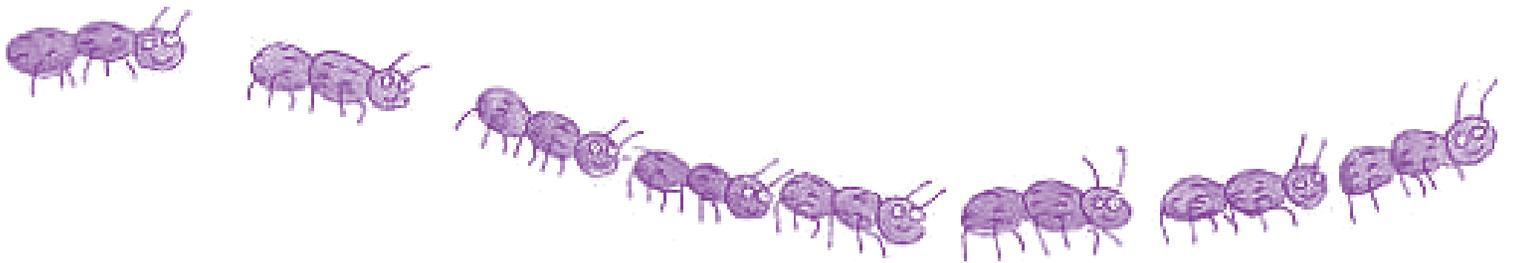


invention



at play



What's inside?

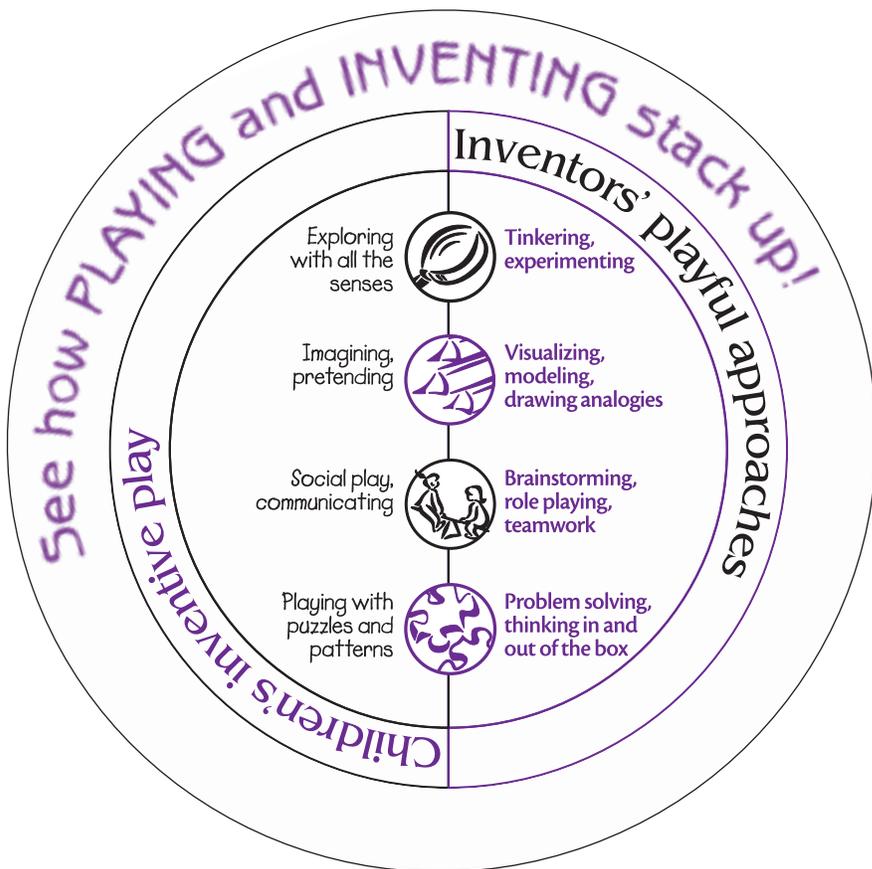
Inventor stories and
activities for adults to do
with children under 10.

