through education and training, some, perhaps most, will never discover what their real capacities are. To that extent they do not really know who they are or what they might become. And now, maybe more than ever, human communities depend on a diversity of talents not on a singular conception of ability.

When we talk of realizing our potential, we should aim to do so in both senses of the word. We need to understand its range and variety. We also need to turn it into reality. This is where the idea of creativity assumes a central significance. The next chapter looks at what creativity means, how it relates to this idea of intelligence and how it can be promoted or stifled, in education, in business and beyond.

BEING CREATIVE

“When people find their medium, they discover their real creative strengths and come into their own. Helping people to connect with their personal creative capacities is the surest way to release the best they have to offer.”

I said in Chapter 1 that there are many misconceptions about creativity: that it’s wrongly thought to be solely the domain of special people or special activities; that you’re either creative or not; or that it’s all about cutting loose and being uninhibited. What’s wrong with these perceptions? What is creativity? How does it relate to intelligence? How does it work in practice? Let me begin with Las Vegas.

VIVA LAS VEGAS

My wife Terry and I have lived and worked together for over 35 years. She is a major fan of Elvis Presley. I can’t over-emphasize what an understatement that is. There are three of us in the marriage. Fortunately, I’m alive. But it’s only a marginal advantage to be honest. In 2007, it was our 25th wedding anniversary and we decided to renew our vows at the Elvis Chapel in Las Vegas. We went with 30 friends and
family, including our two children, James and Kate. It was a
great weekend. We had the Blue Hawaii package. There are
others, but we liked this one. The package included the Elvis
impersonator, four songs from a choice of ten, and smoke.
As we came into the chapel there was a puff of smoke from
a pipe near the altar, presumably to add to the air of mystery
and sacredness. There was also a hula girl, who was optional. I
had opted for her, for reasons I was rather pleased about in the
event. For another $100 we could have had a pink Cadillac,
but we thought that was bit tacky. It could have lowered the
tone of the whole occasion.
After the ceremony, we had a reception at the Venetian
Hotel, which is a huge place and includes, on the second floor,
an indoor replica of San Marco’s Square in Venice, complete
with the Grand Canal, gondolas and gondoliers. I have been
to Venice, and in some ways the Venetian Hotel is better. It’s
more authentic I feel, and it doesn’t smell of sewage.
I mention Las Vegas for a reason. If you think of it, there is
no reason for it to be there. Most other cities have a reason to
be where they are. Some cities, like New York or Barcelona,
are in natural harbors; so they’re good for trade. Others are in
fertile plains or valleys that are perfect for agriculture; or on
major rivers, so they’re good for transport and settlement; or on hilltops, so they’re
good for defense. None of these are true of Las Vegas. As far as I know, nobody is
trying to invade Nevada. Las Vegas is in the
middle of a desert. The area around it is
an arid wilderness. It has no natural water
supply, no local sources of agriculture and it
suffers from extremely high temperatures.
It’s the most unlikely place on earth for a
major city. Yet for years Las Vegas has been
one of the fastest growing cities in America, with a reputation
that is known all around the world. In one sense Las Vegas
really does occupy the most fertile place on earth: the human
imagination.
Las Vegas began life as an idea. It proved to be such a com-
pelling idea that it has generated a maelstrom of imaginative
energy. I’m not asking you to approve of the idea of Las Vegas:
simply to recognize that it is wholly and solely the product of
human imagination. So too is every uniquely human achieve-
ment in every field.

IMAGINATION, CREATIVITY AND INNOVATION

Imagination is the source of our creativity, but imagination
and creativity are not the same thing. Imagination is the ability
to bring to mind things that are not present to our senses.
We can imagine things that exist or things that do not exist
at all. If I ask you to think of an elephant, your old school, or
your best friend you can bring to mind mental images that are
drawn from real experience. We wouldn’t normally think
of mental images of real experiences as imaginative. More
accurately, they are imaginal. If I ask you to think of a green
polar bear wearing a dress, you can imagine that too. But now
you’re bringing to mind something you haven’t experienced;
at least I assume not. These sorts of images are of possibilities
composed in the mind rather than recalled to mind. They
are imaginative. Sometimes we mistake imaginative experiences for real ones. These sorts of experience are imaginary.
Imagination includes imaginal, imaginative and imaginary
thoughts.

Imagination is the primary gift of human consciousness. In
imagination, we can step out of the here and now. We can
revisit and review the past. We can take a different view of the
present by putting ourselves in the minds of others: we can try
to see with their eyes and feel with their hearts. And in imagina-
tion we can anticipate many possible futures. We may not be
able to predict the future but by acting on the ideas produced in our imagination, we can help to create it. The imagination liberates us from our immediate circumstances and holds the constant possibility of transforming the present.

