



Thinking Like a Genius.

EIGHT STRATEGIES USED BY THE SUPERCREATIVE, FROM
ARISTOTLE AND LEONARDO TO EINSTEIN AND EDISON

BY MICHAEL MICHALKO

Even if you're not a genius,
you can use the same
strategies as Aristotle and
Einstein to harness the
power of your creative
mind and better manage
your future.

How do geniuses come up with ideas? What is common to the thinking style that produced "Mona Lisa," as well as the one that spawned the theory of relativity? What characterizes the thinking strategies of the Einsteins, Edisons, da Vincis, Darwins, Picassos, Michelangelos, Galileos, Freuds, and Mozarts of history? What can we learn from them?

For years, scholars and researchers tried to study genius by analyzing

statistics, as if piles of data somehow illuminate genius. In his 1904 study of genius, Havelock Ellis noted that most geniuses are fathered by men older than 30, had mothers younger than 25, and usually were sickly as children. Other scholars reported

that many were celibate (Descartes), others were fatherless (Dickens) or motherless (Darwin). In the end, the piles of data illuminated nothing.

Academics also tried to measure the links between intelligence and genius. But intelligence is not enough. Run-of-the mill physicists have IQs much higher than Nobel Prize-winner Richard Feynman, widely acclaimed for his extraordinary genius, whose IQ was a merely

respectable 122.

Genius is not about scoring 1600 on the Scholastic Assessment Test, mastering 14 languages at the age of seven, finishing Mensa exercises in record time, having an extraordinarily high IQ, or even being smart. After considerable debate initiated in the 1960s by psychologist Joy P. Guilford, who called for a scientific focus on creativity, psychologists concluded that creativity is not the same as intelligence. An individual can be far more creative than intelligent, or far more intelligent than creative.

Most people of average intelligence can figure out the expected conventional response to a given problem. For example, when asked "What is one-half of 13?" most of us immediately answer six and one-half. You probably reached the answer in a few seconds and then turned your attention back to the text.

Productive vs. Reproductive Thinking

Typically, we think reproductively—that is, on the basis of similar problems encountered in the past. When confronted with problems, we fixate on something in our past that has worked before. We ask, "What have I been taught in life, education, or work on how to solve the problem?" Then we analytically select the most promising approach based on past experiences, excluding all other approaches, and work within a clearly defined direction toward the solution of the problem. Because of the soundness of the steps based on past experiences, we become arrogantly certain of the correctness of our conclusion.

In contrast, geniuses think productively, not reproductively. When confronted with a problem, they ask "How many different ways can I look at it?," "How can I rethink the way I see it?," and "How many different ways can I solve it?" instead of "What have I been taught by someone else on how to solve this?" They tend to come up with many different responses, some of which are unconventional and possibly unique. A

productive thinker would say that many different ways exist to express "thirteen" and many different ways to halve something, such as:

$$\begin{aligned}6.5 \\ 1\frac{1}{3} = 1 \text{ and } \frac{1}{3} \\ \text{THIR TEEN} = 4 \\ \text{XIII} = 11 \text{ and } 2 \\ \text{XIII} = 8\end{aligned}$$

As you can see, by expressing 13 in different ways and halving it in different ways, one could say one-half of thirteen is 6.5, or 1 and 3, or 4, or 11 and 2, or 8, and so on.

With productive thinking, one generates as many alternative approaches as one can. You consider the least obvious as well as the most likely approaches. It is the willingness to explore all methods that is important, even after one has found a promising one. Einstein was once



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asked what the difference was between him and the average person. He said that if you asked the average person to find a needle in a haystack, the person would stop when he or she found a needle. He, on the other hand, would tear through the entire haystack looking for all possible needles.

Whenever Feynman was stuck on a problem, he would invent new thinking strategies. He felt the secret to his genius was his ability to disregard how past thinkers thought about problems and, instead, invent new ways to think. He was so "unstuck" that if something didn't work he would look at it several different ways until he found a way that moved his imagination. He was wonderfully productive.

Feynman proposed that schools teach productive thinking instead of reproductive thinking. He believed that the successful user of mathematics is an inventor of new ways of thinking in given situations. He believed that, even if the old ways are well known, it is usually better to invent your own way or a new way than it is to look it up.

