

# HOW DO YOU THINK? – CREATIVE OR LOGICAL

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## **Differences in thinking modes**

Creative thinking and logical thinking are not the same! They are nearly exact opposites and can often be impediments to each other. Businessmen, especially entrepreneurs, often see themselves as creative. Engineers are trained to be logical and usually see themselves, as do scientists of almost all types, as highly logical and systematic in their thinking. However, to be really successful in most occupations (including businessmen and engineers) requires some of both types of thinking. The trick to being successful in these occupations is to be able to convert from one type of thinking to the other as the situation requires. Learning that capability, and a discussion of other revealing characteristics of creative and successful people, are the subjects of this article.

## **Creativity**

There are, in my opinion, two types of creativity. The first is the creativity we all have. It is shown whenever we do something unique to us, such as learn a new piece on the piano, succeed in a difficult experiment in the laboratory, or close a sale that has required some original thinking. We might be quite proud of it, but others have also done it, and sometimes have done it better. Therefore, the world has little regard for this type of creativity.

The second type of creativity is esteemed by others. When we do something of this type, the world takes notice. People praise us and call us creative masters or geniuses. We may get some award, such as a patent or a prize in a contest. We can think of many great people in history who have been honored and who we feel are creative: Leonardo Da Vinci, Shakespeare, Einstein, and Henry Ford. This second type of creativity has four critical elements which must be satisfied if the world is to esteem the creativity act. These necessary elements are:

- **Uniqueness or novelty.** Most people initially think this is the only element of creativity. It is certainly important, and creativity could not exist without it, but for a creative work to be esteemed, other elements must be present.
- **Value.** The creative work must be valued by society. Artwork that seems stupid to us is not called creative (at least by us). Works that seem obvious or trivial are not valued as creative. Creative works can solve problems, especially those that have existed for a long time (such as Pasteur's work on vaccination and understanding of microorganisms). Sometimes a whole body of work is seen as a unit and called creative. These are the criteria that bring recognition. All Nobel prize winners satisfy this criterion, as do other esteemed creative people.
- **Intent.** Truly creative works must be the result of directed effort. If someone just stumbles upon a solution to a problem or just accidentally produces a unique work of art, we call those people lucky, not creative. Serendipity is not creativity. However, some recognition is given for discover if the person has worked to prepare himself or herself to see the implications of the discovery. For instance, Jenner discovered penicillin by accident but recognized the importance

of the discovery because of years of study in the field. As Pasteur said, “Chance favors the prepared mind.” Society values and calls creative those efforts in which the worker knows where the end lies and works so that the desired end is realized. For instance, Michelangelo said that he saw the finished work inside the block of stone and his task was simply to chip away what was unnecessary. We would not have valued his work as creative if he blindly started to sculpt and then fortuitously found that the *David* had been created.

- **Implementational excellence and continuance.** Creative works are done well. We appreciate both the work and the way in which it is accomplished. Sometimes this accomplishment is seen as a gift (Mozart) and at other times it is valued for the effort that went into perfecting the capability to do it (most athletes). Value is especially given when the work is the result of a long term effort (continuance). Successful commercialization is often a mark of creativity in our modern society.

Obtaining a patent for an invention requires these same elements. To receive a patent, the invention must be unique, useful, and properly reduced to practice. The reduction to practice requires both the presence of intent and continuance.

### **Creativity and logic**

The differences between creative and logical thinking can be easily understood by an analogy that compares how the brain works during the thinking process and how a computer works. When we think, we file information away, much like a computer would put information into files for later retrieval. The brain and the computer know the topic of each file and can

logically sort through them when asked to retrieve some information. If new information is developed, it can easily be assigned to an associated file.

Logical problem solving is a process of searching through the known data and/or adding information to existing data, thus enlarging the file on that particular subject. This concept is illustrated in Figure 1a which compares the logical and creative methods of thinking. For example, to solve a math problem, we search through our “how-to-do-math” database until we find the information that applies to the particular problem at hand. When doing science, we search and discover that some piece of information is missing, and we go to the laboratory and fill in that bit. Alternately, we do some experiment and then classify the information we have discovered into the appropriate file where it can be retrieved and related to other information.

The emphasis in logical thinking is following a path that builds from a known position to another in carefully structured steps, making sure that each step rests firmly on previous knowledge. We can apply known formulas or laws (such as Newton’s law of force or Einstein’s law of relativity), which are accepted by the world, and thus obtain new information based upon the principles proven in the past to be true.

Creative thinking, especially in problem solving, is much different. It requires a leap from one set of data to another without any particular logical reason or connection between the two data sets. Artistic creative thinking also requires leaps – from existing artistic material to something unique and different.

Making the leap may require not only recognition of where to go but skill in going there. Hence, creativity is unique, has continuance, and excellent implementation. If it is valued, that

is, if the leap gives something that is useful and esteemed, then the elements of creativity are fulfilled and the work is considered creative by society.

### **Traits of creative people**

Most of us want to be more creative. In his book, *Creativity*, Mihaly Csikszentmihalyi interviews 100 carefully-selected creative people in an attempt to determine what helped them to be creative. Among Csikszentmihalyi's subjects were several Nobel prize winners, CEO's of major corporations, very successful writers, artists, politicians, and leaders of social and natural sciences. It is a good group.