Creativity is a step further on from imagination. Imagination can be an entirely private process of internal consciousness. You might be lying motionless on your bed in a fever of imagination and no one would ever know. Private imaginings may have no outcomes in the world at all. Creativity does. Being creative involves doing something. It would be odd to describe as creative someone who never did anything. To call somebody creative suggests they are actively producing something in a deliberate way. People are not creative in the abstract; they are creative in something: in mathematics, in engineering, in writing, in music, in business, in whatever. Creativity involves putting your imagination to work. In a sense, creativity is applied imagination.

Innovation is the process of putting new ideas into practice. Innovation is applied creativity. By definition, innovation is always about introducing something new, or improved, or both and it is usually assumed to be a positive thing. Whether it is or not, in particular cases, is always a matter of judgment; and judgments can always vary. But the general intention of innovation is beneficial.

**THE CREATIVE MIND**

If you take your dog outside and point at the moon, the dog will look at your finger and then probably at you. If you take a young child outside and point a finger at the moon, the child will look at the moon. This developed skill is called joint attention: the ability to share words and a point of focus. As the brain develops, children learn to understand the idea that one thing can represent another. This ability is the foundation of the most significant achievement of the creative mind: the power of symbolic thought. Language is the most obvious example. When learning to speak, a child learns that the sounds can have meaning, and eventually, that letters represent sounds. Other animals have only a limited capacity for this.

If you say “fetch” to a trained dog, it will sit up and be ready to move. If you were to talk to it about the importance of fetching or great fetchers you’ve known, it will sit blankly until you throw the stick. Show it a picture of the stick and it will probably sniff it. The dog’s abilities don’t go far beyond the association of sounds with actions. They don’t extend, as they quickly do for children, to sophisticated powers of thinking and communication.

The power of representation has given rise to intricate forms of language, mathematics, and the arts, which permeate human consciousness and frame our ideas and feelings about the world. We don’t just look at the moon, we locate it within complex theories of the universe; we don’t just have feelings for each other, we can capture them in music and poetry. We don’t just live in communities: we construct elaborate political theories and constitutions.

**SPEAKING YOUR MIND**

There is a common-sense assumption that language is principally a system of communication: first we have our thoughts and then we find the words to convey them. Studies in linguistics and in developmental and cognitive psychology have long argued convincingly that while language is certainly a sophisticated way of communicating, its role in what and how we think is more complex. The origin of the language we use affects what and how we think. A child quickly learns that things have names. But she does something more. She
absorbs ways of thinking that the words make possible. These interpretations vary hugely between languages. For example, the word ‘camel’ in Arabic can be expressed in many different ways. As well as the standard Arabic word *djemal*, the spoken language uses several hundred other nouns, depending on local dialect. Having the words to describe the nuances makes it easier to see the differences between them. But languages consist of more than the names of things. They are made up of grammatical structure, tenses, moods and syntax; and these also vary between languages, often profoundly. In some North American Indian languages, for example, the simple idea “I see a man” cannot be expressed without indicating with other parts of speech whether the man is sitting, standing or walking. The Greek language has tenses and moods that are not available in English.

These differences illustrate the different ‘natural’ ways of thinking within different language communities. It is relatively easy for an English speaker to learn French or Italian, in part because many of the words are similar, but also because the conventions of these languages are similar. All three are part of the family of Indo-European languages. It can be harder for a European to learn Chinese, because the basic conventions are completely different.

Chinese is a monosyllabic and tonal language. Indeed, Chinese is tonal because it is monosyllabic. Each word is limited to one syllable and is represented by a single character in the written language. The number of similar sounding words would be unmanageable without some means of differentiating for meaning, which is where the voice itself comes in. Words are given a pitch: high, medium, low; and a tone or contour. The voice stays level or rises or falls as the word is pronounced. Almost literally, Chinese is sung. If you sing a wrong note the person you’re speaking to will hear a different meaning altogether. The foreigner first learning to speak Chinese cannot avoid frequent misunderstandings and gaffes; some more serious than others.

On the other hand, unlike English, French or Italian, Chinese does not use inflections to show agreement, tense or number; these have to be inferred from the context and word order. Written Chinese also differs from European languages in that there is no alphabet. Each word is a distinctive character, which has to be learned *in toto* without the benefit of letters to guide pronunciation. For this reason, a number of different dialects have developed over the centuries in China all based on a common written language. The result is that Chinese people from different parts of the country may have difficulty in understanding each other in conversation yet are still able to communicate in writing. An easy way to grasp this concept is to look at the keypad on a computer: whether English, French or Italian, everyone would understand the letters and numbers even though they would give the letters different words and sounds if they read them out loud.

