the wind, the grooved surface on the bottom of a dog’s paw—these everyday natural phenomena inspired such varied inventions as Velcro, human-powered flight, and deck shoes.

Many inventors, even those working with highly mechanical tools and materials, have borrowed from nature. Sometimes this is a deliberate technique, as in turbine inventor Roman Szipur’s observation of the way wind circulates around curved surfaces like feathers or eggshells. At other times, the natural world serves as a place for reflection and daydreaming, as did the bluff-side “dreaming place” where the idea of the telephone came to Bell. *The inventors in this*

Alexander Graham Bell’s favorite retreat, his houseboat Mabel of Beinn Bhreagh



exhibit section make imaginative and unlikely connections, as in childhood efforts at make believe and pretend play.

KEEP MAKING IT BETTER

“My hobby is building and inventing things. I’m still building, and I will keep on building.”

Newman Darby
Sailboard Inventor

Watch a young child examine something he or she has not seen before. Whether or not it was made to be tasted, heard, or shaken, the object will likely be explored with every sense. *Inventors are people who retain and foster the curiosity and sense of exploration through which all of us first learned*

about our world. While some inventors learn their craft in academic settings, many develop their expertise through continual experimentation with their tools and materials. The inventors in this exhibit section are notable for their lifelong curiosity and persistent problem solving.

In some cases, as with Newman Darby, a single type of invention—individually piloted watercraft—has been the focus of a lifetime. For others, such as Garrett Morgan, wide-ranging interests led to a variety of inventions such as the gas mask and the first traffic signal with a “caution” sign. The inventors here demonstrate a passion to improve, and improve some more.

RECOGNIZE THE UNUSUAL

“All sorts of things can happen when you’re open to new ideas and playing around with things.”

Stephanie Kwolek
Kevlar Inventor

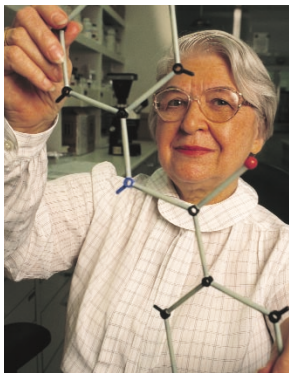
One day in 1965, as DuPont chemist Stephanie Kwolek was trying to dissolve a substance called a polymer, something strange happened. Instead of a clear molasses-like solution, this polymer was cloudy and poured like water. Intrigued with these unusual properties, Kwolek had to persuade her colleagues to keep testing the material despite the fact that it did not fit the expected pattern. The result was a strong yet lightweight fiber named Kevlar with a multiplicity of uses.



Playing in the tub

Kwolek's ability to recognize possibilities where others did not is a quality she shares with many inventors. This tendency to see non-obvious connections and relationships often leads inventors to the key insight that is the basis for their invention. Sometimes it seems as if an inventor had a flash of inspiration or a "Eureka!" moment. But often these instances are examples of a life-time habit, begun in childhood, of curiosity, exploration, and a refusal to give up at the first sign of failure. The flip panels in this section tell the stories of other inventions, like the microwave oven, Post-it Notes, and the implantable cardiac pacemaker, whose creators had the ability to recognize unexpected possibilities.

Photo by Michael Branscom, courtesy of Lemelson-MIT Program

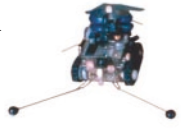


Stephanie Kwolek with a model of a polymer

JUMP THE TRACKS

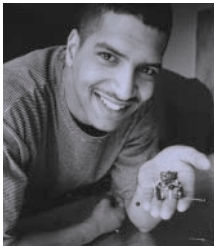
“We can use biology as a lever to pry open the secrets of intelligence. We could then take robots and possibly change things about biology.”

James McLurkin
Robotic Ants Inventor



Have you ever watched a child use a cup for a hat? Or a hat for a bowl? Because they don't necessarily know the accepted uses of many things, children invent their own. And often, even when they learn the "right" use, kids find new and imaginative ways to play with familiar things. *The inventors in this exhibit section retained this spirit of improvisation, combining it with expertise in one or more fields.*

Photo by Donna Covey, courtesy of MIT News Office



James McLurkin and one of his robotic ants

For example, one might wonder what ants have to do with robots, or art supplies with the telegraph. James McLurkin models the communication patterns of his tiny robots on the behavior of swarming insects like ants and bees. Samuel Morse, a portrait artist by training, built the first electric telegraph out of a canvas stretcher and materials from his brother's print shop. These inventors stepped over the boundaries of one field to adopt the tools or strategies of another.

MANY HEADS ARE BETTER THAN ONE

“I think playing is critical for coming up with new ideas. It’s something we try to encourage here at the office. The play state is inherently creative.”

David Kelley
IDEO Founder and Chairman

While the standard image of an inventor is someone working alone in his basement or garage, many inventors, especially today, work in teams. At IDEO, a design firm, experts from a variety of fields come together to design new products, services, environments, and digital experiences. IDEO’s design philosophy is that teamwork boosts the firm’s efforts in innovation and creativity. Teams share and improve ideas, building on their members’ skills and providing more opportunities for problem solving. Being on a team allows each member to engage in interdisciplinary, simultaneous innovation.