The problem " $29 + 3 = ?$ " for example, is considered appropriate for children no earlier than the third grade, because it requires the advanced technique of carrying; yet Feynman pointed out that a first grader could handle it by thinking: 30, 31, 32. A child could also mark numbers on a line and count off the spaces—a method that becomes useful in understanding measurements and fractions. One can write larger numbers in columns and carry sums larger than 10. Or use fingers or algebra ($2 \text{ times what plus } 3 \text{ is } 7?$). Feynman encouraged teaching people to figure out how to think about problems in many different ways using trial and error.

Skewed by the Prism Of Past Experience

The point is that reproductive thinking fosters rigidity of thought. This is why we so often fail when confronted with a new problem that is superficially similar to past experi-

ences, but different from previously encountered problems in its deep structure. Interpreting such a problem through the prism of past experience will, by definition, lead the thinker astray. Reproductive thinking leads us to the usual ideas and not to original ones. If you always think the way you've always thought, you'll always get what you've always gotten.

In 1968, the Swiss dominated the watch industry, as they had for centuries. It was the Swiss who invented the modern electronic watch movement at their research institute in Neuchâtel, Switzerland. That year, however, when this new invention was introduced at the World Watch Congress, every Swiss watch manufacturer rejected it. Based on their past experiences in the industry, the manufacturers believed this couldn't possibly be the watch of the future. After all, it was battery powered, did not have bearings or a mainspring, and had almost no gears. But Seiko, a Japanese electronics company, took one look at this invention and proceeded to change the future of the world watch market.

In nature, a gene pool that is totally lacking in variation would be unable to adapt to changing circumstances. In time, the genetically encoded wisdom would convert to foolishness, with consequences that would be fatal to the species's survival. A comparable process operates within us as individuals. We all have a rich repertoire of ideas and concepts based on past experiences that enable us to survive and prosper. But without any provision for variation, our usual ideas become stagnant and lose their advantages. In the end, we are defeated in our competition with our rivals.

When Charles Darwin returned to England after visiting the Galapagos Islands, he distributed his finch specimens to professional zoologists to be properly identified. One of the most distinguished experts was John Gould. What was most revealing was not what happened to Darwin, but what did not happen to Gould.

Darwin's notes show Gould taking him through all the birds he had

THOMAS EDISON,
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TION EVERY 10 DAYS.
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THOUGH OFTEN OF
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DICTIONARY OF AMERICAN PORTRAITS



named. Gould kept going back and forth about the number of different species of finches: The information was there, but he didn't quite know what to make of it. He assumed that, since God made one set of birds when he created the world, the specimens from different locations would be identical. It never occurred to him to look for differences by location. Gould thought the birds were so different that they represented distinct species.

What is remarkable about the encounter is the completely different impact it had on the two men. Gould thought the way he had been conditioned to think, like an expert taxonomist, and didn't see the textbook case of evolution that unfolded right before him. Darwin didn't even

know the birds were finches. The person with the intelligence, knowledge, and expertise failed to see something new, and the person with far less knowledge and expertise came up with an idea that would shape the way we think about the world.

Thinking Strategies Of Geniuses

Genius is analogous to biological evolution in that it requires the unpredictable generation of a rich diversity of alternatives and conjectures. From this assortment, the intellect retains the best ideas for further development and communication. An important aspect of this theory is that you need some means of producing variation in your ideas and that for this variation to be truly effective it must be "blind." Blind variation implies a departure from reproductive (retained) knowledge.

A growing number of scholars are striving to characterize the way geniuses think. By studying the notebooks, correspondence, conversations, and ideas of the world's greatest thinkers, these scholars have identified specific thinking strategies and styles of thought that enable geniuses to generate a prodigious variety of novel and original ideas.

Eight Strategies

Following are thumbnail descriptions of strategies that are common to the thinking styles of creative geniuses in science, art, and industry throughout history.