As they grow into their cultures, children absorb ways of thinking that are embedded in the particular languages they learn. In this way, languages play a central role in the growth of consciousness. Important as they are, words are not the only way in which we think. Words help us to think about some types of experience, but they are relatively useless in dealing with others. We use different modes of representation to express different types of ideas. It’s said that the composer Gustav Mahler was sitting in his studio completing a new piano piece. As he was playing, one of his students came into the room and listened quietly. At the end of the piece the student said, “Maestro, that was wonderful. What is it about?” Mahler turned to him and said, “It’s about this,” and he played it again. If the ideas in music could be expressed in words, there’d be no need to write the music in the first place.
Some ideas can only be expressed in mathematics. As the Nobel physicist, Richard Feynman, put it: “If you’re interested in the ultimate character of the physical world, at present time our only way to understand it is through a mathematical type of reasoning. I don’t think a person can appreciate much of these particular aspects of the world, the great depth and character of the universality of the laws, relationships of things, without an understanding of mathematics. There are many aspects of the world where mathematics is unnecessary, such as love, which are very delightful and wonderful to appreciate and to feel awe about. But if physics is what are talking about, then not to know mathematics is a severe limitation in understanding the world.”

Mathematics is the best medium for some forms of understanding but relatively poor for others. If you want to describe the movement of electrons, you need algebra. If you want to express your love for someone you could use poetry. If someone asks you, “How much do you love me?” don’t give them a calculator and say, “Here, you work it out.”

The veil of conceptions

Our experiences of the world may be received through direct sensory perception, but how we interpret that information varies from person to person. The nature of our senses determines what we can perceive. But even though we have use of the same senses, people often see the same events differently. This is because they have different points of view. They may be in different physical places and literally have a different angle on what’s going on. If there was no more to it than that, any dispute could be settled by comparing everyone’s point of view and putting together an objective overview. In theory this is what is meant to happen in a court of law. In practice, gathering together everyone’s points of view often deepens the details of the dispute. This is because our individual view of what is going on is deeply influenced by the ideas, values and beliefs through which we interpret our experiences. These affect what we actually perceive and what we make of it all.

Human intelligence is not just a process of perception but of selection. Otherwise there would be too much information coming in; like a radio tuned to an open frequency. When you look at a room, a landscape, the street; you don’t pay equal attention to everything in your field of perception. You notice some things, not others. Two people standing in the same street may perceive it in completely different ways. A traffic warden may see a landscape of offenders; a window cleaner a land of opportunity. A bird fancier wandering through a wood will see it differently from a botanist interested in rare plants. If you drive a yellow car, you’re likely to see yellow cars everywhere.

We see the world not as it is, but through a veil of conceptions. Some theories of intelligence argue that there is a direct line from the senses to the brain to the actions we take. The American philosopher of art, Susanne Langer, argues that there is an intermediate process. The brain she says, is like a great transformer: “The current of experience that passes through it undergoes a change of character not through ... the sense by which the perception entered but by virtue of a primary use, which is made of it immediately. It is sucked into the stream of symbols which constitute a human mind.”

WHAT DO YOU MEAN?

Anything may be a symbol. A sunset may symbolize sadness for you and euphoria for someone else, according to personal associations or state of mind. These symbols are personal and psychological. Formal symbols are intended to mean
something. Let me suggest a broad distinction between forms of symbolic representation that are *systematic* and those that are *schematic*.

**Systematic symbols**

Words and numbers are examples of systematic symbolism. Systems of numbers are built from a small set of basic units that can be combined in an infinite variety of ways to express precise meanings. Just as numbers have accepted values, words too have conventional meanings that are definable in terms of each other; and rules that affect how they can be used and still mean something. In verbal language, one word follows another in sequences that are governed by conventions of syntax.

Systematic symbolism is governed by rules, which divide sense from nonsense very clearly, via agreed procedures. In such systems there are only certain ways in which the various elements can be composed and still have meaning. We may not be able to understand every word in a given sentence, but we can generally recognize that the sentence means something because we understand the rules of the system. If we meet a new word, we can look up the definition, and find its meaning described, using other words. In fact we don’t always need to look up an unfamiliar word because what it means is often clear from its context.

The systematic nature of language is illustrated by the scientist and philosopher, Michael Polanyi, who asked what would happen if we were to replace each different sentence in the English language by a unique word. “We must first envisage,” he said, “that from an alphabet of 26 letters we could construct 26^8 eight-letter words: that is about 100 billion.” That number is roughly the number of neurons in a human brain, of course. This million-fold enrichment of the English language, “would completely destroy it not only because nobody could remember so many words but for the important reason that many would be meaningless. For the meaning of a word is formed and made clear by repeated use and the vast majority of our eight-letter words would be used only once or too rarely to acquire a definite meaning.”

Chemistry, for example, says that the millions of different compounds are composed of about 100 chemical elements: “Since each element has a name and characteristic symbol attached to it, we can write down the composition of any compound in terms of the elements it contains. To classify things in terms of features for which we have names, as we do in talking about things, requires the same kind of connoisseurship as the naturalist must have for identifying specimens of plants or animals. Thus the art of speaking precisely, by applying a rich vocabulary exactly, resembles the delicate discrimination practised by the expert taxonomist.”

