Chapter 8
Creativity and Genius: A Systems Perspective

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M. Csikszentmihalyi, The Systems Model of Creativity, DOI: 10.1007/978-94-017-9085-7_8.
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Introduction

The title of this volume, *Genius and the mind*, suggests that one should look for the explanation to the mysteries of genius inside the human cranium. My goal in this chapter will be to argue that while the mind has quite a lot to do with genius and creativity, it is not the place where these phenomena can be found. The location of genius is not in any particular individual’s mind, but in a virtual space, or system, where an individual interacts with a cultural domain and with a social field. It is only in the relation of these three separate entities that creativity, or the work of genius, manifests itself. In popular usage, ‘genius’ is sometimes used as a noun that stands by itself, yet in reality it appears always with a modifier: musical genius, mathematical genius, scientific genius, and so forth. Genius cannot show itself except when garbed in a concrete symbolic form.

The attribution of genius is not based on any precise criterion; it depends on a consensus of peers. Generally genius is attributed to a person who can perform with ease feats that even the experts in a given field can achieve only with great difficulty. In science, some of the central criteria for which genius is attributed include exceptional memory, fast calculation, original insights, and perhaps more than anything else, the ability to see problems from unusual perspectives. A leading astronomer gives a good summary of the traits that lead to the attribution of genius in describing her teacher, George Gamow:

Gamow was a fascinating person to work with...not just because he was so brilliant...he truly belongs in the genius class... No amount of my attempting to follow him would have made it possible for me to think the way he thought. He just could raise questions that had not been raised before... Some people have some kind of intuition about how the universe works... Maybe that is what you mean when you say ‘genius’. People that take these enormous leaps, (see end note 1).

This ability to ‘take enormous leaps’ is probably grounded in some peculiarity of the nervous system. Perhaps it is a function of that superabundance of glial cells in the left inferior parietal lobe found in the autopsy of Einstein’s brain (Gardner et al. 1996, p. 135). But to tell the truth, at present there is no firm evidence on which to base a structural, or even a functional explanation of genius. In other words, there is no anatomical evidence about differences in brain structure, and there are no measures of thought processes that differentiate geniuses from ordinary mortals, except anecdotal accounts and the direct evidence of superior accomplishments.

At this point in the state of knowledge, it seems more useful to examine genius not as an intra-psychic phenomenon, but as a historical process which takes place in a social and cultural context. And instead of genius, I shall focus on the creative process, which is a much more broadly researched area. Although not all geniuses produce creative works, and not all creative achievements involve genius, the overlap between these two concepts is large enough to treat them as closely related.

Introduction

Creativity research is often dominated by a psychological perspective. Starting with the data presented by Dean, we can take into account more and more social events on the way. We must become more and more open to taking into account if one wishes to have the research data become established in the example of this trend of The Social Research Journal and the journal claims that ‘creativity’ is a classic case of an objective basis. We need to develop an exceptionally gifted individuals (or certain likely characters) (or obstacles), and attributes.

The social system described before and applied to the data collected to answer ‘What is creativity?’ (Csikszentmihalyi 1983; Csikszentmihalyi et al. 1994). In the present case, it is possible to develop its implication for the study.

Why Do We Need a Definition?

Like most psychologists, I was convinced that if one could understand creativity and its sources and motivations individually and collectively, it would become more and more clear. When we became increasingly clear, we stopped doing art and published a work that lack creative personal attributes. Exemplified by those who were hailed as individuals (Csikszentmihalyi and Gardner 1996), is just a single example, you can see that creative potential than the norm. A cohort of women had achieved far greater success than women were successful.

The same situation holds for any science the credit goes to women, whom the idea first occurred. Technology to religion—
Creativity research in recent years has been increasingly informed by a systems perspective. Starting with the observations of Stein (1953, 1963), and the extensive data presented by Dean Simonton showing the influence of economic, political, and social events on the rates of creative production (Simonton 1988, 1990), it has become more and more clear that variables external to the individual must be taken into account if one wishes to explain why, when, and where new ideas or products arise and become established in a culture (Gruber 1988; Harrington 1990). A good example of this trend can be seen in the recent special issue of the Creativity Research Journal and the debate surrounding its lead article (Kasof 1995), which claims that 'creativity' and 'genius' are purely social attributions without any objective basis. We need to believe in the existence of special gifts, of exceptionally gifted individuals, and so we select successful individuals who possess certain likely characteristics (such as good luck, or the ability to overcome obstacles), and attribute to them the disposition of 'genius'.

The particular systems approach developed here is not that extreme. It has been described before and applied to historical and anecdotal examples, as well as to data collected to answer a variety of different questions (Csikszentmihalyi 1988b; 1990; Csikszentmihalyi et al. 1993; Csikszentmihalyi and Sawyer 1995; Feldman et al. 1994). In the present context, I will expand the model more rigorously, and develop its implication for a better understanding of how the work of genius can be studied.

Why Do We Need a Systems Approach?

Like most psychologists, when I started studying creativity over 30 years ago, I was convinced that it was a purely intra-psychic process. I simply assumed that one could understand creativity with reference to the thought processes, emotions, and motivations of individuals who produced novelty. But each year the task became more frustrating. In our longitudinal study of artists, for instance, it became increasingly clear that some of the potentially most creative persons stopped doing art and pursued ordinary occupations, while others who seemed to lack creative personal attributes persevered and eventually produced works of art that were hailed as important creative achievements (Csikszentmihalyi 1990; Csikszentmihalyi and Getzels 1988; Getzels and Csikszentmihalyi 1976). To use just a single example, young women in art school showed as much, or more creative potential than their male colleagues. Yet twenty years later, not one of the cohort of women had achieved recognition, whereas several in the cohort of men were successful.

The same situation holds in science. As Sir Francis Darwin said long ago, '...in science the credit goes to the man who convinces the world, not to the man to whom the idea first occurs' (Darwin 1914). New ideas in any discipline—from technology to religion—are very common; the question is, will they make a
difference? And to make a difference, one must be able to 'convince the world', and have the idea become part of the cultural heritage of humankind.

Confronted with this situation, one can adopt one of two strategies. The first one was articulated by Abraham Maslow and involves denying the importance of public recognition (Maslow 1963). It is not the outcome of the process that counts in his opinion, but the process itself. According to this perspective a person who re-invents Einstein's formula is as creative as Einstein was. A child who sees the world with fresh eyes is creative; it is the quality of the subjective experience that determines whether a person is creative, not the judgment of the world. Although I believe that the quality of subjective experience is the most important dimension of personal life, I do not believe that creativity can be assessed with reference to it. It is a question, in the words of the Bible, 'to render unto Caesar the things which are Caesar's' (Matthew 22:21). If creativity is to retain a useful meaning, it must refer to a process that results in an idea or product that is recognized and adopted by others. Originality, freshness of perceptions, divergent thinking ability are all well and good in their own right, as desirable personal traits. But without some form of public recognition they do not constitute creativity, and certainly not genius. In fact, one might argue that such traits are not even necessary for a creative accomplishment.

In practice, creativity research has always recognized this fact. Every creativity test, whether it involves responding to divergent thinking tasks or whether it asks children to produce designs with coloured tiles, is assessed by judges or raters who weigh the originality of the responses. The tacit assumption is that an objective quality called 'creativity' is revealed in the products, and that judges and raters can recognize it. But we know that expert judges do not possess an external, objective standard by which to evaluate 'creative' responses. Their judgments rely on past experience, training, cultural biases, personal values, idiosyncratic preferences. Thus whether an idea or product is creative or not does not depend on its own qualities, but on the effect it is able to produce in others who are exposed to it. Therefore it follows that what we call creativity is a phenomenon that is constructed through an interaction between producer and audience. Creativity is not the product of single individuals, but of social systems making judgments about individuals’ products.

A second strategy that has been used to accommodate the fact that social judgments are so central to creativity is not to deny their importance, but to separate the process of creativity from that of persuasion, and then claim that both are necessary for a creative idea or product to be accepted (Simonton 1988, 1991, 1994). However, this stratagem does not resolve the epistemological problem. For if you cannot persuade the world that you had a creative idea, how do we know that you actually had it? And if you do persuade others, then of course you will be recognized as creative. Therefore it is impossible to separate creativity from persuasion; the two stand or fall together. The impossibility is not only methodological, but epistemological as well, and probably ontological. In other words, if by creativity we mean the ability to add something new to the culture, then it is impossible to even think of it as separate from persuasion.

Of course, one might prefer to define it as a subjective event that may occur at any time, when creativity is seen as something preserved at all costs, as creativity that aspires to change things, as important to its own end.