1. Geniuses look at problems in many different ways. Genius often comes from finding a new perspective that no one else has taken. Leonardo da Vinci believed that, to gain knowledge about the form of a problem, you begin by learning how to restructure it in many different ways. He felt that the first way he looked at a problem was too biased toward his usual way of seeing things. He would restructure his problem by looking at it from one perspective and move to another perspective and still another. With each move, his understanding would

deepen and he would begin to understand the essence of the problem.

Einstein's theory of relativity is, in essence, a description of the interaction between different perspectives. Freud's analytical methods were designed to find details that did not fit with traditional perspectives in order to find a completely new point of view.

In order to solve a problem creatively, the thinker must abandon the initial approach, which stems from past experience, and reconceptualize the problem. By not settling for one perspective, geniuses do not merely solve existing problems, such as inventing an environment-friendly fuel. They identify new ones.

2. Geniuses make their thought visible. The explosion of creativity in the Renaissance was intimately tied to the recording and conveying of vast knowledge in drawings, graphs, and diagrams, as in the renowned diagrams of da Vinci and Galileo. Galileo revolutionized science by making his thought graphically visible while his contemporaries used only conventional mathematical and verbal approaches.

Once geniuses obtain a certain minimal verbal facility, they seem to develop a skill in visual and spatial abilities that gives them the flexibility to display information in different ways. When Einstein had thought through a problem, he always found it necessary to formulate his subject in as many different ways as possible, including using diagrams. He had a very visual mind; he thought in terms of visual and spatial forms, rather than thinking along purely mathematical or verbal lines of reasoning. In fact, Einstein believed that words and numbers, as they are written or spoken, did not play a significant role in his thinking process.

3. Geniuses produce. A distinguishing characteristic of genius is immense productivity. Thomas Edison held 1,093 patents, still the record. He guaranteed productivity by giving himself and his assistants idea quotas. His own personal quota was one minor invention every 10 days and a major invention every six months.

Bach wrote a cantata every week, even when he was sick or exhausted. Mozart produced more than 600 pieces of music. Einstein is best known for his paper on relativity, but he published 248 other papers. T.S. Eliot's numerous drafts of *The Waste Land* constitute a jumble of good and bad passages that eventually was turned into a masterpiece.

In a study of 2,036 scientists throughout history, Dean Keith Simonton of the University of California at Davis found that the most respected scientists produced not only great works, but also more "bad" ones. Out of their massive quantity of work came quality.

4. Geniuses make novel combinations. In his 1989 book *Scientific*



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Genius, Simonton suggests that geniuses form more novel combinations than do the merely talented. Like the highly playful child with a bucket of building blocks, a genius is constantly combining and recombining ideas, images, and thoughts into different combinations in their conscious and subconscious minds.

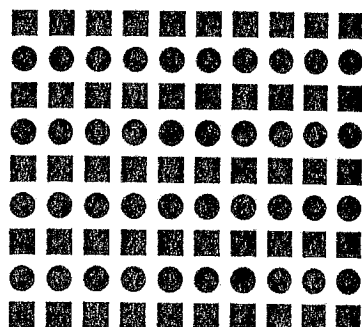
Consider Einstein's equation, $E=mc^2$. Einstein did not invent the concepts of energy, mass, or speed of light. Rather, by combining these concepts in a novel way, he was able to look at the same world as everyone else and see something different. The laws of heredity on which the modern science of genetics is based came from the Austrian monk Gregor Mendel, who combined mathematics and biology to create a new science.

5. Geniuses force relationships. If one particular style of thought stands out about creative genius, it is the ability to make juxtapositions between dissimilar subjects. This facility to connect the unconnected enables them to see things others do not.

Da Vinci forced a relationship between the sound of a bell and a stone hitting water. This enabled him to make the connection that sound travels in waves. In 1865, F.A. Kekule intuited the shape of the ringlike benzene molecule by dreaming of a snake biting its tail. Samuel Morse was stumped trying to figure out how to produce a telegraphic signal strong enough to transmit coast to coast. One day he saw tied horses being exchanged at a relay station and forced a connection between relay stations for horses and strong signals. The solution was to give the traveling signal periodic boosts of power.

6. Geniuses think in opposites. Physicist and philosopher David Bohm believed geniuses were able to think different thoughts because they could tolerate ambivalence between opposites or two incompatible subjects. Albert Rothenberg, a noted researcher on the creative process, identified this ability in a wide variety of geniuses—including Einstein, Mozart, Edison, Pasteur, Conrad, and Picasso—in his 1990 book *The*

TEST YOUR GENIUS THINKING



Most people see the pattern above as alternate rows of squares and circles. It can not be easily seen as *columns* of alternate squares and circles.

Once it's pointed out that it can also be viewed as columns of alternate squares and circles, we, of course, see it. This is because we have become habituated to passively organize similar items together in our minds. Geniuses, on the other hand, subvert habituation by actively seeking alternative ways to look at things and alternative ways to think about them.

—Michael Michalko

Emerging Goddess: The Creative Process in Art, Science, and Other Fields.

Physicist Niels Bohr believed, that if you held opposites together, then you suspend your thought and your mind moves to a new level. The suspension of thought allows an intelligence beyond thought to act and create a new form. The swirling of opposites creates the conditions for a new point of view to bubble freely from your mind. Bohr's ability to imagine light as both a particle and a wave led to his conception of the principle of complementarity. Thomas Edison's invention of a practical sys-

tem of lighting involved combining wiring in parallel circuits with high-resistance filaments in his bulbs—two things that were not considered possible by conventional thinkers (in fact, were not considered at all because of an assumed incompatibility). Because Edison could tolerate the ambivalence between two incompatible things, he could see the relationship that led to his breakthrough.

7. Geniuses think metaphorically. Aristotle considered metaphor a sign of genius, believing that the individual who had the capacity to perceive resemblances between two separate areas of existence and link them together was a person of special gifts. If unlike things are really alike in some ways, perhaps they are so in others.

Alexander Graham Bell compared the inner workings of the ear to a stout piece of membrane moving steel—and conceived the telephone. Einstein derived and explained many of his abstract principles by drawing analogies with everyday occurrences such as rowing a boat or standing on a platform while a train passed by.

8. Geniuses prepare themselves for chance. Whenever we attempt to do something and fail, we end up doing something else. That is the first principle of creative accident. We may ask ourselves why we have failed to do what we intended, which is a reasonable question. But the creative accident provokes a different question: What have we done? Answering that question in a novel, unexpected way is the essential creative act. It is not luck, but creative insight of the highest order.

Alexander Fleming was not the first physician studying deadly bacteria to notice that mold formed on an exposed culture. A less gifted physician would have trashed this seemingly irrelevant event, but Fleming noted it as "interesting" and wondered if it had potential. This "interesting" observation led to penicillin.

Edison, while pondering how to make a carbon filament, was mindlessly toying with a piece of putty,

turning and twisting it in his fingers, when he looked down at his hands and the answer hit him between the eyes: Twist the carbon like rope. B.F. Skinner emphasized a first principle of scientific methodologists: When you find something interesting, drop everything else and study it. Too many fail to answer opportunity's knock at the door because they have to finish some preconceived plan. Creative geniuses do not wait for the gifts of chance; instead, they actively seek the accidental discovery.

Applying These Strategies Yourself

Creative geniuses know how to use these thinking strategies—and teach others to use them. Sociologist Harriet Zuckerman discovered that six of Enrico Fermi's students won the Nobel Prize, just as he had. Ernest Lawrence and Niels Bohr each had four winning students. J.J. Thomson and Ernest Rutherford between them trained 17 winners. These Nobel laureates were not only creative in their own right, but were also able to teach others how to think creatively. Zuckerman's subjects testified that their most influential masters taught them different thinking styles and strategies rather than what to think. So, clearly, genius strategies can be learned.

Recognizing and applying the common thinking strategies of creative geniuses could help make you more creative in your work and personal life. □



About the Author

Michael Michalko is the author of *Thinkertoys* (A Handbook of Business Creativity) and *ThinkPak* (A Brainstorming Card Set). His new book *Cracking Creativity: The Secrets of Creative*

Geniuses (Ten Speed Press, 1998, 352 pages, \$24.95) is available from the Futurist Bookstore; see page 33 for details.

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