Out of our Minds: Learning to be creative,
Fully Revised and Updated Edition
By Sir Ken Robinson

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KNOWING YOUR MIND

"Now, more than ever, human communities depend on a diversity of talents; not on a singular conception of ability."

HUMAN INTELLIGENCE IS MUCH RICHER than we have been led to believe by industrial/academic education. Appreciating the full range and potential of human intelligence is vital for understanding the real nature of creativity.

YOU'RE MORE THAN YOU THINK

Liz Varlow is a viola player with the London Symphony Orchestra and winner of the prestigious Frink Award. She was born in Birmingham, England, and started playing the violin at the age of eight. She won two scholarships to the Royal College of Music, and went on to win numerous prizes. Fellow musicians describe her as a very fine musician who has developed her musical sensitivity to the highest levels. What sets her apart is that she is profoundly deaf. Her hearing began to deteriorate at the age of sixteen. By the time she was nineteen, she had become deaf for reasons that have never been established. Nonetheless she has maintained her

capabilities as an outstanding professional musician. How does she perform without hearing?

"How does anyone play?" she says. "I know how to make sounds and also know how what I'm doing sounds. A 'normal' hearing player does this too. They make sounds and use hearing to check it. It's too late afterwards if the note is out of tune. With the benefit of a fine aural memory, a solid technique and a good sense of humor I have been able to deal with all professional situations and found deafness to be little handicap."

Dame Evelyn Glennie is one of the world's most accomplished percussionists. She travels the world giving virtuoso concerts to huge public acclaim. Her many CDs have sold millions of copies and she has won a variety of awards from professional music organizations including Musician of the Year. She is in demand worldwide to lead master classes on musicianship. She too is deaf. She became profoundly deaf at the age of twelve just as she was beginning to develop her musical abilities. She persisted in developing these abilities despite the lack of the one sense that most people would consider critical to their fulfillment. Such examples defy ordinary logic. How can someone who is deaf become an outstanding musician? The achievements of Liz Varlow and of Evelyn Glennie demonstrate the extraordinary flexibility and virtuosity of the human mind. It is these qualities that underpin the uniquely human capacities for creativity and innovation.

LIVING IN TWO WORLDS

One of the founding perceptions of modern philosophy is that we live in two distinct worlds. There is a world that exists whether or not you exist: the world of material objects, events and of other people. This world existed before you were born and, if all goes well, it will continue to exist after you have gone. There is another world that exists only because you

exist: the world of your own private consciousness, feelings and sensations. Your world is one in which, as the psychologist R.D. Laing put it, there is only one set of footprints.[1] Your world came into being when you were born and it will end when you die. We share the first world with other people: we share the second world with no one. Recognizing the difference between *your* world and *the* world marks an important stage in the development of personal identity. How do we come to see the external world as we do? How do we know it's really there and not just in our minds? How do we get out of our minds?

Some of the philosophers of the Enlightenment worried about whether the outer world was as it seemed and even whether it was there at all. One of the most celebrated was the earnest Bishop Berkeley (1685–1753). His theory of idealism proposed that the whole world might be no more than an elaborate idea in the mind of God. His theory was greeted with amusement by the celebrated wit, Dr Johnson (1709–1784). One of the Bishop's supporters attacked Dr Johnson's flat rejection of idealism saying that Berkeley's theory "could not be refuted." Dr Johnson turned to a nearby boulder, kicked it with his foot and said, "I refute it thus." To Dr Johnson and everyone else, even idealist philosophers seem to carry on living in the world and doing their shopping despite their uncertainty about its existence.

The outer world may be an illusion but for everyday purposes we assume it is not: we simply accept that the people and things we see about us are real and appear to us all in the same way. However tantalizing these problems may be for philosophers, they're only problems if we think about them as such. For most of the time, we live our lives in what has been called the *natural attitude*.[2]

While some seventeenth and eighteenth century philosophers were busy dismantling public confidence in the material world, a new breed of scientists set about bringing it under our

control. As Bertrand Russell (1872–1970) commented, the scientific outlook is not so much a rejection of philosophical doubts: it is more an illustration that in daily life, we assume as certain many things that on closer scrutiny we find to be full of apparent contradictions. How then do we bridge the gap between these two worlds?[3]

Consciousness and the brain

These days it is taken for granted that consciousness and brain are intimately related. This is a relatively recent idea. The ancient world saw only a tenuous link. The brain is an unpromising sight. It's a crinkled ball of flesh that has no moving parts and lives remotely from the rest of the body in a cage of bone. Normal human brains are about the size of a melon and look like a large walnut. The upper side seems to be in two halves or hemispheres and has a surface of convoluted folds. This is the cerebral cortex or new brain. It is thought of as being in four regions or lobes, *parietal*, *frontal*, *posterior* and *anterior*. A shaft of nerve fibers known as the corpus callosum connects the two hemispheres. Underneath the brain and to the back is a smaller cauliflower-shaped area called the cerebellum in an area known as the old brain. Coming out of that and connecting in to the spinal cord is the brain stem.