**An Outline of the Field**

Thus, starting from a given set of facts to adopt a view of the world that operates. This environment, which here is called a field, is the process that can be observed, and the object and field’s interact.

The domain is a new construct, to be a genius, at least within the system. Original thought, rules of representation, composer, chemist, or astronomer, music, chemistry, have by reference to their respective fields, without tradition there would be no field.

Creativity occurs where ideas can be transmitted through social changes, either because of social structure to be well-positioned for it, or because of social structure. For example, until quite recently not all who had the means and the opportunity, like Lavoisier, or physician, or laboratory equipment, and to produce a criticism of cultures with a tradition of record-keeping and observation of their insights to be shared.

But most novel ideas, which are not socially sanctioned by society, should not be included in the field. The term ‘field’ is used in two quite different senses, and use it is not always clear.
Introduction

Of course, one might disagree with this definition of creativity. Some will prefer to define it as an intra-psychic process, as an ineluctable experience, as a subjective event that need not leave any objective trace. This is especially so in our days, when creativity is seen by many as the last admirable quality for which human beings can legitimately take credit and therefore something that must be preserved at all costs in its own aura of mystification. But any definition of creativity that aspires to objectivity will have to recognize the fact that the audience is as important to its constitution as the individual to whom it is credited.

An Outline of the Systems Approach

Thus, starting from a strictly individual perspective on creativity, I was forced by facts to adopt a view that encompasses the environment in which the individual operates. This environment has two salient aspects: A cultural, or symbolic aspect which here is called the domain; and a social aspect called the field. Creativity is a process that can be observed only at the intersection where individuals, domains, and field’s interact.

The domain is a necessary component of creativity because it is impossible to be a genius, at least by the definition used here, in the absence of a symbolic system. Original thought does not exist in a vacuum. It must operate on a set of rules, of representations, of notations. One can be a creative carpenter, cook, composer, chemist, or clergyman because the domains of woodworking, gastronomy, music, chemistry, and religion exist and one can evaluate performance by reference to their traditions. Without rules there cannot be exceptions, and without tradition there cannot be novelty.

Creativity occurs when a person makes a change in a domain, a change that will be transmitted through time. Some individuals are more likely to make such changes, either because of personal qualities, or because they have the good fortune to be well-positioned with respect to the domain—they have better access to it, or because of social conditions that allow them free time to experiment. For example, until quite recently the majority of scientific advances were made by men who had the means and the leisure—clergymen like Copernicus, tax collectors like Lavoisier, or physicians like Galvani—men who could afford to build their own laboratories and concentrate on their thoughts. All of these individuals lived in cultures with a tradition of systematic observation of nature, and a tradition of record-keeping and of mathematical symbolization which made it possible for their insights to be shared and evaluated by others who had equivalent training.

But most novel ideas will be quickly forgotten. Changes are not adopted unless they are sanctioned by some group entitled to make decisions as to what should or should not be included in the domain. These gatekeepers are what we call here the field. The term ‘field’ is often used to designate an entire discipline or kind of endeavour. In the present context, however, I want to define the term in a more narrow sense, and use it to refer only to the social organization of the domain—

the teachers, critics, journal editors, museum curators, agency directors, and foundation officers who decide what belongs to a domain and what does not. In physics, the opinion of a very small number of leading university professors was enough to certify that Einstein’s ideas were creative. Hundreds of millions of people accepted the judgment of this tiny field, and marvelled at Einstein’s creativity, without understanding what it was all about. It has been said that in the United States ten thousand people in Manhattan constitute the field in modern art. They decide which new paintings or sculptures deserve to be seen, bought, included in collections and therefore added to the domain.

In creativity research the field usually consists of teachers or graduate students who judge the products of children or other students. It is they who decide which test responses, mosaics, or portfolios, are to be considered creative. In this sense it is true that creativity tests can measure creativity—as long as it is recognized that what is meant by ‘creativity’ here is acceptance by the field of judges. Such creativity, while part of the domain of creativity research, may have nothing to do with creativity in any other domain. At every level, from Nobel Prize nominations to the scribbles of 4-year olds, judges are busy assessing new products and deciding whether or not they are creative—in other words, whether they are enough of an improvement to be included in a domain.

The systems model is analogous to the model that scholars have used to describe the process of evolution. Evolution occurs when an individual organism produces a variation which is selected by the environment and transmitted to the next generation (see for example Campbell 1976; Csikszentmihalyi 1993; Mayr 1982). The variation which occurs at the individual level corresponds to the contribution that a person makes to creativity; the selection is the contribution of the field, and the transmission is the contribution of the domain to the creative process. Thus creativity can be seen as a special case of evolution; it is to cultural evolution as mutation, selection, and transmission of genetic variation are to biological evolution.

In biological evolution it makes no sense to say that a beneficial step was the result of a particular genetic mutation alone, without taking into account environmental conditions. For instance, a genetic change that improved vision may contribute little to the evolution of a nocturnal species, whereas a change that enhanced hearing would be beneficial to it. Moreover a genetic mutation that cannot be transmitted to the next generation is also useless from the point of view of evolution. The same considerations apply to creativity when the latter is seen as the form evolution takes at the cultural level.

The Cultural Context

What we call creativity always involves a change in a symbolic system that has a counterpart in a mental structure. A change that does not affect the way we think, feel, or act will not be creative. Thus genius presupposes a community of people who share ways of thinking and acting, and the practice of others’ actions. It helps to the extent that they do, or that the units of imitation that are the essence of culture. Memes are similar. The notes of a song tell us the daily ingredients to mix and how they are transmitted in the chemical code. The sounds contained in memes are transmitted. Memes and reproduce themselves. Once invented, then we have creativity.

Memes seems to have clear time. One of the earliest memes is the tool they used for chopping. The first stone blades remained almost unchanged for close to a million years, 50,000 years ago in the Upper Paleolithic, for the chipping stone blades, and a little bit later, for the chipping stone blades, and a little bit later, for their own replication. But the meme of the flint scrapers, which is included in the minds of men, and goes back much further, was increasing.

The meme of a flint scrapers, which includes all the artifacts and environment. Other early dot-like memes, each including a set of memes, were used after the last Ice Age about 15000 years ago, and of course proliferated to an extent which no other technique was subdivided into a few pieces. The master even a minute fraction.

Cultures as Symbolic Domains

It is useful in this context to distinguish symbolic domains. This is not to claim that they are unities; after all, there are several cultures that may be used by anthropologists, and
who share ways of thinking and acting, who learn from each other and imitate each other’s actions. It helps to think about creativity as involving a change in memes, or the units of imitation that Dawkins (1976) suggested were the building-blocks of culture. Memes are similar to genes in that they carry instructions for action. The notes of a song tell us what to sing; the recipes for a cake tells us what ingredients to mix and how long to bake. But whereas genetic instructions are transmitted in the chemical codes we inherit on our chromosomes, the instructions contained in memes are transmitted through learning. By and large we learn memes and reproduce them without change; when a new song or a new recipe is invented, then we have creativity.

Memetic seems to have changed very slowly in human history for a very long time. One of the earliest memes was the shape that our ancestors gave to the stone tools they used for chopping, carving, scraping, and pounding. The shape of these flint blades remained almost unchanged during the Palaeolithic, or Old Stone Age, for close to a million years—99.5% of human history. It is not until about 50000 years ago, in the Upper Palaeolithic, that humans began to use new tools: blades specialized for performing specific functions, and even tools for making other tools. The first change in the meme of the tool took almost a million years; once this first step was taken, however, new shapes followed each other in increasingly rapid succession. For thousands of generations, men looked at the stone blades they held in their hands, and then reproduced one exactly alike, which they passed on to their children. The meme of the tool contained the instructions for its own replication. But then someone discovered a more efficient way of chipping stone blades, and a new meme appeared, which started reproducing itself in the minds of men, and generating offspring, that is new tools that had not existed before, which were increasingly different from their parent.

The meme of a flint scraper or a flint axe is part of the domain of technology, which includes all the artifacts humans use to achieve control over their material environment. Other early domains were those of language, art, music, religion, each including a set of memes related to each other by rules. Since the recession of the last Ice Age about 15000 years ago, memes and corresponding domains have of course proliferated to an extent that would have been impossible to foresee only a few seconds earlier in evolutionary time. Nowadays the single domain of technology is subdivided into so many subdomains that no single individual can master even a minute fraction of it.

Cultures as Symbolic Domains

It is useful in this context to think about cultures as systems of interrelated domains. This is not to claim that culture is nothing but a system of interrelated domains; after all, there are over a hundred different definitions of culture being used by anthropologists, and no single definition can be exhaustive. The claim is
simply that in order to understand creativity, it is useful to think of culture in this way.