**SCHEMATIC SYMBOLS**

Words and numbers work well for ideas that can be laid out sequentially. Pictures, on the other hand, present the whole pattern of ideas simultaneously. In visual form we can express thoughts that do not fit the structures of words. Paintings, poems, music and dance are examples of schematic symbols. Their meanings are uniquely expressed in the forms they take. If you want to understand the meaning of a painting you can’t turn to a dictionary of colors to see what blue and green usually mean when they are put together. There is no manual of chords and harmonies that will tell us what a symphony is driving at and no dramatic codebook to tell us what a play means. There are no fixed meanings for the symbolic forms of art, to divide sense from nonsense. The meaning of a work of art is available only in the particular form in which it is expressed. The sound and feel of work in the arts is inseparable not only
from *what* it means but from *how* it means. A painting, a play, a symphony, a novel are complex and unique forms created out of a sense of form and cultural knowledge rather than from systematic meanings.

Schematic forms may use systematic symbols. Plays, novels and poems are written in words, after all; and musical notation allows us to see each note in written form. But the score is not the music, just as the text is not the play. These are the symbols in which the schematic work is encoded and from which it must be interpreted either in performance or by the reader. Words can be used in a functional way to get the world’s business done. Few of us spend much time refining a quick note or email to a friend or someone we work with. Our interest is in what is being said rather than in how it is expressed: in content rather than form. Poetry is a different matter. Consider this by W.B. Yeats:

*When You Are Old*

When you are old and grey and full of sleep,
And nodding by the fire, take down this book,
And slowly read, and dream of the soft look
Your eyes had once, and of their shadows deep;
How many loved your moments of glad grace,
And loved your beauty with love false or true,
But one man loved the pilgrim soul in you,
And loved the sorrows of your changing face;
And bending down beside the glowing bars,
Murmur, a little sadly, how Love fled
And paced upon the mountains overhead
And hid his face amid a crowd of stars.

W.B. Yeats (1865–1939)

Poets are concerned not only with literal meanings but also with the layered associations of words and of the rhythms and cadences of the poem as a whole. We don’t only respond to a poem, or a play, or to music, line-by-line or note-by-note. The complete work is more than the sum of its parts. It is a feature of schematic symbols that we respond to them as a whole.

**CREATING AND RECREATING**

Human consciousness is shaped by the ideas, beliefs and values that we derive from our experiences and through the meaning which we derive from them. Our ideas can liberate or imprison us. In a literal sense we create the worlds in which we live; and there is always the possibility of re-creation. As psychologist George A. Kelly put it: “to make sense out of events we thread them through with ideas and to make sense of the ideas we must test them against events.”

He describes this process as one of successive approximations. The great generative ideas in human history have transformed the world view of their times and helped to reshape their cultures. We make the world we live in and we can remake it. This process of cultural evolution is probably what the comedian George Carlin had in mind when he said, “Just when I found out the meaning of life, they changed it.”

What is true of the long cycles of creative change in a social culture is also true of the shorter cycles of creative work by individuals and groups. The creative process is also one of successive approximations.

**THE CREATIVE PROCESS**

I define creativity as the process of having original ideas that have value. There are three key terms here: *process, original* and "Creativity is the process of having original ideas that have value."
value. Creativity is a process more often than it is an event. To call something a process indicates a relationship between its various elements: that each aspect and phase of what happens is related to every other. Being creative involves several processes that interweave within each other. The first is generative. The second is evaluative.

Generating ideas

Being creative has similar features in all disciplines. The Nobel winning chemist Sir Harry Kroto is also a professional designer. I asked him what differences he experienced, if any, between creativity in the arts and sciences, in the studio and the laboratory. He said that for him the process is exactly the same, even though the outcomes are different (as we’ll see in Chapter 7). In all creative processes we are pushing the boundaries of what we know now, to explore new possibilities; we are drawing on the skills we have now, often stretching and evolving them as the work demands. In the early stages, being creative may involve playing with an idea, doodling or improvising around the theme. It may begin with a thought that is literally half-formed: with a sketch, a first plan or a design; the first notes of a melody or the intimation of a solution to a problem. There may be several ideas in play and a number of possible starting points. Creativity does not always require freedom from constraints or a blank page. A lot of creative work has to work to specific briefs or conventions and great work often comes from working within formal constraints. Some of the finest poetry is in the form of the sonnet, which has a fixed form to which the writer must submit. Japanese haiku similarly makes specific formal demands on the poet, as do many other forms of poetic structure. These do not inhibit the writer’s creativity; they set a framework for it. The creative achievement and the aesthetic pleasure lie in using standard forms to achieve unique effects and original insights.