This exhibit section features inventors such as Linus Torvalds, inventor of the Linux computer operating system, and car designer Jerry Hirshberg, founder of Nissan Design International. The collaborative approaches of these inventors follow in the footsteps of Thomas Edison. Although often viewed as the quintessential lone genius inventor, Edison’s most important innovation may be his Menlo Park, New



Thomas Edison and his staff in the Menlo Park lab, 1880

Photo courtesy of Smithsonian Institution

Jersey, lab, where he developed inventions with a team of scientists, machinists, carpenters, glassworkers, and others. His laboratory expanded the 19th-century craft-shop model of invention, pointing toward the corporate research-and-development labs to come.

Shape Your Thinking through Play

- How have attitudes toward play changed over time?
- What kinds of toys did inventors play with as children?
- Is the quality and quantity of children’s play changing?
- How do new electronic and digital technologies affect children at play?
- How can new technologies provide rich motor and sensory experiences?
- If play is changing, how will that affect invention?

The video commentaries, toy displays, and activities featured in the Shape Your Thinking through Play section of the exhibition ask you to consider these questions, both for yourself and for future generations.

Public Programs Schedule

Room for Thought: Exploring Spaces for Inventive Play

Saturday, July 20 1–5 p.m.

From the playground to the workshop, this discussion and exhibition visit bring together a variety of perspectives on the role of play and our environment in promoting creativity in both children and adults.

Mindfest: A Festival of Playful Invention and Exploration

Saturday, August 17 10 a.m.–5 p.m.

Science, invention, and technology combine with music and photography in this day-long celebration for the playful of all ages. Experiment with the latest in digital technology from MIT's Media Lab and use everyday materials to create extraordinary playthings. Participate in hands-on activities, workshops, and discussions led by inventors, scientists, and the creatively playful.

Free Play Friday

Friday, September 20 6:30–8:30 p.m.

End your week with a bang by taking your inner child on a play date! This adults-only evening features hands-on activities designed to ignite your creativity. Explore *Invention at Play* and rediscover your inner inventor.

Play with the Everyday in a New Way:

Chain-Reaction Workshop

Saturday, September 28 10:30 a.m.–12:30 p.m.; 2–4 p.m.

Join us for a fun-filled morning or afternoon exploring innovative ways to incorporate everyday objects into play. This workshop is designed for children ages six and up and their adult companions.*

Toy Invention Festival

Saturday, October 5 12–4 p.m.

Celebrate the wonders of toys in an afternoon of toy building and an exploration of children's literature celebrating the invention process. Meet and invent with master toy-maker Rick Hartman and mechanical-sculpture artist Arthur Ganson.

Portrait of Invention: An Evening with Paul MacCready

Friday, November 8 6:30–8 p.m.

Join Paul MacCready, inventor of the *Gossamer Condor* and *Gossamer Albatross* for an evening of conversation with the "father of human-powered flight." Learn about this intriguing inventor's work and his visionary approach to technology and the future.

Free Play Friday

Friday, November 15 6:30–8:30 p.m.

End your week with a bang by taking your inner child on a play date! This adults-only evening features hands-on activities designed to ignite your creativity. Meet John Fabel, inventor of the Ecotrek backpack.

Digital-Reaction Workshop

Saturday, December 7 10:30 a.m.–12:30 p.m.; 2–4 p.m.

Traditional craft materials merge with new technology in these fascinating play workshops featuring the latest programmable-brick technology. This workshop is designed for children ages six and up and their adult companions.*

*Free tickets will be available for the September 28 and December 7 workshops at the Constitution Avenue entrance to the Museum on the day of the event from 10 a.m., on a first-come, first-served basis. Space is limited to 40 participants per workshop.

Resources

Invention at Play is a traveling exhibition. The Association of Science-Technology Centers (ASTC) will manage its national tour. Check the ASTC website at astc.org to find out where the exhibition will be on display from February 2003 to December 2005.

Lionel toy train, 1936–41



Photo by Harold Dorwin, courtesy of Smithsonian Institution

Check out inventionatplay.org to:

- Download *Play a New Way with the Everyday*, an activity guide for families
- Receive information on school programs and educational materials
- Get updated program listings

Check out www.smm.org/pie for information on the PIE (Playful Invention and Exploration) Network and the digital activities in the exhibition.



Smithsonian National Museum of American History

The Museum is located at 14th Street and Constitution Avenue, N.W., Washington, D.C. Hours are 10 a.m. to 5:30 p.m.; closed December 25. Admission is free. Museum exhibition areas, performance spaces, and most rest rooms accommodate wheelchairs. For further information call 202-357-2700 (voice) or 202-357-1729 (TTY) or visit americanhistory.si.edu.

Lemelson Center for the Study of Invention and Innovation

Invention at Play was developed by the Lemelson Center at the Smithsonian's National Museum of American History in partnership with the Science Museum of Minnesota. The exhibition, its related programs and materials, and its national tour are supported by The Lemelson Foundation and by the National Science Foundation.



On the cover: *Student playing with a Hoberman Sphere*, photo by Eric Long, courtesy of Smithsonian Institution; *Akhil Madhani with his Black Falcon robotic arm*, photo by L. Barry Hertherington, courtesy of Lemelson-MIT Program; *Gertrude Elion in the lab in 1948*, photo by GlaxoSmithKline, courtesy of the family of Gertrude B. Elion
Design by Fletcher Design/Washington, D.C.