It then follows that cultures differ in the number of domains they recognize, and in the hierarchical relationship among domains. For example in Western cultures, philosophy tended to develop out of religion, and then the other scholarly disciplines separated out of philosophy. For a long time religion was the queen of disciplines, and it dictated what memes could be included in different domains. Now scholarly domains are much more autonomous, although it could be claimed that mathematics has become the benchmark by which other domains are judged.

The multiplication and gradual emancipation of domains has been one of the features of human history across the planet. For a long time almost every aspect of cultural thought and expression was unified in what we would call a religious domain. Art, music, dance, narrative, proto-philosophy, and proto-science were part of an amalgam of supernatural beliefs and rituals. Now every domain strives to achieve independence from the rest, and to establish its own rules and legitimate sphere of authority.

It is usually the case that a domain with time develops its own memes and system of notation. Natural languages and mathematics underlie most domains. In addition there are formal notation systems for music, dance, logic; and other less formal ones for instructing and assessing performance in a great variety of different domains. For instance Piaget (1965) gave a very detailed description of how rules are transmitted in a very informal domain: that of the game of marbles played by Swiss children. This domain is relatively enduring over several generations of children, and it consists in specific names for marbles of different sizes, colour, and composition. Furthermore, it consists in a variety of arcane rules that children learn from each other in the course of play. So even without a notation system, domains can be transmitted from one generation to the next through imitation and instruction.

**Creativity as Change in Domains**

Typically, the memes and rules that define a domain tend to remain stable over time. It takes psychic energy to learn new terms and new concepts, and in so far as psychic energy is a very scarce and necessary resource (Csikszentmihalyi 1988b), and provided that the old terms and rules are adequate to the task, it makes sense for domains to remain stable. Thus, the Egyptian civilization, for example, seems to have suffered no ill effects for intentionally keeping its religion, art, technology, and political system unchanged for several thousands of years.

The common belief is that if creativity is rare, it is because of supply-side limitations; in other words, because there are few geniuses. The truth seems to be that the limits to creativity lie on the demand-side. If there is too little creativity, it is because both individually and collectively we cannot change our cognitive structures rapidly enough to recognize and adopt new ideas. For example, each
The Cultural Context

The Cultural Context

year about 100,000 new books are published in the United States alone. Assuming they all contain new ideas, how many of them will be read by enough people to change the culture? At the last census, about 300,000 individuals claimed to be artists. Even if they all produced exceptionally creative works, how many of them could we pay attention to, and remember? Surveys suggest that the average American can name fewer than two living artists.

A good example of how difficult it is to overcome the inertia that protects traditional memes is the history of the metric system. Before the metric system was adopted, weights and measures were not translatable into one another, and differed from culture to culture. The metric system was a perfect expression of rationalism, and it was introduced in France in the late eighteenth century as a way to make measurement simpler and more comparable. In this sense, the *metre* was a very creative new meme that saved much time and needless mental effort. By 1875 this new system had been adopted by almost every European nation, and then by the rest of the world. Even Great Britain capitulated in the second half of the twentieth century. But in the United States the system is still resisted, partly because there is too much money invested in the older, more awkward system, and partly because it would take too much mental effort to learn the new system.

Domains tend to change when one culture is exposed to the memes of another, usually equally advanced but different culture. Thus ancient Greece, being at the crossroads of trade between the North and the South, and between the East and the West, was influenced by ideas and practices converging from the Asiatic steppes and from Egypt, and from Europe as well as Persia and the Middle East. In Europe, similar melting pots for ideas arose later in Venice, Florence, Burgundy, the Hanseatic ports and the great sea-faring nations such as Portugal, Spain, England, and the Netherlands. Another source of change comes from conflicts between or within cultures; as Simonton has documented, social unrest is typically linked with the adoption of new memes (Simonton 1990).

Creativity is the engine that drives cultural evolution. The notion of 'evolution' does not imply that cultural changes necessarily follow some single direction, or that cultures are getting any better as a result of the changes brought about by creativity. Following its use in biology, evolution in this context means increasing complexity over time. In turn complexity is defined in terms of two complementary processes (Csikszentmihalyi 1993, 1996). First, complexity means that cultures tend to become differentiated over time—they develop increasingly independent and autonomous domains. Second, the domains within a culture become increasingly integrated; that is, related to each other and mutually supportive of each other's goals by analogy to the differentiated organs of the physical body that help each others' functioning.

In this sense, creativity does not always support cultural evolution. It generally contributes to differentiation, but it can easily work against integration. New ideas, technologies, or forms of expression often break down the existing harmony between different domains, and thus might, at least temporarily, jeopardize the complexity of a culture. The separation of physics from the tutelage of religion accomplished by Galileo's discoveries ushered in an era of tremendous
differentiation in science, but at the expense of a corresponding loss of integration in Western culture. Presumably, if the evolution of culture is to continue, creative insights will in the future restore the interrelation between the currently divergent domains, thus temporarily restoring the complexity of the culture, at least until new steps in differentiation again sunder it apart.

What Characteristics of Domains Enhance Creativity?

According to this perspective, at any given point in time domains differ from one another (or from the same domain at earlier and later times) in terms of how easy it is to make a creative contribution to them. We shall review some of these characteristics below.

One obvious factor is the stage of development that the domain has attained. There are times when the symbolic system of a domain is so diffuse and loosely integrated that it is almost impossible to determine whether a novelty is or is not an improvement on the status quo. Chemistry was in such a state before the adoption of the periodic table, which integrated and rationalized knowledge about the elements. Earlier centuries may have had many potentially creative chemical scientists, but their work was too idiosyncratic to be evaluated against a common standard. Or conversely the symbolic system may be so tightly organized that no new development seems possible; this resembles the situation in physics at the end of the last century, before the revolution in thinking brought about by quantum theory. Both of these examples suggest that before a paradigmatic revolution, creativity is likely to be more difficult. On the other hand, the need for a new paradigm makes it more likely that if a new viable contribution does occur despite the difficulty, it will be hailed as a major creative accomplishment.

At a given historical period, certain domains will attract more gifted young people than at other times, thus increasing the likelihood of creativity. The attraction of a domain depends on several variables: its centrality in the culture, the promise of new discoveries and opportunities they present, and the intrinsic rewards that working in the domain gives. For instance, the Renaissance in early fifteenth century Florence would have not happened without the discovery of Roman ruins which yielded a great amount of new knowledge about construction techniques and sculptural models, and motivated many young people who otherwise would have gone into the professions, to become architects and artists. The quantum revolution in physics at the beginning of this century was so intellectually exciting that some of the best minds for several generations flocked to physics, or applied its principles to neighbouring disciplines such as chemistry, biology, medicine, and astronomy. Nowadays similar excitement surrounds the domains of molecular biology and computer sciences. As Kuhn (1962) remarked, potentially creative young people will not be drawn to domains where all the basic questions have been solved and therefore appear to be boring, offering few opportunities to experience the intrinsic and extrinsic rewards of solving important problems.

The Social Context

Even the most individually creative, a new meme must be valued socially before it becomes a part of the local culture. A new idea, one that follows the rules of a dominant paradigm, is likely to be accepted without much trouble, even if the new idea is in principle, completely different from the old one; the two are inseparable. But an idea that breaks away from the paradigm we might have originally developed ourselves.

Nowadays everyone ages as a creative artist. It is also fails to be creative, for failing to recognize the idea of the creative. The implications of this have been in their place we would like to remember that a 100 year.
The Social Context

Even the most individually-oriented psychologists agree that in order to be called creative, a new meme must be socially valued. Without some form of social valuation it would be impossible to distinguish ideas that are simply bizarre from those that are genuinely creative. But this social validation is usually seen as something that follows the individual's creative act, and can be, at least conceptually, separated from it. The stronger claim made here is that there is no way, even in principle, to separate the reaction of society from the person's contribution; the two are inseparable. As long as the idea or product has not been validated we might have originality, but not creativity.

Nowadays everyone agrees that van Gogh's paintings show that he was a very creative artist. It is also fashionable to sneer at the ignorant bourgeois of his period, for failing to recognize van Gogh's genius and letting him die alone and penniless. The implication, of course, is that we are much smarter, and if we had been in their place we would have loved van Gogh's paintings. But we should remember that 100 years ago those canvases were just the hallucinatingly original works of a sociopathic recluse. They became creative only after a number of

What Characteristics of Domains Enhance Creativity?

A domain with clear rules, where novelty can be evaluated objectively, with a rich and complex symbolic system, and a central position in the culture, will be more attractive than one lacking such characteristics.