As I mentioned earlier, being creative always involves doing something, so it will always involve using some form of media. These may be physical media, such as steel, wood, clay, fabric or food; they may be sensory media, like sound, light, the voice or the body; they may be cognitive media, including words, numbers, or notation. Whatever the media, there is an intimate relationship between the ideas that form and the media through which they take shape. This is true whether the process is focused on designing a building, developing a mathematical theorem, a scientific hypothesis or a musical composition. Creativity is a dialogue between the ideas and the media in which they are being formed. Robert Cohan has been a major influence in the world of modern dance. I asked him about the process of choreography. Dancers, he told me, think physically. It isn’t that they begin from a verbal proposition and try to dance it. Choreography evolves in the making. It is a material process of movement and reflection on movement. Being creative is not just a question of thinking of an idea and then finding a way to express it. Often it is only in developing the dance, image or music that the idea emerges at all.

Making judgments

Creativity is not only about generating ideas; it involves making judgments about them. The process includes elaborating on the initial ideas, testing and refining them and even rejecting them, in favor of others that emerge during the process. Sometimes creative works arrive in the world more or less fully formed and need no further work. It’s said that Mozart made few revisions to many of his compositions. The poet John Milton was blind. Each morning he dictated whole sections of his epic work Paradise Lost to his daughters and

“If you’re not prepared to be wrong, it’s unlikely that you’ll ever come up with anything original.”
made only minor changes to the text. Usually, creative work is more tentative and exploratory.

There are likely to be dead ends: ideas and designs that do not work. There may be failures and changes before the best outcome is produced. You can see examples of the iterative nature of the creative process in the successive drafts of poems and novels, of scholarly papers or in designs for inventions and so on. It is well known that Thomas Edison ran through dozens of ideas and designs for the light bulb before settling on the final version.

Terrance Tao is acknowledged to be the world’s greatest living mathematician and he has been awarded many honors. In 2002, at the age of 31, he received the Fields Medal for Mathematics, which is the equivalent of the Nobel Prize. He says that discovery in mathematics is a constant process of trial and error: “You come up with a wrong idea,” he says, “work on it for a month and realize it doesn’t work and then you come up with the next wrong idea and then finally by process of elimination you come up with something that does work.” I asked the renowned chemist, Sir Harry Kroto, how many of his experiments fail. He said about 95 percent of them. Of course failure is not the right word, he said: “You’re just finding out what doesn’t work.” Albert Einstein put the point sharply: “Anyone who has never made a mistake, has never tried anything new.” I don’t mean to say that being wrong is the same thing as being creative but if you’re not prepared to be wrong, it’s unlikely that you’ll ever come up with anything original.

Evaluating which ideas work and which don’t, involves judgment and critical thinking. This can happen throughout the creative process and can involve standing back in quiet reflection. Evaluation can be individual or shared, involve instant judgments or long-term testing. In most creative work there are many shifts between these two modes of thought. The quality of creative achievement is related to both. Helping people to understand and manage the interaction between generative and evaluative thinking is a pivotal task of creative development.

Michael Polanyi makes a distinction between focal and subsidiary awareness. Whatever we’re doing, we’re aware of our actions on at least these two levels. If you’re knocking a nail into a piece of wood with a hammer, the focus of your attention is on the head of the nail. You also have to be aware in a subsidiary way of the weight of the hammer and the arc of your arm. It is important that this relationship is the right way round. If you start to focus on what your arm is doing, you’re likely to miss the nail. Polanyi continues: “Subsidiary awareness and focal awareness are mutually exclusive. If a pianist shifts his attention from the piece he is playing to the observation of what he’s doing with his fingers while playing it, he gets confused and may have to stop. This happens generally if we switch our focal attention to particulars on which we had previously been aware only in their subsidiary role.”

In any creative process the focus of our attention has to be right. Although there are always points where criticism is necessary, generative thinking has to be given time to flower. At the right time and in the right way, critical appraisal is essential. At the wrong point, it can kill an emerging idea. Similarly, creativity can be inhibited by trying to do too much too soon or at the same time. The final phases are often to do with refining the detail of the expression: with producing the neat copy so to speak. But asking people to write a poem right away in their best handwriting can inhibit the spontaneity they need in the initial phase of generating ideas. They need to understand that creativity moves through different phases, and to have some sense of where they are in the process. In most situations,
trying to produce a finished version in one move is impossible. Not understanding this can make people think that they are not creative at all.

JUDGING VALUE

When I was a teenager, one of my cousins came to the house flushed with excitement. He'd thought of an invention that was going to make us all rich. He'd been walking down the road and was watching an elderly woman inching painfully along with a walking stick. In a moment of inspiration, he thought how much easier it would be if the walking stick had a little wheel on the end of it. Instead of lifting it every time she took a step she could just push it along. He couldn't believe that no one had thought of it before. We made him a drink and broke it to him gently. It was a good idea but for the one catastrophic flaw.

Judging the value of new ideas can be difficult. By definition, creative ideas are often ahead of their times. In the mid-1830s, Michael Faraday gave the first demonstration of electromagnetism at the Royal Institution in London. He stood in a gaslit lecture theatre before a distinguished audience of scientists and showed bright blue sparks leaping between two copper spheres. The audience was impressed but many of them were at a loss to know what to make of it all. “This is all very interesting, Mr Faraday,” said one of them. “But what use is it?” “I don’t know,” Faraday is purported to have said, “What use is a newborn baby?” A world without electricity is now unthinkable. Our lives depend on it in almost every way, from food supplies to transport to heating, lighting and telecommunications. The nineteenth century saw few of the uses of electricity that we now take for granted. It was not as if people’s homes were cluttered with dishwashers and televisions, simply waiting for Faraday to complete his experiments.

The applications of electricity only followed the harnessing of electricity itself. Faraday’s discoveries helped to create circumstances in which these applications were developed. At the time, many people simply couldn’t see the point of it. This is the often way with creative insights. They run ahead of their times and confuse the crowd.

Original thinkers are often appreciated more by subsequent generations because values change. Countless scientists, inventors, artists and philosophers were ridiculed in their own times, though their work has been revered by later generations. Think of Galileo, whose work on heliocentrism (placing the sun at the center of our solar system) was denounced as heretical and not considered science at all. Avant-garde artists are constantly asked, “But is it art?” There are many examples of artists who died in penury, whose work now changes hands for fortunes. Equally, people who were thought of as visionary in their own times can be discredited by history for exactly the same reason. Think of phrenology. There are very few scientists who still take seriously the idea that personality can be interpreted by considering the shape of the human skull. However, in the mid-nineteenth century it was highly influential in shaping ideas about psychiatry (see Chapter 3).

Our view of the past is rarely settled. We live in a perpetual present tense. Our knowledge of other periods can never match their vast complexity as they were experienced and understood at the time. Our perception of the past is partial and selective. What we include and acknowledge is always open to change and revision. This is often because of changes in contemporary values. Individuals long forgotten or overlooked may be reinterpreted as key agents of cultural progress because of a shift in current fashion or political outlook. The strong sentiment and self-assurance of Raphael, for example, endeared him to many Victorians as the central figure in the Renaissance. There are those today who think more of Michelangelo, for his restless self-doubt, and build
their image of the period around him. In these ways, our sense of history and of ourselves involves a continual selection and reselection of ancestors. History is not dead because the present is so alive.

Being original

Creativity is about coming up with new ideas. But what do we mean by new? Do we have to come up with something that has never been thought of before? Common sense suggests not — that a creative outcome can be original on different levels: for the person involved; for a particular community; for humanity as a whole. The towering figures of science, the arts, technology and the rest produced works of historic originality. Teachers don’t expect that of young children. They try to encourage work that’s original for the children themselves. Some may be capable of historic originality (think of Mozart and other prodigies).

"Creativity moves through different phases. Trying to produce a finished version in one move is usually impossible. Not understanding this can make people think that they are not creative at all."

MAKING CONNECTIONS

Creative insights often occur by making unusual connections: seeing analogies between ideas that have not previously been related. All of our existing ideas have creative possibilities. Creative insights occur when they are combined in unexpected ways or applied to questions or issues with which they are not normally associated. Arthur Koestler\(^3\) describes this as a process of bi-association: when we bring together ideas from different areas that are not normally connected, so that we think not on one plane as in routine linear thinking but on several planes at once. Creative thought involves breaching the boundaries between different frames of reference. Some modes of thinking dominate in different types of activity: the aural in music, the kinesthetic in dance, and the mathematical in physics. They often draw on different areas of intelligence simultaneously. Mathematicians often talk of visualizing problems and solutions. Dance is closely related to musical understanding; visual arts draw deeply from spatial intelligence. The composition of music is often informed by an implicit understanding of mathematics.

FREEDOM AND CONTROL

Creative achievement is related to control of the medium. Simply asking people to be creative is not enough. Children and adults need the means and the skills to be creative. I can’t play the piano. I don’t mean I’m incapable of playing; I have just never learnt how to do it. To that extent, I can’t be creative on the piano. I can make noises on it and give vent to my immediate feelings. In that sense I can be expressive. But I cannot be musically creative in the same way as those who can actually play it.

Many people have problems with mathematics. They see it as a sort of puzzle, the point of which is not wholly clear. Trying to appreciate equations if you don’t speak mathematics is like trying to appreciate a musical score if you don’t read music. Non-musicians see a puzzle: musicians hear a symphony. Those who speak mathematics look through equations to the beauty and complexity of the ideas they express. They hear the music. For some of us, grasping mathematical beauty is like trying to read Proust with a French phrasebook.

