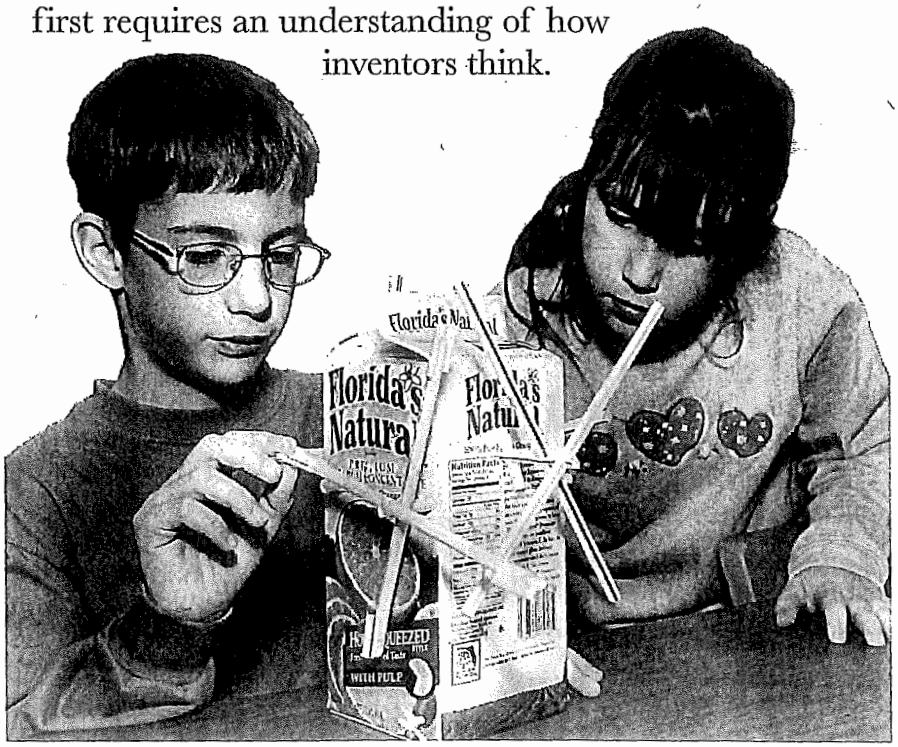
* Excerpt from *The Ultimate Building Book* by Steven Caney. Running Press Kids. 2006.

TRYING NEW IDEAS LEADS TO BETTER SOLUTIONS

Creativity is the special ingredient that often turns building projects into inventions. Just about everything you encounter from toys and tools to gadgets and games is an invention that someone first thought of and then built. But a creative idea can only become an invention when someone figures out how to build it. Proving that an idea really works is one of the requirements for patenting an invention, along with showing it is something no one has ever done before and that it serves some useful function.

For our purposes, however, these requirements can be eased a bit. Any construction that demonstrates a creative solution previously unknown to you, the builder, can be considered an invention. In that spirit, nearly every construction, every model, and every experiment has an element of the invention process. Something new is tried, and something new is learned from the results. The experiments that work are repeated and added to your growing vocabulary of building techniques. In some ways, every time you build something, you are acting like an inventor. But to really develop your skills and spirit for building inventions first requires an understanding of how inventors think.

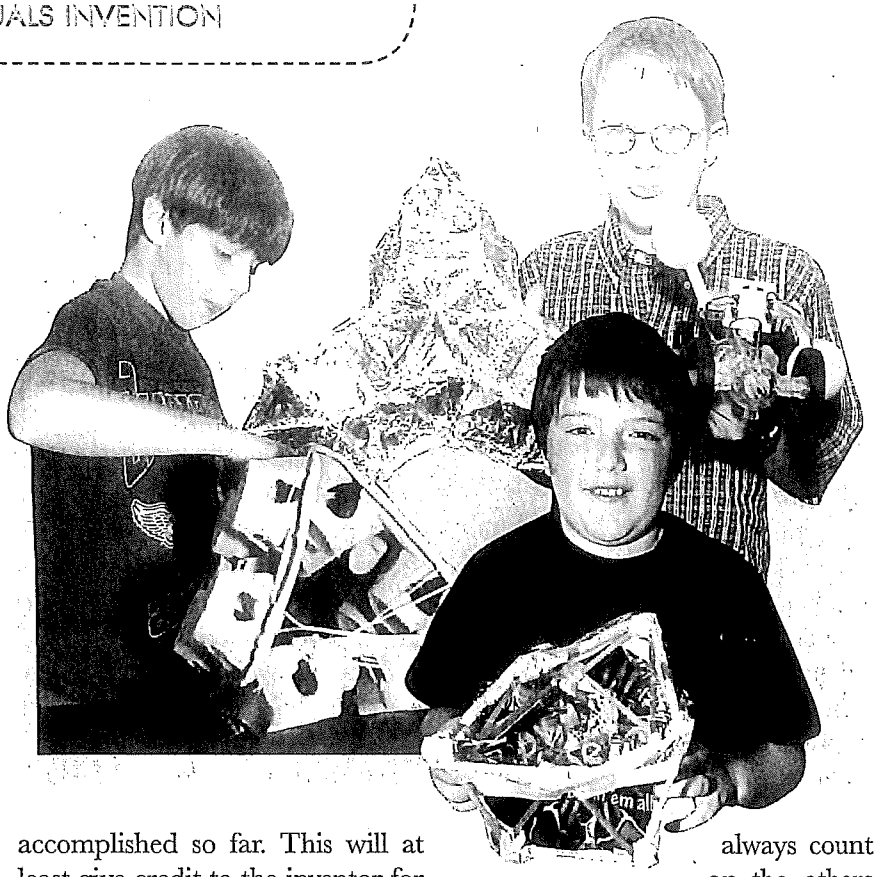


Learn to Think Like an Inventor

Most inventors have a passion for messing around with materials, building contraptions, conducting experiments, observing how things work, figuring out better ways to solve problems, being inspired by clues others don't see, and then force fitting their good ideas into usable solutions. To help figure out how to make an invention idea work, the inventor must develop a special creative attitude for looking at everyday things from different perspectives. Nearly anything can be considered a possible clue in the mental hunt for the right combination of ingredients to make an invention idea work. For example, suppose the invention problem was building something to catch houseflies. What clues might the inventor get from considering the attributes of duct tape, a piece of cheese, plastic wrap, paper cups, molasses, or ice cubes? How about a combination of these items like a cup and molasses, or cheese and duct tape? A look around the room or a walk around the block will usually reveal all kinds of clues for ways to make any idea work.

Once the inventor has a solution in mind, the process of building an invention is neither to build randomly nor to build according to a plan. Instead, the inventor's work is to build and test, rebuild to improve and test again, and keep on rebuilding until the invention works. Older builders are often able to make sophisticated models of invention ideas with parts that really work, and it's okay for young

builders to make simpler and sometimes nonworking models that come with explanations of how the inventions are supposed to work. This is also the invention process at work. Builders must understand that unsatisfactory results should not be seen as failures, but rather as necessary experiments on the way to solving the invention. Therefore, inventions in progress should be built more for testing functionality than for final appearance. Once you figure out how to make it work, the design can be refined.



A normal part of inventing is getting stuck and then finding ways to get unstuck. One of the best ways to get new input for solving an invention problem is for the inventor to present the work-in-progress to others—but do it this way. Begin the presentation by stating what the invention is supposed to do, and then show what has been accomplished so far. This will at least give credit to the inventor for solving part of the problem. Next comes the explanation of what doesn't work or where the process has stalled. At this point, you can always count on the others present to spontaneously offer a flood of suggestions for what to do next. The inventor can then decide if any new ideas are worth trying.

HOW TO GET INSPIRATIONS FOR INVENTION IDEAS

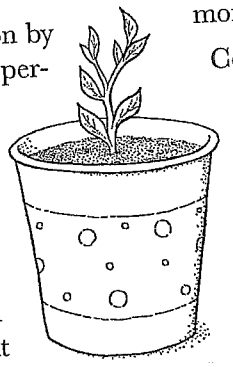
Not all inventors work the same way or the same way all the time. Sometimes the inspiration for an invention comes from a personal need or the awareness of a need that others have. Fifteen-year-old Chester Greenwood invented earmuffs in response to other kids laughing when he wore his grandmother's scarf to the ice-skating pond. And a teenage Levi Strauss is credited with putting rivets at the corners of pants pockets so they wouldn't rip when gold miners stuffed their pockets with nuggets.

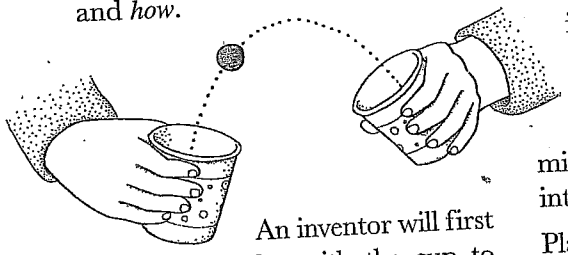
These are good examples of the common expression "Necessity is the mother of invention." And these types of planned inventions require a clear understanding of what needs to be accomplished. The more the problem is discussed, the more ideas for solutions will be generated, and the closer the inventor will get to finding the best one. In other words, a problem that is well-defined will directly lead the inventor to the best solution.

But sometimes necessity is *not* the inspiration for invention. Many inventors are inspired by the discovery of some interesting phenomenon. They then use creative thinking to see how that phenomenon might solve some other problem. The inventor of Velcro was inspired by the way barbed burrs from bushes would stick to his pant legs when he walked through the woods. A very young George Ferris's fantasy of taking a ride on a huge waterwheel later led to his

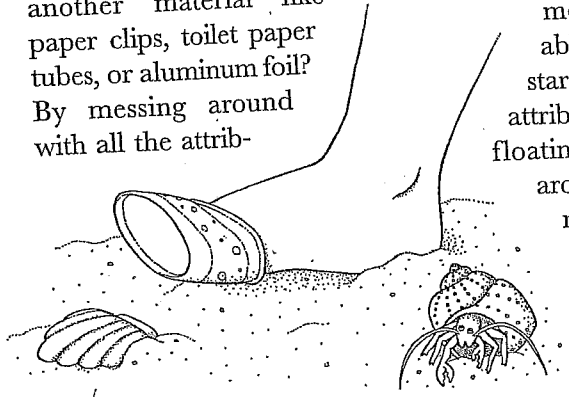
invention of the Ferris wheel. And after seeing empty pie-baking tins being used in a backyard game, somebody invented the Frisbee.

Discovering a phenomenon by seeing things from a new perspective is what inspires inventions and is one of the most useful skills an inventor can learn. For example, an inventor might look at a paper drinking cup and begin to imagine other things it might be used for. In the mind of the inventor, this is simply figuring out "What else does it want to be?" In some ways, it's like conducting an interview of the object, asking questions that begin with *who, what, when, where, why,* and *how.*





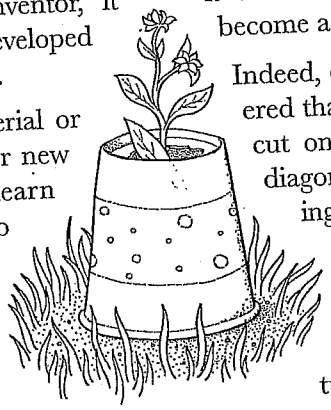
An inventor will first play with the cup to discover all its attributes. In its present use, we already know the cup is waterproof, has a certain shape and size, and holds a certain volume. But what if you bend, tear, or cut the cup in some way? How does that change its attributes? What if you use several cups attached together side to side or end to end? And what if you add another material like paper clips, toilet paper tubes, or aluminum foil? By messing around with all the attributes of a paper cup and asking a lot of "What if?" questions, the inventor will learn what else that paper cup wants to be—and even more clearly what it doesn't.



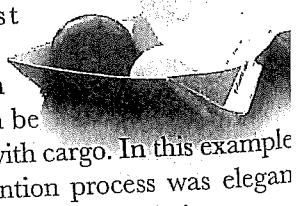
Considering each of these attributes, the inventor will then figure out all the other things the cup might be used for. Because the cup is waterproof to hold liquids, what else could it hold that needs a waterproof container? Maybe fill a cup with soil and use it to start seedlings. The cup may be designed to hold things, but what if it is turned upside down? Maybe it then becomes a protector of some kind, a translucent shell over small delicate seedlings planted in a garden, or a bare-toes cover for walking on a hot beach. If one of these ideas or some other application is exciting enough to inspire the inventor, it might be further developed into a new invention.

Playing with a material or an object to discover new perspectives and learn what else it wants to be is a technique that can also be used to find creative solutions to well-defined problems. Let's say you want to invent and build a toy sailboat and the only materials available are common discards and disposables. The inventor might start by thinking about what attributes are important for a floating model and then look around the house for scrap materials and things that are waterproof and can also float. The results of that might include empty plastic jugs, paper and plastic drinking cups, storage containers with snap-on lids, empty milk cartons, balls and balloons, and probably lots of other stuff.

This is like a scavenger hunt with the inventor looking at each object as it is encountered on the search and asking "Is it waterproof? Will it float? How can I turn it into a sailboat?" By looking closely at each object, by handling each one and seeing how it might be made into a boat by cutting, tearing, bending, or doing something to it, each material will begin to reveal if it wants to (or doesn't want to) become a sailboat.



Indeed, one kid inventor discovered that an empty milk carton cut on three sides across the diagonal makes a great floating catamaran boat. When the cut milk carton is folded open, it forms two pontoon hulls in the shape of a "W." To turn it into a sailboat, the inventor made a slit in the middle of the "W" hull and added a paper plate as a sail. This milk carton sailboat cannot only sail swiftly with the slightest breeze, the twin hulls can be loaded with cargo. In this example the invention process was elegant and so was the final design.



BUILDER'S TIP

WHAT ELSE DOES IT WANT TO BE?

Nearly every material, every component, and every product that was created for one particular purpose can also be used to do something else. Sometimes these new uses are even more exciting than the original use. If you mess around with stuff in enough ways, you might discover that paper tubes can become musical instruments, plastic wrap and water make a giant magnifying lens, a length of hose makes a good short-distance telephone, a paper clip bent a special way becomes a building module, and a plastic six-pack carrier can be used to blow streams of big bubbles.

The idea is to learn what else the object wants to be by imagining what it might do differently if it floated on water, if it were three times as big, or if it glowed in the dark. The more ideas you try out, the better chance you will find—or actually invent—an exciting, new use for the object. To help in the discovery process, here is a list of words you might start with to see what else an object might want to be. It helps to have the object with you to try out the idea as you think of it—being able to look at the object and handle it also helps generate new ideas.

What else could this be if it could . . .

float in air?
float on water?
be giant size?
be miniature in size?
fly?
roll?
change color?
be worn?
be carried?
be upside down?
be sideways?
get hot?
get cold?
be hung?
move by itself?
become invisible?
last forever?
be soft?
be hard?
be smooth?
be rough?
glow?
be fuzzy?
emit sounds?
be unbreakable?
be thrown away?
be used to build with?
hold something?
protect something?
be a toy?
be connected to something else?
be cut in pieces?
smell good?
smell bad?
be sticky?
have wheels?
be waterproof?
be eaten?
be a work of art?
save time?
be used by pets?

How could you use the object in different places, like . . .

in your bedroom?
at school?
in a hiding place?
in a car?
on a bicycle?
in a specific room?
on the floor?
on the wall?
on the ceiling?
at a restaurant?
in bed?
on a table?
on a boat?
at the beach?
at the park?