Domains also vary in terms of their accessibility. Sometimes rules and knowledge become the monopoly of a protective class or caste, and no one else is admitted to it. Creative thought in Christianity was renewed by the Reformation, which placed the Bible and its commentaries in reach of a much larger population that had previously been excluded by an entrenched priestly caste. The enormously increased accessibility of information available on the Internet might also bring about a new peak in creativity across many different domains, just as the printing press did over four centuries ago.

Finally, some domains are easier to change than others. This depends in part on how autonomous the domain is from the rest of the culture, or from the social system that supports it. Until the seventeenth century, it was difficult to be creative in Europe in many branches of science, since the Church had a vested interest in preserving the status quo. In Soviet Russia, the Marxist-Leninist dogma took precedence over scientific domains, and many new ideas that conflicted with it were not accepted. The most notorious case, of course, was Lysenko's application of the Lamarckian theory of evolution to the development of new strains of grain. This theory was considered to be more 'Marxist' than the Darwinian-Mendelian paradigm. Even in our time, some topics in the social (and even in the physical and biological) sciences are considered less politically correct than others, and are given scant research support as a consequence.
other artists, critics, and collectors interpreted them in terms of new aesthetic criteria, and transformed them from substandard efforts into masterpieces.

Without this change in the climate of evaluation, van Gogh would not be considered creative even now. But would he have been creative anyway, even if we didn’t know it? In my opinion, such a question is too metaphysical to be considered part of a scientific theory. If the question is unanswerable in principle, why ask it? The better strategy is to recognize that in the sciences as well as in the arts, creativity is as much the result of changing standards and new criteria of assessment, as it is of novel individual achievements. Having adopted such a convention, it becomes easier to understand how new memes are accepted in the domain, and in the culture (see note 2).

Who Decides What is Creative?

The recognition that culture and society are as involved in the constitution of creativity as the individual may set the course of investigation on the right footing, but it certainly does not answer all the questions. In fact, it brings a host of new questions to light. The major new question this perspective reveals is; ‘Who is entitled to decide what is creative?’ According to the individual-centred approach, this issue is not problematic. Since it is assumed that creativity is located in the person and expressed in his or her works, all it takes is for some ‘expert’ to recognize its existence. So if some kindergarten teachers agree that a child’s drawing is creative, or a group of Nobel Prize physicists judge a young scientist’s theory creative, then the issue is closed, and all we need to find out is how the individual was able to produce the drawing or the theory.

But if it is true, as the systems model holds, that attribution is an integral part of the creative process, then we must ask, ‘What does it take for a new meme to be accepted into the domain? Who has the right to decide whether a new meme is actually an improvement, or simply a mistake to be discarded? How can creativity be influenced through the attributional process?’

In the systems model, the gatekeepers who have the right to add memes to a domain are collectively designed as the field. Some domains, such as Assyrian languages and literature, may have a very small field consisting of a dozen or so scholars across the world. Others, such as electronic engineering, may include many thousands of specialists whose opinion would count in recognizing a viable novelty. For mass market products such as soft drinks or motion pictures, the field might include not only the small coterie of product developers and critics, but the public at large.

In some domains it is almost impossible to do novel work without access to capital. To build a cathedral or to make a movie requires the collaboration of people and materials, and these must be made available to the would-be creative artist. Not surprisingly, creativity in the arts and sciences has flourished historically in societies that had enough surplus capital to finance experimental work. For example, the masterpiece is not the only product of the gothic cathedral and Venetian art. The artists took off after the masterpieces and resources accumulate in a different way.

Occasionally fields become absorbed by a single person, or a very large. For instance, van Gogh’s was a separate aesthetic field. When Caravaggio painted in a relaxed pose, it was not dismissed as art because it looked to the average official had the role of a political leader, movies, and even recorded music, contributed to the field.

Some of the most important contributions to the field of psychoanalysis are the conceptual contributions that Freud made to his ideas, and discuss his ideas, and then develop theories of themselves as practitioners. Freud’s ideas might have been absorbed into the culture, and thus would not have the impact of computer languages, theory applications; and an example is the mainframe computers, their developers, and users, themselves as a field of ‘expert’ to determine what is creative.

In any case, the point is that creativity is not determined just by the domains, but also by how the decision is made at the level of the field. Organizations such as National Science spend a large quantity of money to develop creativity, and the new ideas are good news if they are accepted in the domain. We need creativity of new ideas in the field of electronics become
example, the masterpieces of Florence were built with the interest that accumulated on the ledgers of the city’s bankers throughout Europe; the masterpieces of Venice were the fruit of that city’s seagoing trade. The Dutch painters and scientists took off after Dutch merchants began to dominate the sea lanes. As resources accumulate in one place, they lay down the conditions for innovation.

Occasionally fields become extensions of political power, responsible to society at large. For instance, the works of Renaissance artists were not evaluated by a separate aesthetic field, but had to pass muster from ecclesiastical authorities. When Caravaggio painted his vigorously original portrait of St Matthew in a relaxed pose, it was not accepted by the Prior of the church that had commissioned it because it looked too un-saintly. In the Soviet Union, specially trained party officials had the responsibility of deciding which new paintings, books, music, movies, and even scientific theories were acceptable, according to how well they supported political ideology.

Some of the most influential new ideas or processes seem to occur even though there is no existing domain or field to receive them. For instance, Freud’s ideas had a tremendous diffusion even before there was a domain of psychoanalysis, or a field of analysts to evaluate them. Personal computers were widely adopted before there was a tradition and a group of experts to judge which were good, which were not. But the lack of a social context in such cases is more apparent than real. Freud was immersed in the domain of psychiatry, and simply expanded its limits until his conceptual contributions could stand on their own as a separate domain. The first field of psychoanalysis was composed of medical men who met with Freud to discuss his ideas, and were convinced by them to the point of identifying themselves as practitioners of the new domain. Without peers and without disciples, Freud’s ideas might have been original, but they would have had no impact on the culture, and thus would have failed to be creative. Similarly, personal computers would not have been accepted had there not been a domain, in this case computer languages, that allowed the writing of software and therefore various applications; and an embryonic field, that is people who had experience with mainframe computers, with video games, and so on, who could constitute themselves as a field of ‘experts’ in this emerging technology.

In any case, the point is that how much creativity there is at any given time is not determined just by how many original individuals are trying to change domains, but also by how receptive the fields are to innovation. It follows that if one wishes to increase the frequency of creativity, it may be more advantageous to work at the level of fields than at the level of individuals. For example, some large organizations such as Motorola, where new technological inventions are essential, spend a large quantity of resources in trying to make engineers think more creatively. This could be a good strategy, but it will not result in any increase in creativity unless the field, in this case management, is able to recognize which of the new ideas are good, and has ways for implementing them, that is including them in the domain. Whereas engineers and managers are the field who judge the creativity of new ideas within an organization such as Motorola, the entire market for electronics becomes the field that ultimately evaluates the organization’s
products. Thus at one level of analysis the organization is the entire system, with innovators, managers, and production engineers as its parts; whereas at a higher level of analysis the organization becomes just one element of a broader system including the entire industry.

**Characteristics of Fields that Enhance Creativity**

Fields vary on a variety of dimensions, such as the extent to which they are autonomous. Some fields can make judgments about creativity irrespective of the society in which they are embedded, whereas others do little more than mediate public opinion. The autonomy of a field is to a certain extent a function of the codification of the domain it serves. When the domain is arcane and highly codified, like Assyriology or molecular biology, then the decision as to which new meme is worth accepting will be made by a relatively small field. On the other hand in the domains of movies or popular music, which are more more accessible to the general public, the specialized field is notoriously unable to decide which works will be creative. For the same reasons, creativity is much more ephemeral in the arts compared to the sciences. Works of art that seemed to shine with originality to audiences at the beginning of this century may seem trite and pointless to us. It is instructive to compare the list of Nobel Prize winners in literature against that of the winners of the science prizes; fewer of the writers from years past are now recognized as creative compared with the scientists.

Another important dimension along which fields vary is the extent to which they are open or closed to new memes. The openness of a field depends in part on its internal organization, in part on its relation to the wider society. Highly hierarchical institutions, where knowledge of the past is greatly valued, generally see novelty as a threat. For this reason churches, academies, and certain businesses based on tradition seek to promote older individuals to leadership positions, as a way of warding off excessive change. Creativity is not welcome in fields whose self-interest depends on keeping a small cadre of initiates performing the same routines, regardless of efficiency; some of the trades unions come to mind in this context.