The results of this study are revealing – and surprising. According to Csikszentmihalyi, creative people share the following attributes (also summarized in Figure 2):

1. **DEPTH AND BREADTH.** Creative people have both depth in some area of specialization and breadth in understanding of other areas. Although the world values specialized knowledge, creative people have often found inspiration for their creativity from areas that were vastly different from their area of expertise. But without the depth in the narrow field, the ability to use the insights may not be valuable in advancing knowledge or creating something worthwhile.
2. **FOCUSED AND RELAXED.** Creative individuals have great energy, but they are often quiet and at rest. They can work long hours with great concentration while projecting an aura of freshness and enthusiasm. Creative people often find that they improve their work by surrounding themselves with a pleasant environment (such as going to the mountains or to a lake), but they can also focus in an office.

3. **SMART AND UNCERTAIN.** They are highly intelligent but also, at times, doubtful of their understanding. Lack of intelligence can be a hindrance to creativity because the proper associations and skills in the specialty might not be done easily. However, too much intelligence can give overconfidence and block the seemingly naive questions that may lead to deeper insights.
4. **DISCIPLINED AND PLAYFUL L.** Creative people possess the paradoxical trait of both playfulness and discipline. The playfulness and humor are often associated with exploring new ideas. Discipline is associated with focus and hard work.
5. **REALISTIC AND IMAGINATIVE.** Creative individuals alternate between imagination and reality. They can brainstorm and fantasize on novel concepts but the novelty they see is rooted in reality, and they know which is which.
6. **INTROVERTED AND EXTROVERTED.** Creative people seem to harbor opposite tendencies on the continuum between extroversion and introversion. They can be the "solitary genius" and love to be alone, but they can also be vitalized by interactions with people.
7. **HUMBLE AND PROUD.** Creative people are remarkably humble and proud at the same time. They know the extent of their contribution — both its value and also the minuteness that it represents in the entire scheme of life.
8. **TRADITIONAL AND REBELLIOUS.** They see value in both conservatism and rebelliousness. One favors careful work and the other leads to new discoveries.
9. **OBJECTIVE AND PASSIONATE.** They feel deeply about the importance of their work and often derive strength from it. On the other hand, they understand that their

passion is not the passion of all. Furthermore, they are able to see their work in the entire scheme of life and, where appropriate, adjust it to fit what is valued by society. Some, however, anticipate what will be valued by society, but do so with objectivity and reality.

10. **PAIN AND PLEASURE.** They suffer both pain and receive great enjoyment from their work. These characteristics are much more closely related than we sometimes imagine.

What is the meaning of all this apparently contradictory information? Simply this, I think. Creative people are balanced as suggested in Figure 2. They are also flexible enough to be able to evaluate the moment and adjust to whatever is needed.

Some researchers have suggested that our brains are divided in their primary functions with the left and right sides carrying out separate and quite distinct tasks. The left side has been related to analytical thinking and the right to unstructured thinking (sometimes erroneously called creative thinking). Csikszentmihalyi's analysis suggests that truly creative people use both halves of their brain and know when to emphasize one over the other.

### **Engineering creativity**

The skills and engineering principles taught to engineers are presented logically, although great creativity was usually involved when the concepts were originally developed. Much of the work of engineers requires calculations and analysis – tasks that depend heavily on logical thinking. Hence, engineers must be logical to be successful.

However, some key engineering tasks require creative thinking. Perhaps the most obvious of these is the engineering design method. The overall method for designing and manufacturing a part is given in Figure 3. However several of the steps in the process, such as concept generation and evaluation, involve several internal steps as shown in Figure 4. These

steps are iterative and are often non-logical. New ideas must be generated and they are often obtained from some non-logical activities such as brain-storming. Hence, the engineering design method has, at its heart, significant non-logical, non-structured thinking. Successful engineers will learn how to master these non-traditional skills.

### **Businessmen/Entrepreneurs**

Entrepreneurism is, by its very nature, creative. All entrepreneurs depend upon their own creativity or the creativity of key players within their organization. Most entrepreneurs wish they were more creative. They also realize that both logic and creativity are required to optimize the performance of their companies. They need the logic for many tasks including analysis of financial data, structuring of market distribution channels, and presentation of corporate plans. Personal skills should require development of both logical and creative thinking.

As supervisors of other employees, the entrepreneur also realizes that many tasks done within the company can best be done by committees. With the realization gained from this article, the entrepreneur can evaluate the dominant thinking method of individual employees and then assemble working teams that have employees with complementary thinking skills (usually diversity is best).

### **Increasing personal creativity**

Creativity is not easy. It is not just a flash of inspiration. It is hard work. As two of the most creative people who ever lived have said: "Invention is 10% inspiration and 90% perspiration" (Edison), and "The best way to have a good idea is to have lots of them" (Pauling). A summary of some general guidelines for improving creativity is given in Table 1. In general,

these require self-confidence and persistence. The reward of this work is, of course, creative success.

Table 1 Some keys to improving personal creativity

- Practice mental jumping from one set of data to another. Strive to make unusual and unexpected associations.
- Acquire information in many areas.
- Develop good skills so that your implementation will be excellent.
- Be persistent in the process of being creative.
- Be confident. Don't be afraid of making mistakes since mistakes are an inevitable result of the process.
- Be perceptive. Rely on your intuition, imagination, and impetuosity.
- Move away from the normal environment of a problem. Get help in this by using tools to help creativity. (Tools can include brainstorming, role playing, analogies, what-if scenarios, etc.)
- Develop an appreciation for the aesthetics of the problem and solution (realizing that most truly creative solutions have symmetry and beauty).