Many adults say they cannot draw. They are right. They cannot. They are not incapable of it any more than I am incapable of learning the piano. They just do not know how. The problems they face are often of two kinds. The first problem
is perceptual: we have to learn to look at things differently. Drawing is not a deductive process, like philosophy; it is a visual one. The problems that many people experience when drawing, arise from the logical/rational processes that tend to dominate and interfere with our modes of thought. We become intent on drawing an object in a photographic way, and find that we can't; rather than simply perceiving the object as it appears to us. The second problem is technical: knowing how to create on the page what the eye has learned to see. Given adequate hand-eye co-ordination, most people can learn to draw, but most people have not acquired the necessary skills. Like learning to write, learning to draw is a technical and cultural achievement not a biological one. Unless these things are taught, and learnt, the creative possibilities of drawing remain limited.

Most children’s drawings follow a recognizable pattern up to the age of thirteen or so. At about the age of eight, for example, they begin to develop a sense of perspective. As they mature, they pay increasing attention to details and attempt more sophisticated pictures. Without good teaching, their drawing reaches a plateau, usually at about the age of twelve or thirteen. Many people give up drawing altogether at this point, often through frustration. They reach a stage where their creative ambitions have outrun their technical abilities. As a result, most adults have the graphic skills of a young adolescent. This is hardly surprising. Children don’t develop these abilities just by getting older, any more than they wake up on their sixteenth birthday to discover they can drive a car.

This doesn’t mean that people with limited skills cannot be creative. There are different levels and phases of creative development. Some people produce highly creative work with relatively undeveloped techniques. In general though, creative development goes hand in hand with increasing technical facility with the instruments or materials that are being used.

Here as everywhere it is a question of balance and synergy. Technical control is necessary for creative work but it is not enough. Being creative is about speculating, exploring new horizons and using imagination. Many highly trained people, musicians, dancers, engineers, scientists, are very skilled but not especially original. There are many possible reasons for this. They may not be working in their best medium. A musician may be competent in an instrument but not excited by it. There are other possibilities. One of them is bad teaching. I know many would-be musicians who endured the drudgery of practicing scales and harmonies only until they could put the instrument away forever. Facilitating creative development is a sophisticated process that must find a balance between learning skills and stimulating the imagination to explore new ideas.

THIS TIME IT’S PERSONAL

I find it helpful to make a broad distinction between general and personal creativity.

General creativity

Original thinking is possible in anything that we do. In the general run of our lives we settle naturally into routines of behavior and habits of thought. When we encounter a new problem or situation, our established habits can make it difficult to see novel solutions. There are various tools and techniques to help unblock conventional ways of thinking. These thinking techniques include divergent or lateral thinking.

In logico-deductive thought, ideas build on each other in carefully consistent steps and lead to a limited number of permissible answers; or sometimes to only one. Lateral and divergent thought works by making much freer associations:
often by thinking in metaphors or analogies, or even reframe-
ning the question itself to open up more possibilities. There
are some tests for divergent thinking just as there are for IQ.
Typically, you might be asked how many uses you can think
of for a paperclip. An average score might be 10 or 15, all
involving paper. People who are good at these tests might
come up with over 100 ideas, and be able to see beyond the
conventional use of a paperclip. They might consider a use for
a paperclip that is 50 feet high and made out of rubber. The
questioner didn’t say it couldn’t be.

Some of the most interesting breakthroughs in science, tech-
nology and the arts come from reframeing the question, just as
Copernicus and Galileo chose to question whether the earth
was at the center of the universe. The questions we ask are
often more important than the answers we search for. Every
question leads to particular lines of inquiry. Change the ques-
tion and whole new horizons may open up to is. The true value
of a generative idea is that it leads to new sorts of questions.

These general techniques of creative thinking can be used to
generate a flow of ideas and possibilities, especially in groups
and committees. They include the repertoire of thinking skills
developed by Edward De Bono; and the concept of creative
Synectics, developed by William Gordon and George Prince.
Used properly they can have genuine benefits in business, in
the community and in our personal lives. Often they involve
separating the processes of analyzing problems, generating
solutions and evaluating the best options. These techniques
also focus on giving positive rather than negative responses
to people’s ideas, and they emphasize the value of sharing
multiple points of view.

Personal creativity

In addition to general capacities for creative thinking we
all have unique talents and passions, and our own personal
creative potential. It may be for a particular form of music
or specific instrument, or music in general; it may be for
mathematics or chemistry or contemporary dance; you may
have a vocation for becoming a firefighter, a homemaker, a
physician or a teacher. We each have skills and abilities that
can be developed. In my book, The Elements, I talk about this
personal dimension of creative achievement: the point where
individual talent meets personal passion. Personal creativity
often comes from a love for particular materials. A sculptor
will feel inspired by the shape of a piece of wood or the texture
of stone; musicians love the sounds they make and the feel of
the instruments. Mathematicians love the art of mathematics
just as dancers love to move; writers may feel inspired by a
love of the expressive power of words; and painters by the
potential of a blank canvas and their color palette.

Herb Alpert is one of the great popular musicians of his
generation. If you listen to him playing the trumpet, it is as if
he is speaking to you through it. In a sense, he is. His creativity
as a musician is indivisible from his passion for the expressive
qualities of the trumpet itself. He is now also a distinguished
sculptor and painter. In each medium, his creative achieve-
ments have been inspired by his love and feel for the materials
he uses and the possibilities he sees in them for creative ex-
pression. For other musicians, their best medium is the guitar,
the piano, or the violin. There are many examples of people
whose creativity is fired by particular media: not water colors
but pastels, not mathematics in general but algebra in partic-
ular. I spoke once with a professor of physics from California.
He described himself as a native speaker of algebra. When he
came across algebra at school he had an intuitive feel for it.
He said that English was his second language. He now
spends most of his life speaking algebra.

Discovering the right medium is often a tidal moment in the
creative life of the individual. The composer and conductor,
Leonard Bernstein, talked about the moment when he fell in
love with music. When he was a young child, he came downstairs one morning to find an upright piano in the hallway of his home. Evidently, his parents had agreed to look after the piano while some friends were out of the country. Bernstein’s family was not especially musical and he had never been close to a piano before. With a child’s curiosity he lifted the lid and pressed on the keys and felt the sounds vibrate from the instrument. A wave of excitement rushed through him. He didn’t know why this happened but he knew then that he wanted to spend as much time as he could making such sounds. He had found his medium. In doing so he opened the door to his own creative potential.

Porcelain was introduced into Britain in the eighteenth century. Some of the most exquisite and valued pieces of porcelain were made in the Chelsea Porcelain Factory that was founded by Nicholas Sprimont in 1743. Before Sprimont discovered porcelain he was a silversmith by trade. He was a competent enough silversmith and made a good living. But he then came upon this new material and it fired his imagination. He loved the feel of it and the possibilities it held. Over the next 20 years he produced beautiful objects that far surpassed his achievements in silver. His creative energies and his accomplishments were driven by his relationship with the material itself; by the possibilities he saw in the medium he used.16

Creativity can be inhibited by the wrong medium. Some years ago, I worked with a very good literary editor on a book I had written. She was an excellent judge of style and added hugely to the quality of the book, as good literary editors should. She told me she had become a literary editor in her forties. Before that she was a concert pianist. I asked why she had changed professions. She said that she had been giving a concert in London with a distinguished conductor. After the concert they had dinner. Over the meal, he mentioned how good her performance had been and she thanked him. “But you didn’t enjoy it, did you?” he said. She was taken aback. This hadn’t occurred to her. She said she hadn’t enjoyed it particularly, but then she never did. He asked why she did it and she said, “Because I’m good at it.”

She explained that she had been born into a musical family. She had taken piano lessons and showed talent; she had gone on to take a music degree, then a doctorate of music and on to a concert career. Neither she nor anyone else had stopped to ask whether she wanted to do this or whether she enjoyed it. She did it because she was good at it. The conductor said, “Being good at something isn’t a good enough reason to spend your life doing it.” In the weeks that followed she wrestled with this idea and concluded that he was right. She finished the season of concerts, closed the piano lid and never opened it again. She turned instead to books, the art form she really loved.

When people find their medium, they discover their real creative strengths and come into their own. Helping people to connect with their personal creative capacities is the surest way to release the best they have to offer.

CONCLUSION

I said in Chapter 5 that intelligence is diverse, dynamic and distinct. So too is the creative process. It can operate in the many diverse fields of human intelligence, it is about making dynamic connections, and the results are always in some way unique. Creativity is not a single power that people simply have or do not have. It involves many different mental functions, combinations of skills and personal attributes. We all have creative capacities but very many people conclude that
they are not creative, when in truth they have never learnt and practiced what is involved. The capacity for creativity is essentially human and it holds the constant promise of alternative ways of seeing, of thinking and of doing. It means, as George Kelly put it, that no one needs to be completely hemmed in by circumstances: "No one needs to be the victim of their own biography." Or as Carl Jung once said, "I am not what has happened to me. I am what I choose to become."

**7. FEELING BETTER**

"Being creative is not only about thinking; it is about feeling."

**BEING CREATIVE IS NOT** a purely intellectual process. It may draw on all areas of human consciousness: on feelings, intuitions and being playfully imaginative, as well as on knowledge and practical skills. Creativity often taps into areas of consciousness that are not regulated by conscious thought. Our best ideas sometimes come to mind without our thinking consciously about them at all. If we can't work something out, it is often better to sleep on a problem or put it to the 'back of our minds' where our subconscious mulls it over in ways that we can't control and may deliver a solution to us unbidden. Feelings, hunches, subconscious perceptions and intuitions can all play a central part in creative work, and not only in the arts. So too does a sense of aesthetics, of beauty, and sensuousness. This is true in all fields, from dance to calculus.

**BEYOND THE NUMBERS**

I once asked a professor of mathematics how he assessed PhDs in pure math. Actually, my first question was, "How long are
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