The functions of the mind that we now associate with the brain were thought by the ancient anatomists to be located in the heart and the lungs. The brain was thought to be the home of the soul that endured physical death and passed into the afterlife. The brain had no obvious functions otherwise. By the Middle Ages anatomists had concluded that the brain plays a more practical role in this life too. As anatomical studies became more sophisticated, they gradually revealed the physical connections through the spinal cord and nervous system between the brain and the rest of the body. The debate

still rages about the nature of the relationship between the motionless grey substance that makes up the material brain, and the vibrant thoughts, feelings and desires that constitute human consciousness. The fact that there is a relationship between consciousness and the brain is easy enough to establish. Removing the brain does bring consciousness to an abrupt end. But how the conscious mind arises from the physical matter of the brain is not yet known. How is it that a ball of flesh the size of a melon can generate the insights of Isaac Newton, the music of Mozart, the dance of Martha Graham, the poetry of Shakespeare and the spiritual longings of Gandhi? How do we account for what has been called the ghost in the machine?

There is a common-sense distinction between mind and consciousness. In one sense, consciousness is what you lose when you go to sleep and regain when you wake up and become aware of your surroundings. Consciousness has a second meaning, that of understanding. It is in this sense that we talk of raising consciousness of an issue. Babies are born with a brain. They develop a mind as they grow, absorb and reflect on their experiences.

The brain has more on its mind that conscious thought. A good deal of the brain's activities are not apparent to the conscious mind. Much of its work is silent traffic within the rest of the body's automatic functioning: with the involuntary processes of bodily metabolism, glandular functions and the complex perceptions of taste, smell, touch, vision, hearing, and so on. Conscious thought accounts for only a proportion of what the brain is doing at any given moment. Although the relationship between the mind and the brain are still largely a mystery, much more is known than ever before about what the various parts of the brain do and how they relate to each other as they're doing it.

MAPPING THE MIND

Scholars have long thought that different parts of the brain have different functions. In the Middle Ages it was believed that the mind consisted of different faculties, and that each of these was located in a different part of the brain. These faculties included memory, imagination and logical reasoning. This theory was used as a justification for the classical curriculum of the grammar schools. Memory, it was thought, was trained by learning Latin vocabulary: logical reasoning by geometry, and imagination by poetry and music.[4]

Just as most human brains are similar in appearance, most skulls are the same general shape. On closer inspection they have distinctive bumps and hollows and individual variations in shape and size. In the eighteenth century, the Austrian scientist Franz Gall (1758–1828) studied the brains of hundreds of dead people and tried to match their shapes with the personalities of their former owners. From these he developed a detailed theory about personality, brain shape and the patterns of bumps on the skull, a theory known as *phrenology*; literally the 'study of the mind.' Gall identified 32 personality traits all associated with different patterns of bumps on the skull. The phrenologists believed that there was a direct link between specific functions, such as speech, and different regions of the brain. Gall's phrenological speculations were later discounted by more considered studies of the brain.

Studies of people with brain damage in the nineteenth century also showed that the idea of exclusive locations for particular brain functions was misleading. Modern research shows that the capacities of the brain are much more complex and dynamic than initial theories suggested. In the last 30 years there have been spectacular advances in the study of the living brain, using various techniques of brain scanning. These technologies can track the patterns of electrical activity and blood flow in the brain during different activities and have

shed new light at two levels on how the brain works. There is a growing understanding of the functions of the different regions of the brain and of how they interact. There are also new discoveries at the molecular level about the synaptic and neural processes of the brain. Both areas of research suggest three crucial themes for understanding creativity. They are that human intelligence is highly *diverse*, *dynamic* and *distinct.*

DIVERSITY

The view of the Enlightenment philosophers was that knowledge of the world could only be derived from systematic logic and the empirical evidence of the senses. This approach has a powerful appeal to common sense. In practice though there are other factors to take into account. First of all, our senses are limited. We do not see the world as it is but as our particular human senses present it to us.

The nature of our senses determines our *field of perception*: what we are actually able to perceive and how. There is more to the world than meets the eye, or any of our senses. We experience the world as we do partly because of the way we are built. As human beings we are typically between five and six feet tall, we stand upright and our bodies are broadly symmetrical. Unprotected, our bodies can endure only small variations in heat. We have at least nine senses: sight, taste, touch, hearing, smell, balance, orientation, pain and temperature. Our eyes are at the front of our heads and we have binocular vision. We can see light that has a wavelength from about 400 nanometers (extreme violet) to about 770 nanometers (extreme red). Our ears can normally hear sounds in the range 20–15,000 Hz. We live in a rich sensory environment, surrounded by sights, sounds, smells, temperature and textures, but we perceive only some of it.

Other animals have different and often more specialized senses and consequently they inhabit very different sensory worlds. Some mammals such as bats can detect ultrasonic frequencies well above 15,000 Hz. Some animals and birds can detect infrasound or low-frequency sound. Pigeons can detect sounds as low as 0.1 Hz. Elephants communicate using sounds as low as 1 Hz. The result is that two animals living in exactly the same physical environment may have entirely different views of what's going on. Compare the lives of a seahorse and a killer whale, living in the same stretch of ocean; they may inhabit the same environment but they live in completely different worlds. One factor is their relative size and strength. But they are also equipped with entirely different sensory capacities.

Our senses are the channels through which information flows between the outside world and our own consciousness. If those channels were different, other sorts of information would flow through them and our view of the outside world could well be transformed. Your view of the world would be quite different if you could hear the sounds that bats hear; or see the world as cats do; or had the smell receptors of a dog; if you could see sounds, or breathe underwater, or fly.

Our physical configuration may determine what we *can* perceive of the world, but there are other factors that affect what we actually *do* perceive. These are cultural factors and they also have crucial significance for the development of creativity. