Inventions and the creative process

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Patents and inventions, while related (in that the former describes the latter), are orthogonal instruments. A patent is merely a legal document that entitles its bearer to an argument. Although it might contain an invention, this isn't absolutely necessary. Whether it does is generally the subject of the (aforementioned) argument. That's what lawyers are for. On the other hand, an invention is an abstract instrument created by the mind, and in the (nascent) information age, machines can also create.

The courts move much more slowly than does technology. The result is that patent art—and what is thought to be patentable—has frequently lagged behind specific opportunities for new innovation to create value. This has happened in the past. When there are paradigm shifts in technology, the patenting standards eventually shift too, but with a lag. I have seen many such shifts during my career.

There are obvious legal conundrums as to who owns inventions created by a machine. Although I expect this to be the next shift in the evolution of intellectual property law, I will leave the subject of patents to a future column. For this first installation of my column, let's consider the act of creation.

What is creative genius?

What constitutes creation? I had said that an invention is an abstraction created by the mind. The mind itself is an abstraction—it is part of the infinite creation, secular or not. We think of the mind as living within the brain (although it can travel to the far corners of the universe), but it is not the brain. The brain is merely the engine on which the mind runs, whether or not we choose to be conscious of it.

Every human being is innately gifted with the potential for creative genius. Thomas Mann said that we are all born as prodigies. In fact, children are especially creative because they are completely uninhibited, and because they do not take any limitations for granted. As we learn to become adults, we learn to stifle many of those aspects of our personal natures that directly link to our potential for creative genius.

How creative are you? Here's a simple exercise by creativity consultant Michael Gelb. At the end of the next paragraph, stop reading (momentarily) to do a thought experiment. I will name a common object. Time yourself for two minutes, and write down every new use for that common object that you can think of. We will come back to score this later.

OK, ready? Think *paper clip*. Now, write as many uses for that object as possible.

What was your best idea? Keep this in mind for later. As a side note, I would bet that if you have young children in the house, they could think of more uses for a paper clip than you did, although they may not quite grasp the concept of a two-minute deadline.

Left brain, right brain

Fairly recently, scientists learned that the brain has a distinct left side and a distinct right side, and that the each side performs distinct types of processing. It is the archetypical heterogeneous machine. The left side primarily performs logical processing: spatial reasoning, axiomatic reasoning, speed and distance estimation, pattern matching, arithmetic, and so on. The right side performs creative (in the canonical sense) processing. It deals in emotions, feelings, intuition, and so on—those things normally associated with interpersonal skills, and with the fine arts (music, literature and poetry, painting and sculpture, and dance).

If you are right-handed, try writing with your left hand occasionally when you are brainstorming (vice-versa for lefties). This might cause "crossovers" within the brain that can jump-start an idea. Thomas Jefferson was extraordinarily creative, not to mention brilliant. He could write with both hands simultaneously—in two different languages.

Human potential experts Jack Canfield and Mark Victor Hansen suggest that to appeal to another person's emotions during a conversation, you should establish eye contact, and especially focus on the other person's left eye so as to stimulate their right brain.

The three minds

Again, *mind* is distinct from *brain*. There are three distinct minds that occupy or "run on" the heterogeneous engine that we call a brain.

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- The *conscious mind* is the mind that reasons and handles quotidian functions. It is the only mind that most adults use with any real awareness.
- The *subconscious mind* handles autonomic functions—such as breathing—at a level generally below our awareness.
- The *superconscious mind* is aware of everything (although most adults are not aware of it); it holds the answers to all questions. It is the dreaming mind; the imaginer.

Ideally, for the mind to conceive invention, it should use both sides of the brain and all three minds. Productivity expert and consultant Brian Tracy describes three primary triggers to creativity. These are

- intensely desired goals,
- pressing problems, and
- focused questions.

People achieve maximum creativity by pulling all three triggers simultaneously; this engages all three minds, and causes them to work together. The more emotion you can inject into a problem, the more you will stimulate your creative ability.

All creation starts with a thought. Every physical entity that exists today was once merely an abstraction, a thought.

At the opening ceremony of the Experimental Prototype Community of Tomorrow (Epcot), a reporter asked Roy Disney whether he found the event bittersweet since his uncle Walt Disney (who had conceived Epcot) had not lived long enough to see it. Disney eyed the reporter with bemusement, and said, "You obviously do not understand the creative process. Walt already *saw* Epcot—years ago. That's why you are getting to see it today."

The art of invention

Each invention begins with the "mind's eye" seeing the need for the invention. Invention flows from (at least) three distinct approaches to thought. These are

- invention driven by the left brain,
- invention driven by the right brain, and
- naive invention done as an idiot savant.

To actively engage in the process of invention, you should use all three approaches. The world's greatest inventor, Thomas Edison, exemplified all three. I will explain each approach.

First, most of us in the hard sciences are accustomed to left-brain thinking. Wherever there is an imperfect system (and all systems are imperfect subject to some set of optimization criteria), extensive and thorough analysis will eventually pinpoint the problems. Once we understand the problem's source, it is (usually) immediately apparent how to mitigate the problem, or at least how to palliate its effect. These means (of mitigation) may constitute inventions.

Many such inventions cause side-effects; that is, they create new problems. I call these *iatrogenic inventions*. They are a rich source of yet more (derivative) inventions. The patent literature is replete with derivatives of iatrogenic inventions. They are very easy to spot. They usually have a title of the form "Improved <title of original iatrogenic invention>."

Edison was relentless in searching for the right solution to create the electric light bulb, and he was meticulous about documenting his results. This is left-brain processing, although as I will explain later, his assiduity was driven by a right-brain exercise that he employed, which is the best use of synergy in the creative process. Edison performed over 16,000 tests, documenting each result in his quest to realize the light bulb.

There is a story that a friend of his was in the lab on the occasion of his (roughly) 5,000th test, which resulted in an explosion and a small fire. His friend advised him to give up. He advised that after 5,000 failures, Edison should move on to something else. Edison replied, "I have not had 5,000 failures. I have successfully learned 5,000 ways not to make an electric light bulb, which narrows the field, and brings the goal closer. In addition, this time I learned a new way to make an explosion, which may be useful in some other application."

Assuming that you have an expert level knowledge in a particular field (and have left-brain reasoning down pat), the second approach is to invent via free association using the right brain. It is important while doing this to silence the "inner critic" in the left brain.

Free association should really be free; do not think about why an idea won't work at this stage. If pigs did have wings, what new things could be done with that? What new things would such a world need?

Try combining things that are not apparently related. Zebras with polka-dots? A flashing light with a folding umbrella? A beach ball and a beach chair? How could you combine these? What uses could you find for such combinations?

Take something that already exists (for example, a paper clip) and think of new uses for it. Could you use it backwards in space or backwards in time? How about using it upside-down or inside-out? What would be different if it were in motion? Rotating? What if it was a thousand or a million times bigger or smaller?

What if your invention had a different weight or density? What might it look like in four dimensions? What new things could be done with two or more of them or half of one? What if it were in a different state (solid, liquid, or gas)? What new problems would this cause?

If that causes problems, what would happen if we reversed cause and effect? How could we reverse them? What if your invention was invisible?

What features do you see in a landscape or hear in a piece of music that could apply to your invention? If your invention doesn't seem useful now, would it be useful if it were floating in space? If it were underwater? Or inside a glacier? Or maybe in a gelatin mold?

After turning the right brain loose to create many ideas in the first phase of brainstorming, and only after that, go back and criticize each idea to see if you can make it work using the first (left brain) approach. Admittedly, most of the ideas that you will generate will be bad—assuming that you generate a lot of them. The goal is to gen-

erate as many ideas as you can. Only then do you engage the critical mind.

Linus Pauling was once asked how he was able to get great ideas. He said, "First, and most important, get *lots* of ideas. Second, and only then, have discernment."

As I had mentioned previously, Edison used a right-brain exercise to energize himself and give himself relentless drive. He would allocate time in his schedule to engage in "active dreaming" (which is analogous to meditation or prayer, although it is more focused). Edison was not merely interested in an electric light bulb to create clean lighting for the home (replacing oil lamps and candles). Rather, he saw the light bulb as a vehicle to create a new world.

He knew that if clean lighting was safe and affordable, everyone would want it. Then, since homes and other buildings did not have electricity, there would be a huge industry that would be born to create the infrastructure to generate and distribute electricity to every home. Once everyone had electricity, there would be an even larger market (and its supporting industries) for new inventions—household appliances—that everyone would want, and that would change the quality of life: electric washers and dryers, ovens, fans, electric heat, and vacuum cleaners, to name a few. He frequently and actively dreamed of this new world, and he presciently posited many of the household devices that are common today. The mission was never just about lighting. It was about dramatically turning the world into a different and better world.

The third and perhaps most important method is to forget what you know, and invent as an idiot savant. Even better, invent things in an area that you know nothing about. You will not have the "benefit" of an inner critic who "knows better." This is why it is fruitful to invent (using something like the second approach) with a group of people having diverse backgrounds.

Brilliant things will naturally occur to ordinary people who lack the expertise to know that they should not consider certain approaches. Some of my best inventions have come about only because I have completely misunderstood someone else's explanation of a problem.

Amazingly, Edison had no formal education. He had no formal instruction in electricity, materials, or physics. He came to the problem as a credulous naif with a grand concept of a new world. He arrived following a 50-year era of men with technical educations trying to accomplish the same thing—and failing. Edison brought an open mind, a new world view, and a surplus of creative energy to the problem to surpass 50 years of work done by those with more knowledge.

Note that left-brain invention tends to be evolutionary. It is not the art of building a completely different type of mousetrap (or perhaps even a different type of mouse); instead it's the art of making the existing mousetrap better. On the other hand, right-brain (and naive) invention tends to be revolutionary: we envision a world without mice or a world run by mice without people. Some of it is the stuff of children's storybooks, and of cartoons, but occasionally there is a real technological breakthrough that changes how we live: the light bulb, the telephone, the automobile, the electronic computer, or the Internet.

Stifling creative abilities

As an aside, scientific knowledge, although essential, will frequently subvert creative thought. It is important to bring knowledge to bear in sculpting an invention, but this should occur later in the creative process, particularly for right-brained and naive (revolutionary) invention. In product development, it is natural to be suspicious of anything new, since new methods tend to come replete with side-effects (also known as "bugs").

Good development engineers will usually give you a (basically correct) list of 100 reasons why a new idea will not work within the first 10 minutes of hearing the idea. Engineers like this are vital. Corporations could not produce quality products without them. But this is the wrong mindset to bring to a brainstorming session. Leave these people in the lab, where they are good at what they do.

Bring in these people only after freely associating ideas. They will be quick to point out all of the problems that you must overcome. These insights are essential to making an invention workable and useful. Also, many of these insights are inventions in and of themselves.

How creative are you?

Now, let's see how you scored on our creativity exercise. Count the number of uses for a paper clip in the two minutes you thought about it. The average score for most people is 6 to 8 uses. Many more than this, say doubling it, is rare and indicates a very creative person. Doubling it again (32 uses) would put you off the scale. In-between (24 uses) is a number that correlates strongly to other indicators of creative genius.

Now, of all of your posited uses, select the best one. Your selection reveals another key to your personal creative style. Why did you choose this particular use as being the best? Did you choose it as the best because it was the most practical or logical use? Or because it was the most ingenious or unusual use? Or was there another reason? All reasons are equally good, but they reveal different creative orientations and tastes. Especially creative people tend to choose the application that is the most unusual.

Remember that I had said that if you have young children in the house, they would probably beat you at this test? I wasn't really sure that this was true, so I asked my 9-year-old son, Alex, to take it. Although I didn't hold him to two minutes, he did not even pause until he had written over 40 uses. After a brief pause, he came up with a dozen more. I finally told him that he had done "good enough." Alex left me in the dust.

Here's 10 of his uses that I especially liked: a folding chair for hamsters, a picture frame for leprechauns, punk jewelry for the dog's nails, a tattoo shape, miniature "automatic" chopsticks, wind chimes (using several), a metal Mohawk toupee (using many of them), eyeglass frames for cats (using two), a tool for picking the dog's nose, and a dream catcher made using a few of them. Did you think of any of these?

Creativity and humor

Finally, I had mentioned the link between creativity and inhibition. Creativity consultants Jim Loehr and Peter McLaughlin begin their organized creativity workshops with humor sessions. They have found that when the laughs increase, the new ideas flow in proportion to the laughs. And when the laughs end, the flow of ideas ebbs. They have found a direct link between laughter and creativity. They believe that laughter reduces inhibition because people become less concerned with having their ideas judged foolish.

So whatever you do, laugh. Or at least keep smiling. And if you sometimes find this hard to do, here's an old trick that helps. Take two paper clips and unfold each one into the shape of a "C." Take one of them, and jam it inside your lips (outside the teeth) in one corner of your mouth. Repeat with the other corner. Your mouth should now be a moronic looking rictus.

And if you have young children, I'll bet they've already thought of this one.

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