In addition to autonomy and openness, there are many other features of a field that will make it either more or less likely to stimulate the acceptance of new memes. One of the most important ones is access to resources. A field is likely to attract original minds to the extent that it can offer scope for experiment and promises rewards in case of success. Even though, as we shall see, individuals who try to develop domains are in general intrinsically motivated—that is, they enjoy working in the domain for its own sake—the attraction of extrinsic rewards such as money and fame are not to be discounted.

Leonardo da Vinci was one of the most creative people on record in terms of his contributions to the arts and the sciences, and constantly moved during his lifetime from one city to another, in response to changing market conditions. The leaders of

**Societal Conditions**

We have already considered some factors that are responsive to novel ideas. In this chapter we consider the traits of societies that are conducive to creativity: the domain, the organization, and the individual.

As mentioned earlier, a system is a surplus is in a better position to accept and implement new ideas. An organization that makes information more accessible, for example, will reward creativity by making more information available. In addition, great scientific laboratories, financial centers, or the painting of pictures as a career might serve as primary. But it seems that creativity, the impact on the organization and individuals, is an important goal in itself. So the material surplus produced by innovation contributes to the production of cars and
Creativity

The extent to which they are able to pursue creativity irrespective of the field is determined by a number of factors. A certain extent a function of the extent to which the main arcane and highly codified decision-making processes work in a field, the degree to which the field is small and relatively small field. On the other hand, which are much more accessible opportunities, usually available in fields that seem to have an origin. May seem like an intrinsic to society. However, the writers in literature against the writers from years past are not always the same. The fields vary in the extent to which a person's experience in a field depends on his/her wider society. Highly hierarchical fields are generally more valued, generally see the pursuit of creativity as a way to achieve leadership positions, as a status, not welcome in fields whose initiates performing the same tasks unions come to mind in this context. The many other features of a field can facilitate the acceptance of new ideas into resources. A field is likely to have some scope for experimentation, and as we shall see, individuals who are not to be motivated—that is, they enjoy a lack of extrinsic rewards such as a great deal of interest. The people on record in terms of his creativity may have moved during his lifetime. The leaders of the Social Context

Florence, the Dukes of Milan, the Popes in Rome, and the King of France waxed and waned in terms of how much money they had to devote to new paintings, sculptures, or cutting-edge scholarship. As their fortunes changed, Leonardo moved to wherever he could pursue his work with the least hindrance.

The great flowering of impressionism in Paris was in part due to the willingness of the new middle classes to decorate their homes with canvases. This in turn attracted ambitious young painters from every corner of the world to the banks of the Seine. The first beneficiaries of the new affluence were academic painters, but as their craft became so perfect it became boring. Subsequently, new photographic techniques made life-like pictures no longer unique, benefiting those painters who broke with tradition and introduced new memes.

How central a field is in terms of societal values will also determine how likely it is to attract new persons with an innovative bent. In the present historical period, bright young men and women are attracted to a range of contrasting domains, all of which, however, have widespread ideological and/or material support. Some might be attracted to computer sciences because they provide the most exciting new intellectual challenges; some to oceanography because it might help to save the planetary ecosystem; some to currency trading, because it provides access to financial power, and so to family medicine, because it is the new medical speciality in demand. Any field that is able to attract a disproportionate number of bright young persons is more likely to witness creative breakthroughs.

Societal Conditions Relevant to Creativity

We have already considered some of the societal conditions that make a field more responsive to novel ideas. It is useful, however, to focus more explicitly on the traits of societies that facilitate the entire creative process, including all three elements: the domain, the field, and the person.

As mentioned earlier, other things being equal a society that enjoys a material surplus is in a better position to help the creative process for several reasons. It makes information more readily available, it allows for a greater rate of societal differentiation and experimentation, and it is better equipped to reward and implement new ideas. A subsistence society has fewer opportunities to encourage and reward novelty, especially if it is expensive to produce. Only societies with ample material reserves can afford to build great cathedrals, great universities, great scientific laboratories. Even the composition of music, the writing of poetry, or the painting of pictures seems to require a market where subsistence needs are not primary. But it seems that there is often a lag between social affluence and creativity, and the impact of wealth may take several generations to manifest itself. So the material surplus of nineteenth century America was first absorbed by the need to build a material infrastructure for society (canals, railways, factories), before it was invested in supporting novel ideas, such as the telephone or the mass production of cars and planes.
A further and more controversial requirement might be that an egalitarian society is less likely to support the creative process than one where relatively few people control a disproportionate amount of the resources, especially in relation to the arts. Aristocracies or oligarchies may be better able to support creativity than democracies or socialist regimes, simply because when wealth and power are concentrated in a few hands, it is easier to use part of it for risky and ‘unnecessary’ experiments. The development of a leisure class often results in a refinement of connoisseurship that in turn provides more demanding criteria by which a field evaluates new contributions.

Societies located at the confluence of diverse cultural streams can benefit more easily from that synergy of different ideas which is so important for the creative process. It is for this reason that some of the greatest art, and the earliest science, developed in cities that were centres of trade. The Italian Renaissance was in part stimulated by the Arab and Middle Eastern influences that businessmen and their retinues brought into Florence and the seaports of Venice, Genoa, and Naples. The fact that periods of social unrest often coincide with creativity is probably due to the synergy that results when the interests and perspectives of usually segregated classes are brought to bear on each other. The Tuscan cities supported creativity best during the fourteenth and fifteenth centuries, a period in which noblemen, merchants, and craftsmen fought each other bitterly, and when every few years a good portion of the citizenry was banished.

But it is not enough to be exposed to new ideas, it is also important to be interested in them. There have been societies with great resources at the confluence of trade routes where new ideas have been shunned. In Egypt, for example, a unique burst of creativity resulted in astonishing accomplishments in architecture, engineering, art, technology, religion, and civic administration. Following this, the leaders of society apparently agreed that the best policy was to leave well enough alone. Thus most of Egyptian art for several thousand years was produced in a few central workshops supervised by priests or bureaucrats, relying on universally binding rules, common models, and uniform methods. ‘...originality of subject-matter,’ writes the sociologist of art Arnold Hauser ‘was never very much appreciated in Egypt, in fact was generally tabooed, the whole ambition of the artist was concentrated on thoroughness and precision of execution...’ (Hauser 1951, p. 36).

Whether a society is open to novelty or not depends in part also on its social organization. For instance, a farming society with a stable feudal structure would be one where tradition counts more than novelty, whereas societies based on commerce, with a strong bourgeois class trying to be accepted by the aristocracy, have usually favoured novelty. Whenever the central authority tends towards absolutism, it is less likely that experimentation will be encouraged. Chinese society is another good example of a central authority supported by a powerful bureaucracy that resisted the spread of new ideas for centuries. Despite enormous early cultural advances, and a great frequency of creative individuals, Chinese authorities believed that the only purpose for the printing of books, was instruction. Nevertheless, currently China has ideas that in the past they have not.

The Creative Person

When we get to the level of the individual, we find ourselves on more familiar ground. According to this theory, creativity is an attribute of individuals. A recent analysis of the case studies of ten theses written by psychologists (Wehner et al. 1991) identified a set of cognitive processes that were the most frequently shown by creative people.

The systems model makes a number of assumptions about the creative process in a theoretical manner. It emphasizes the importance of the first performance, that it must have access to a domain of skills, and that it has to be able to use them. This implies that motivation often plays a significant role in the creative process, because psychologists have studied this aspect of creativity in detail.

Second, the system model suggests that the environment in which the personality traits that favour creativity are expressed is the most important factor in the creative process. For example, if a subject is provided with a creative problem, it is possible for one to be taken up by the environment, so as to be understood, are all the other conditions necessary to make someone creative.

But none of these personality traits are sufficient; one can be creative and not even necessary; conserving creativity to the point of being creative is not enough. Primitive painters like le Doux, who are not known to be traditional but do not necessarily adhere to it, may have contributed creatively to the development of a new style. It is true that those who can manage to do this have a higher proportion of their efforts to the characteristics of such people.
and Geniuses: A Systems Perspective

...might be that an egalitarian regime would be more likely than one where relatively few resources, especially in relation to the number of people, are available to support creativity than a regime where wealth and power are concentrated in the hands of a few. This is a central issue for risky and 'unnecessary' activities that help support creativity, and this is why it is so important for the creative process to occur in a period in which noblemen, artists, and scientists lived together, and when every few years a new generation of young artists and scientists would be generated.

In such a period, it is also important to be able to use great resources at the confluence of traditional and modern. In Egypt, for example, a particular accomplishment in architecture, mathematics, and administration. Following this, the art of sculpture was developed, and this was produced in a few places, relying on universally shared knowledge...s. "...originality of subject matter, the public action of execution..." (Hauser 1990).

This tends in part also on its social context. In a feudal society where the aristocracy was accepted by the aristocracy, and where the central authority tended towards authority, creativity will be encouraged. Chinese society was not entirely different, supported by a powerful state and a powerful central authority. Despite enormous authority, Chinese creative individuals, Chinese authorities believed that the uses of gunpowder for weapons, or of movable type for the printing of books, were bad ideas. Of course, they might have been right. Nevertheless, currently China is trying to catch up as fast as possible with the new ideas that in the past they had elected to ignore.

The Creative Person

When we get to the level of the person in creativity research, we are immediately on more familiar ground. After all, the great majority of psychological research assumes that creativity is an individual trait, to be understood by studying individuals. A recent analysis of doctoral dissertations on the topic found that six out of ten theses written by psychology Ph.D.s in 1986 were focused on individual traits (Wehner et al. 1991) and none dealt with the effects of culture and social groups. Cognitive processes, temperament, early experiences, and personality were the most frequently studied topics.

The systems model makes it possible to see the contributions of the person to the creative process in a theoretically coherent way. In the first place, it brings to attention the fact that before a person can introduce a creative variation, he or she must have access to a domain, and must want to learn to perform according to its rules. This implies that motivation is important—a topic already well understood by scholars in the field of creativity. But it also suggests a number of additional factors that are usually ignored: for instance that cognitive and motivational factors interact with the state of the domain and the field.

Second, the system model reaffirms the importance of individual factors that contribute to the creative process. People who are likely to innovate tend to have personality traits that favor breaking rules, and early experiences that make them want to do so. Divergent thinking, problem finding, and all the other factors that psychologists have studied are relevant in this context.

Finally, the ability to convince the field about the virtue of the novelty one has produced is an important aspect of personal creativity. The opportunities one has to get access to the field, the network of contacts, the personality traits that make it possible for one to be taken seriously, the ability to express oneself in such a way as to be understood, are all part of the individual traits that make it easier for someone to make a creative contribution.

But none of these personal characteristics is sufficient, and probably they are not even necessary: conservative and unimaginative scientists have made important and creative contributions to science by stumbling on important new phenomena. Primitive painters like le Douanier Rousseau or Grandma Moses, who were trying to be traditional but could not quite paint realistically enough, have been seen as having contributed creatively to the history of art. At the same time, it is probably true that those who can master a domain, and then want to change it, will have a higher proportion of their efforts recognized as creative. So we now review briefly the characteristics of such persons.
Accessing the Domain

In order to bring about a novel change, a person has to have access to the information contained in a given domain. How much access a person has depends on two sets of factors: one external and structural, the other subjective and internal. The external factors include the amount of cultural capital a person can dispose of, and the domain-related roles available in the social environment. Cultural capital consists of the educational aspirations of one’s parents, the non-academic knowledge one absorbs in the home, and the informal learning that one picks up from home and community. Moreover, it involves learning opportunities which include schooling, mentoring, exposure to books, computers, museums, musical instruments, and so forth. Domain-related roles are those opportunities for expressing one’s creative potential that vary from culture to culture, from social class to social class, and from historical epoch to epoch. For example, whether a person will be able to study physics or music long enough to be able to innovate in it depends in part on whether there are laboratories or conservatories in which one can practice and learn state-of-the-art knowledge in the particular domain.

Whether people will avail themselves of existing knowledge does not depend only on these external, structural factors. It depends also, perhaps more, on subjective traits such as curiosity, interest, and intrinsic motivation. At this point we do not know to what extent such dispositions are inherited and form part of a person’s temperament, and to what extent they are learned and cultivated in the early family environment. In either case, the fact is that traits such as curiosity and motivation vary considerably between people. For instance one of the subjects of our study, Manfred Eigen, was drafted into the German air defence out of high school, at age 15. He was taken to Russia to man an anti-aircraft battery on the Eastern front, and at the end of World War II he was taken prisoner by the Soviet troops. He escaped from the prison of war camp and walked for over 500 miles without money or food, evading Russian soldiers, until he reached the doors of the University of Gottingen. Here he was resolved to study science, having heard that Gottingen had the highest reputation in the field. The University had not reopened yet after the war, but when it did the young Eigen was admitted even without his High School diploma. He went to work with a vengeance, received his doctorate at age 23, and by 1967—at age 40—his discoveries in chemistry had earned him a Nobel prize.

This example shows the extent to which internal factors like curiosity and determination can compensate for the lack of structural opportunities. There are similarities to the ways in which Michael Faraday (described in Chap. 5 by Michael Howe) overcame obstacles in his determination to become a scientist. It would have been easy for Eigen to resign himself to the lack of educational opportunities in the prison camp, or in post-war Germany—in which case it would have been impossible for him to contribute creatively to science. However, it should be added that his curiosity and determination seem, at least in part, to be the result of the cultural capital he had accumulated in his early years. Eigen’s father was a musician, and he grew up in a family where children were expected to have training in music and science. However, when he was drafted into the army he was so firmly established in his music that he could not give up his progress. Nevertheless, in a gulag, or if Germany had been less structured, it is probable that he would have lost his opportunities.

Producing Novelty

Being able to access a domain is one thing, but it is another to actually produce novel ideas. In other words, as suggested by the personal qualities that help bring about creative innovation, cognitive style, personality, and culture all play a role in creativity. Innate ability refers to the physical endowment that a person has. Geniuses such as musicians like Mozart seem to have physical abilities that set them apart from others before they start practising. But innate ability is limited, and it is not always clear that a creative individual has a particular domain such as basketball. In addition, it is clear that a creative person can also have physical co-ordination. Any innate ability may not be inherited, as suggested by the fact that a genetic analysis of seven or more siblings of a famous individual seems to support the notion that creativity is not inherited. It may be that creativity is a result of the interaction between brain organization and domain rather than another instance of a unique ability that was inherited.

Clearly, very little is known about the role of system structures and creativity. What is known is that people to claim that left-handers have an advantage in music. Many exceptional
The Creative Person

was a musician, and he grew up in a family where culture was held in high esteem, where children were expected to be proficient in a variety of subjects, and where training in music and science was provided as a matter of course. By the age of 15, when he was drafted into the Army, Eigen’s desire to access the domain of science was so firmly established that the enormous obstacles in his way scarcely slowed down his progress. Nevertheless, if for example he had been taken to a Siberian gulag, or if Germany had been prevented from rebuilding its scientific infrastructure, it is probable that Eigen would not have been able to overcome this lack of opportunity.

Producing Novelty

Being able to access a domain is indispensable but certainly not sufficient, for a person to make a creative contribution. He or she must also have the ability and inclination to introduce novelty in the domain. It is convenient to divide the personal qualities that help the production of novelty into four kinds: innate ability, cognitive style, personality, and motivation.

Innate ability refers to the fact that it is easier to be creative if one is born with a physical endowment that helps to master the skills required by the domain. Great musicians like Mozart seem to be unusually sensitive to sounds from the earliest years, and artists seem to be sensitive to colour, light, and visual shapes even before they start practising their craft. If we extend the definition of creativity to domains such as basketball—and in principle there is no reason for not doing so—then it is clear that a creative player like Michael Jordan benefits from unusual physical co-ordination. At this point, we know very little about the relationship between brain organization and the ability to perform in specific domains. It would not be surprising, however, to discover that interest or skill in certain domains can be inherited, as suggested by David Lykken in Chap. 2. Howard Gardner’s postulate of seven or more separate forms of intelligence (Gardner 1983, 1993) also seems to support the notion that each of us might be born with a propensity to respond to a different slice of reality, and hence to operate more effectively in one domain rather than another. Many of the subjects in our study displayed unusual early abilities that were almost at the level of the child prodigies described by Feldman (1986). On the other hand, a roughly equal number of individuals who achieved comparable creative contributions appeared to have rather undistinguished childhoods, and were not recognized as exceptional until early adulthood.

Clearly very little is known as yet about the relationship of central nervous system structures and creativity, although many claims are being made these days with limited support. For instance, cerebral lateralization research has led many people to claim that left-handers or ambidextrous individuals, who are presumed to be using the right side of their brains more, are more likely to be creative. Left-handers are apparently over-represented in such fields as art, architecture, and music. Many exceptional individuals from Alexander the Great to Leonardo da
Vinci, Michelangelo, Raphael, Picasso, Einstein were all left-handers (Coren 1992; Paul 1993). Suggestive as such trends might be, there is also evidence that left-handers are much more likely to be prone to a variety of unusual pathologies (Coren 1992, pp. 197–220). Thus whatever neurological difference handedness makes might not be directly linked to creativity, but rather to deviancy from the norm that can take either a positive or a negative value.

The most salient attributes of the cognitive style of potentially creative individuals appear to be divergent thinking (Guilford 1967) and discovery orientation (Getzels and Csikszentmihalyi 1976). These are, of course, some of the most thoroughly researched dimensions of creativity to be found in the psychological literature. Divergent thinking, usually indexed by fluency, flexibility, and originality of mental operations, is routinely measured by psychological tests given to children, and shows modest correlations with childish measures of creativity, such as the originality of stories told or pictures drawn (Runco 1991). Whether these tests also relate to creativity in ‘real’ adult settings is not clear, although some claims to that effect have been made (Milgram 1990; Torrance 1988). Discovery orientation, or the tendency to find and formulate problems where others have not seen them, has also been measured in selected situations, with some encouraging results (Baer 1993; Runco 1995). As Einstein and many others have observed, the solution of problems is a much simpler affair than their formulation. Anyone who is technically proficient can solve a problem that is already formulated, but it takes true originality to formulate a problem in the first place (Einstein and Infeld 1938).

Some scholars dispute the notion that problem finding and problem solving involve different thought processes. For example, the Nobel-prize winning economist and psychologist Herbert Simon has claimed that all creative achievements are the result of normal problem-solving (Simon 1985, 1988). However, the evidence he presents is based on computer simulation of scientific breakthroughs. This is not relevant to the claim, since the computers are fed pre-selected data, logical algorithms, and a routine for recognizing the correct solution—all of which are absent in real historical discoveries (Csikszentmihalyi 1988a, c).

The personality of creative persons has also been exhaustively investigated (Barron 1969, 1988). Psychoanalytic theory has stressed the ability to regress into the unconscious while still maintaining conscious ego controls as one of the hallmarks of creativity (Kris 1952). The widespread use of multi-factor personality inventories suggest that creative individuals tend to be strong on certain traits such as introversion and self-reliance, and low on others such as conformity and moral certainty (Csikszentmihalyi and Getzels 1973; Getzels and Csikszentmihalyi 1976; Russ 1993). Some examples of this approach are provided by Robert Albert in his evaluation of the mathematicians Srinivasa Ramanujan and G. H. Hardy (Chap. 6).

There is a long tradition of associating creativity with mental illness, or genius with insanity (Jacobson 1912; Lombroso 1891). Recent surveys have added new credence to this tradition by demonstrating rather convincingly that the rate of various pathologies such as suicide, alcoholism, drug addiction, and institutionalization for nervous diseases is much higher than expected in certain ‘creative’ professions, such as drama, poetry, music, and so forth (Jablow and Lieb 1988;
were all left-handers (Coren 1979). But rather than deviance from the norm, it may be that there is evidence that a variety of unusual pathologies and biological differences handedness be found (Runcie 1991). Whether these differences are clear, although some (Torrance 1988). Discovery is not always clear, although some (Torrance 1988). Discovery of problems where others have not been formulated, with some encouraging many others have observed, the formulation. Anyone who has already formulated, but it takes place (Einstein and Infeld 1938). Discovery of finding and problem solving, the Nobel-prize winning economists that all creative achievements (Einstein 1985, 1988). However, the evolution of scientific breakthroughs. Researchers are fed pre-selected data, the correct solution—all of which (Csikszentmihalyi 1988a, c).

The Creative Person

Jamison 1989; Martindale 1989; Richards 1990). These results, however, only demonstrate that some fields, which have in our culture get little support, are associated with pathology either because they attract persons who are exceptionally sensitive (Mitchell 1972; Piechowski 1991), or because they can offer only depressing careers. They may have little or nothing to say about genius itself. Another perspective on these issues is provided by Gordon Claridge in Chap. 10.

One view this author has developed on the basis of his studies is that creative persons are characterized not so much by single traits, but rather by their ability to operate through the entire spectrum of personality dimensions. So they are not just introverted, but can be both extroverted and introverted depending on the phase of the process. When gathering ideas a creative scientist is gregarious and sociable; when he starts working, he might become a secluded hermit for weeks on end. Creative individuals are sensitive and aloof, dominant and humble, masculine and feminine, as the occasion demands (Csikszentmihalyi 1996). What dictates their behaviour is not a rigid inner structure, but the demands of the interaction between them and the domain in which they are working.

The importance of motivation for creativity has long been recognized. If one has to bet on who is more likely to achieve a creative breakthrough—a highly intelligent but not very motivated person, or one less intelligent but more motivated—one should always bet on the second (Cox 1926). Because introducing novelty in a system is always a risky and usually unrewarded affair, it takes a great deal of motivation to persevere. One recent formulation of the creative person's willingness to take risks is the 'economic' model of Sternberg and Lubart (1995).

In order to want to introduce novelty into a domain, a person should first of all be dissatisfied with the status quo. It has been said that Einstein explained why he had so much time on developing a new physics by saying that he could not understand the old physics. Greater sensitivity, naivety, arrogance, impatience, and higher intellectual standards have all been added as reasons why some people are unable to accept the conventional wisdom in a domain, and feel the need to break out of it.

Values also play a role in developing a creative career. There are indications that if a person holds financial and social goals in high esteem, it is less likely that he or she will continue long enough bravely to the insecurities involved in the production of novelty, and will tend to settle for a more conventional career (Csikszentmihalyi et al. 1984; Getzels and Csikszentmihalyi 1976). A person who is attracted to the solution of abstract problems (theoretical value) and to order and beauty (aesthetic value) is more likely to persevere.

Perhaps the most salient characteristic of creative individuals is a constant curiosity, an ever renewed interest in whatever happens around them. This enthusiasm for experience is often seen as part of the 'childishness' attributed to creative individuals (Csikszentmihalyi 1996; Gardner 1993). Another way of describing this trait is that creative people are intrinsically motivated. A recurrent refrain among them goes something like this, 'You could say that I worked every day of my life, or with equal justice you could say that I never did a lick of work in
my life. In other words, work and enjoyment are so deeply intertwined that they cannot be disentangled.

How these patterns of cognition, personality, and motivation develop is still not clear. Some may be under heavy genetic control, while others develop under the conscious direction of the self-organizing person. In any case, the presence of these traits is likely to make a person more creative if the conjunction with the other elements of the system—the field and the domain—happen to be propitious.

**Convincing the Field**

To make a creative contribution, a person must not only be able to produce a novelty in the domain, but must also be able to present the novelty in such a way that the field will accept it as an improvement over the status quo, and thus worth including in the canon of the domain. If this does not happen, the novelty is likely to disappear from the record without affecting human consciousness any further. There are exceptions, as when a painting or a theory that had been ignored in the author’s lifetime is rediscovered posthumously. In such cases what changes is not the creative contribution, but the field or the domain that receives it. As the totality of the system changes with time, a painting or theory that was simply different may become ‘creative’, or vice versa. In most cases, however, the author’s own actions will help determine whether the novelty is accepted or not.

Every model of the creative process recognizes that after the phases of preparation, incubation, and insight there must follow a phase of elaboration during which the novel idea or product is polished and prepared for public scrutiny. For a scholar this might involve many months of hard work preparing an article for publication; for an inventor it involves building a prototype that will pass the scrutiny of the patent office; for an artist it might involve convincing a gallery or a collector that a canvas is worth exhibiting. This phase of the creative process is often the least appealing, and it involves skills and behaviors that are often at variance with the preceding phases. For instance if the beginning of the creative process involves a great deal of flexibility, idiosyncreasy, and divergent thinking, its end requires convergent thinking, social skills, and sheer endurance. It is partly for this reason that the creative personality includes opposite dimensions; the creative process requires opposite personality traits.

In our longitudinal study of artists, it became apparent that the kind of young people who in art school were considered to be the most promising embodiments of the ‘artist’, had a great deal of trouble once they left college. Art teachers rewarded students who were highly original, reclusive, abrasive, unconcerned about material rewards and success. But after graduation, such students had a very hard time getting public support for their work. They antagonized the ‘field’ of critics, gallery owners, and collectors, and pretty soon found themselves without contacts or commissions. At that point most of them lost heart and took up some other occupation, refurbishing old houses, customizing cars, starting a plumbing company, thereby forfeiting the fruits of their originality. However, some who left their mark on the public mind, or who retained originality also had the ability to resort to public relations, using the atmosphere of the art schools to further their work. Andrew Steptoe in Chap. 1 has also appeared to have coupled the two.

This is how George Santayana expressed this requirement:

> I’ve always looked upon the task of the artist as similar to the task of his contemporaries of the cognate sciences—except that he must persuade his audience.

> ...Everybody has to sooner or later come to the assembly of the people around me. I can’t say and don’t bring it to frame and have the audience participate in my society.

In order to persuade one’s audience to internalize the rules of the game, one must anticipate its judgements and appeal to it. Practically all creative individuals have in one way or another an audience of peers, and their immediate forget the bad ones. For example, Linus Pauling, the winner of this year’s Nobel prize, said to his students: ‘There are many bad ones’. To be able to do so, one must be able to accept a representation of which idea or list of ideas matches closely the one accepted by the audience.

An extreme example of this can be found in the in the case of the inventor Jacob Rabinow and his group of new inventions in addition to being inventors, they were also inventors of the field, because he works for the best possible solution to the problem, other individuals deserve recognition as well. Rabinow mentions few examples:

So you need three things to be an inventor—a big mind, a good amount of information—so that you could have a good idea, and you should know a lot about music. You should be able to hear music and be able to remember what you heard; you should be able to imitate birds that you’ve heard. You should be able to hear music and remember what you heard. You should be able to imitate birds that you’ve heard.

So you have to have the ideas, you have to have the means of carrying them out, you have to have the incentive to carry them out, and eventually you become a creative person.
The Creative Person

company, thereby forfeiting any claims to changing the domain. The young artists who left their mark on the world of art tended to be those who in addition to originality also had the ability to communicate their vision to the public, often resorting to public relations tactics that would have been abhorrent in the pure atmosphere of the art school. It is interesting that in the analysis presented by Andrew Steptoe in Chap. 11, the more successful artists of the Italian Renaissance also appear to have coupled creativity with social and diplomatic skills.

This is how George Stigler, a winner of the Nobel prize in economics, expressed this requirement in his interview for our study:

I've always looked upon the task of a scientist as bearing the responsibility for persuading his contemporaries of the cogency and validity of his thinking. He isn't entitled to a warm reception. He has to earn it, whether by the skill of his exposition, the novelty of his views ... Everybody has to sooner or later say, unless he's insane, 'I have to accept the judgement of the people around me. I can't say I'm great if everybody else says I'm not.' Or if I do say it and don't bring it to fruition, I am clearly a romantic or a utopian, not an active participant in my society.

In order to persuade one's contemporaries, it is important for a person to be able to internalize the rules of the domain and the opinions of the field, so that one can anticipate its judgements and avoid having to beat one's head against a wall. Practically all creative individuals say that one advantage they have over their peers is that they can tell when their own ideas are bad, and that they can immediately forget the bad ideas without investing too much energy in them. Linus Pauling, the winner of two Nobel prizes, was asked at his sixtieth birthday party how he had been able to come up with so many epochal discoveries. 'It's easy', he is said to have answered, 'You think of a lot of ideas, and throw away the bad ones'. To be able to do so, however, implies that one has a very strong internal representation of which ideas are 'good' and which are 'bad', a representation that matches closely the one accepted by the field.

An extremely lucid example of how a person internalizes the system is given by the inventor Jacob Rabinow, who has 250 patents on a variety of very different inventions. In addition to being a prolific inventor himself, he is also prominent in the field, because he works for the patent office, and hence decides which inventions by other individuals deserve recognition. In describing what it takes to be an original thinker, Rabinow mentions first the importance of what I have called the domain:

So you need three things to be an original thinker. First, you have to have a tremendous amount of information—a big database if you like to be fancy. If you're a musician, you should know a lot about music, that is, you've heard music, you remember music, you could repeat a song if you have to. In other words, if you were born on a desert island and never heard music, you're not likely to be a Beethoven. You might, but it's not likely. You may imitate birds but you're not going to write the Fifth Symphony. So you're brought up in an atmosphere where you store a lot of information.

So you have to have the kind of memory that you need for the kind of things you want to do. And you do those things which are easy and you don't do those things which are hard, so you get better and better by doing the things you do well, and eventually you become either a great tennis player or a good inventor or
whatever, because you tend to do those things which you do well and the more you
do, the easier it gets, and the easier it gets, the better you do it, and eventually you
become very one-sided but you’re very good at it and you’re lousy at everything
else because you don’t do it well. This is what engineers call positive feedback.
The small differences at the beginning of life become enormous differences by the
time you’ve done it for 40, 50, 80 years as I’ve done it. So anyway, first you have
to have the big database.

Next, Rubinow brings up what the person must contribute, which is mainly a
question of motivation, or the enjoyment one feels when playing (or working?)
with the contents of the domain:

Then you have to be willing to pull the ideas, because you’re interested. Now, some
people could do it, but they don’t bother. They’re interested in doing something else. So if
you ask them, they’ll, as a favor to you, say: ‘Yeah, I can think of something.’ But there
are people like myself who like to do it. It’s fun to come up with an idea, and if nobody
wants it, I don’t give a damn, it’s just fun to come up with something strange and different.

Finally he focuses on how important it is to reproduce in one’s mind the criteria
of judgement that the field uses:

And then you must have the ability to get rid of the trash which you think of. You cannot
think only of good ideas, or write only beautiful music. You must think a lot of music, a
lot of ideas, a lot of poetry, a lot of whatever. And if you’re good, you must be able to
throw out the junk immediately without even saying it. In other words, you get many ideas
appearing and you discard them because you’re well trained and you say, ‘that’s junk.’
And then you see the good one, you say, ‘Oops, this sounds interesting. Let me pursue that
a little further.’ And you start developing it. And by the way, if you’re not well trained,
but you’ve got ideas, and you don’t know if they’re good or bad, then you send them to the
Bureau of Standards, National Institute of Standards, where I work, and we evaluate them.
And we throw them out.

Conclusion

It is certain that those who are interested in the phenomenon of genius will con-
tinue to focus on the, individual and his or her thought processes. After all, the
unique qualities of those whose mind takes ‘enormous leaps’ are so attractive that
we can’t curb our curiosity about them. What the present chapter seeks to
achieve, however, is to point out that genius cannot be recognized except as it
operates within a system of cultural rules and it cannot bring forth anything new
unless it can enlist the support of peers. If these conclusions are accepted, then it
follows that the occurrence of genius is not simply a function of how many gifted
individuals there are, but also of how accessible the various symbolic systems are,
and how responsive the social system is to novel ideas. Instead of focusing
exclusively on individual geniuses, it will make more sense to focus on commu-
nities that may or may not nurture genius. In the last analysis, it is the community
and not the individual who makes genius manifest.
Notes

1. This quote and the subsequent ones are taken from interviews conducted by the author with 100 creative individuals in the context of a study supported by the Spencer Foundation.

2. The parameters of the systems model are very simple, but difficult to understand. Its implications are so counter-intuitive that most people exposed to the model dismiss it out of hand, even before they have a chance to reflect on it. A typical objection is the following caveat from one of the reviewers of this volume: 'My only criticism concerns the author's consistent confusion of creativity with the recognition and acceptance of creativity. Is the universe still there if no humans are around to recognize its existence? ... Was Herman Melville not a genius until a critical mass of individuals began to really like *Moby Dick*? If so, how many people did it take to recognize him as a genius before he became one...?' I would love to be able not to confuse creativity with its recognition and its acceptance. But how would I go about it? Unfortunately, as a scientist, I must resign myself to observe creativity only after it has been recognized. There is no other way to do it. For creativity, unlike the universe, is not a physical entity that would exist even if humans were not around to recognize its existence. The first obstacle in the way of understanding the systems model is to think that creativity is a 'natural kind'—something on the order of atoms or molecules. My contention is that if no humans had ever existed, and all of Shakespeare's works were to miraculously materialize on a distant planet, no entity in the universe would know whether they were 'creative'—for they would lack the essential element of human response. This argument is not the same conundrum that George Berkeley proposed almost three centuries ago, when he asked whether there would be a sound in the forest if a tree fell, and no one was there to hear it. If by 'sound' we mean the vibrations of molecules in the air, then certainly there is sound regardless of human presence. But the same argument does not hold for creativity, which is a judgement people make of certain ideas or products, and which therefore cannot exist without people.

The reviewer proceeds with the rhetorical question: 'Was Melville not a genius ...?' The answer is 'No'. If a critical mass of individuals had not begun 'to really like *Moby Dick*', then the reviewer would not have used Melville as an example, and the readers could not have understood the reviewer's reference. In other words, whether Melville is or is not a genius as long as he is unrecognized is a metaphysical question which cannot be answered in empirical terms. The reason the question can be asked in the first place is that a critical mass has already identified Melville as a genius. 'How many people does it take ... to recognize him as a genius' is an empirical question, and one of the purposes of the systems model is to begin answering it.

Acknowledgement The research reported herein was supported by a grant from the Spencer Foundation.
References


References

References