“Imaginative play is a key that opens the doors of intuition.” —Frances Vaughan, child psychologist

PLAY MATTERS!

We all know play is fun. But did you know that play is an essential ingredient in a child’s intellectual and creative development? Scholars have discovered surprising parallels between the ways children play and the creative processes practiced by inventors.

When children pretend, build with blocks and boxes, solve puzzles, take things apart, or rig a new way to do something, they are practicing flexible habits of mind and making important new connections. Children who engage in this kind of thoughtful play with a wide variety of materials are forming the basis for lifelong creative talents, like those of inventors.



This Invention at Play booklet:

- highlights inventors who started out as great players and who recall a strong link between their play and inventing. (Many have never stopped playing!)
- encourages adults to create an enriching play/inventing environment at home with hands-on, minds-on suggestions.
- offers open-ended play and inventing activities for adults and children to do together.

“My hobby is building and inventing things. I’m still building, and I will keep on building.”—Newman Darby, sailboard inventor

Most inventions don’t take shape the first time around. Inventors make models (called prototypes), experiment with materials, make adjustments, and continue to fine-tune their inventions—to keep making them better.

INVENTOR STORIES

Newman Darby—Sailboard

Newman has been **building** boats since boyhood. He **experimented** with different ways to steer a boat and found he didn’t need a keel or a rudder. Instead he could just tip the sail left or right. From there, he **tested** different-size sails. His most important **innovation** was a universal joint. It worked like a joystick, connecting the sail to the board. This allowed for greater control of speed and steering.

Krysta Morlan—Cast Cooler and Waterbike

As a teenager, Krysta had to spend months with her legs in casts. She came up with two great **inventions** to help with her recovery. The first one is her Cast Cooler. It’s a system that keeps skin cool and comfortable while bound in a cast. The second, called the Waterbike, is an underwater bicycle used for physical therapy—or just for **fun**.

Photo by Dan Auber, courtesy of Kathy Morlan



Keep Making It Better



ACTIVITY

Float-a-Boat Challenge

Brainstorm multiple solutions to float your boat. Build model boats with different materials: cardboard, clay, Bubble Wrap, Styrofoam, plastic and paper cups, aluminum foil. Float them in a bathtub, a wading pool, or a pond.

- Which ones float?
- Which ones sink?
- What changes can you make to keep making your boat better?
- Try adding a rudder or a sail. What happens?
- Try adding pennies. How much weight can each boat carry? Why?



“All sorts of things can happen when you’re open to new ideas and playing around with things.”—Stephanie Kwolek, Kevlar inventor



Recognize the Unusual

INVENTOR STORIES

Art Fry—Post-it Notes

Art **recognized** the possibilities in a batch of “bad” glue. It was superweak instead of superstrong and just the thing he needed for his peel-off bookmark idea. Instead of tossing the sticky stuff, he used it to **invent** Post-it Notes.

Stephanie Kwolek—Kevlar

Stephanie worked in a lab and **experimented** with materials every day. She **discovered** Kevlar when she realized that a plastic solution she often studied was acting “different.” The material was supertough and superlight. She ended up with Kevlar, a chemical fiber best known for its use in bullet-resistant vests.

As a young girl, Stephanie liked to spend time **exploring** in the woods. She also designed and sewed her own clothes.

What can you **ACTIVITY** invent from a bag of junk?

Place the same set of objects—inventive play stuff (see next page)—in individual paper bags. Distribute to each person. See how many different ideas can come from the same junk.



“To invent, you need a good imagination and a pile of junk.”

—Thomas Edison, inventor of the incandescent lightbulb

ACTIVITY

What can you invent by experimenting with one material at a time?

Stephanie Kwolek discovered an amazing new substance while fooling around with a type of plastic she thought she knew everything about.

Try tinkering with a common material: newspaper, cardboard, aluminum foil, Styrofoam, pipe cleaners ...

Take your test material and: fold it, wet it, stretch it, tear it, pull it apart, put it back together, draw on it, heat it (with supervision!), cool it, play with it, and pretend with it.

Make a list of all the things you did with your chosen material. How did it change each time? What does it remind you of as you put it to different tests? Did you recognize anything unusual happening?

What's your next step? You might try adding one other material to it and seeing what happens. Now try connecting materials—things like foil, cardboard, rubber bands—with household objects to make a device that: waters a plant, feeds a pet, turns out a light.



Here are some other familiar materials that can spark play and invention.

Broken equipment to take apart and put back together (cut off all cords!)

Tools: screwdrivers, pliers, hammers

Cool trash: egg cartons, Bubble Wrap, huge appliance boxes, tiny jewelry boxes, and every kind in between



Watering devices: turkey baster, squeeze and spray bottles, funnel, hoses, straws, pitchers and bowls

Small stuff: bottle caps, toothpicks, screws, thread, safe sewing needles

Things that roll: marbles, dowels, toy wheels, paper towel and toilet paper rolls, balls, beads, old trike and bike tires

Sticky, attaching stuff: magnets, clay, glue, tape, paper clips, sponges



Building materials: blocks, wood scraps, tiles, plastic wrap, Popsicle sticks, wire, clay

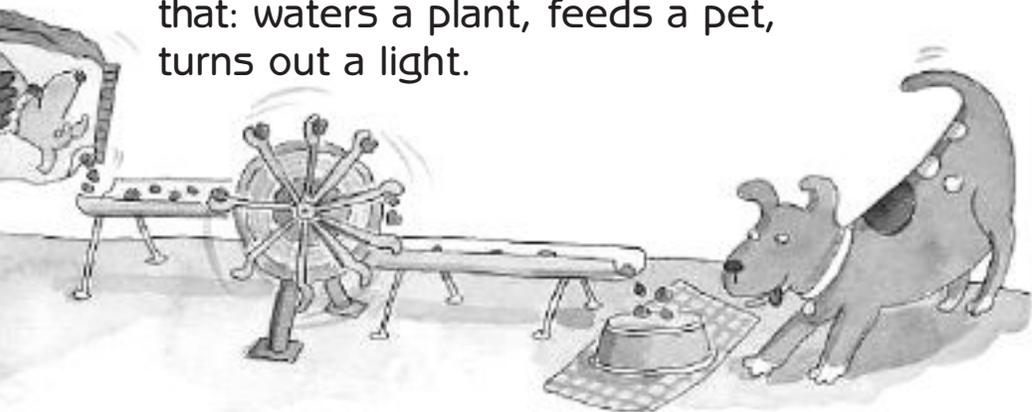
Nature stuff: rocks, shells, leaves, sticks, sand, dirt, water, snow, ice

Supervised stuff: nails, tacks, scissors, pins, glue gun



Paper and fabric: cardboard, tissue and typing paper, poster board, felt, old towels, muslin

Safety goggles or old glasses



“Always listen to children ... they might have ideas we’ve never thought of.”—Alexander Graham Bell

Borrow from Nature

INVENTOR STORIES

Alexander Graham Bell—Telephone

Alexander (called Aleck) took what he learned from studying the human ear to **invent** the telephone. His **observations** of sound waves hitting the inner ear bones and eardrum helped him make the “leap” to creating the first telephone.

From boyhood, Aleck was fascinated by the natural world. He would go to a favorite grassy spot, lie on his back, and watch birds fly overhead. He also formed a nature club with friends, collecting birds’ eggs and animal skeletons in his chosen role as “professor of anatomy.”



Photo by Donna Coveney, courtesy of MIT News Office



Does your child have a **quiet place** to relax, think, and daydream? Do you have one of your own?

Alexander Graham Bell’s “dreaming place” gave him the quiet time to daydream and collect his thoughts.

What other animals that crawl, swarm, fly, or burrow might inspire inventors as they build robots?



Answer: All of them!

“[My father] advised me to sit ... in my reading chair for an entire evening, close my eyes, and try to think of new problems to solve.”—Luis Alvarez, Nobel Prize winner in physics, 1968

ACTIVITY See what you can borrow from nature!

The key is to take your time, observe closely, and talk about what you see, hear, smell, and touch. Are there things in nature that might inspire part of a future invention?

LOOK FOR TYPES OF MOTION:

crawling, walking, flying, running, slithering, dripping, floating

MATERIALS: sap, dirt, mud, twigs, dew, rain, grass, moss

NATURAL CONTAINERS: acorns, pinecones, flower petals, cupped leaves, shells

TEXTURES: smooth, slick, spongy, rippled, sharp, bristly

MASS/WEIGHT: sand, rocks, pebbles, water, ice

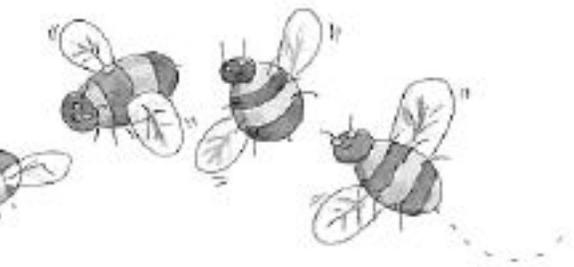
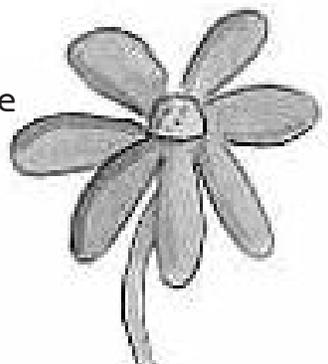
PATTERNS: branching patterns in lightning, veins of leaves, ferns and pinecones, spiderwebs, bird nests, clouds, tree branches

James McLurkin— Robotic Ants

James based his robotic ants on the behavior of real ants. He kept a big container of ants right on his desk so that he could watch them closely. He also watches bees to figure out how they communicate with each other.

He explains: “The goal is to explore ideas about robot communities using one of the best examples around—nature.”

Don't forget to take along your inventor's idea books to capture ideas in drawings or notes. But above all, carry your ideas, impressions, and inspirations home in your head. Take them to your dreaming place and ponder how you might use your nature observations in future inventions.



Where do inventors get their ideas?

Just about anywhere: in bed, on walks, while hiking, biking, working out, and playing around—even underwater.



“I’ve come up with some of my best ideas in the shower—in fact, I’ve even installed a whiteboard in my shower—so I can jot down my ideas.”

—David Kelley, inventor and founder of IDEO “inventing” firm

PLAY AND INVENTING RESOURCES

Cool Kids’ Books

- Erlbach, Arlene, *The Kids’ Invention Book* (Minneapolis: Lerner Publications, 1999)
- Gauch, Patricia Lee, *Christina Katerina & the Box* (New York: PaperStar—Putnam & Grosset Group, 1998)
- St. George, Judith, *So You Want to Be an Inventor?* (New York: Philomel Books, 2002)

Good Books for Parents

- Auerbach, Stevanne, *Dr. Toy’s Smart Play* (New York: St. Martin’s Press, 1998)
- Root-Bernstein, Robert and Michele, *Sparks of Genius* (New York: Houghton Mifflin, 1999)
- Sobey, Ed, *Inventing Toys: Kids Having Fun Learning Science* (Tucson: Zephyr Press, 2002)

Awesome Websites

- inventionatplay.org: read inventors’ stories, play inventive games, explore favorite toys.
- www.pienetwork.org: discover “Cricket,” the latest in digital play.
- inventiondimension.com: discover more inventors, play Brain Drain, and try a monthly trivia challenge.

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Smithsonian
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*Lemelson Center for the Study of
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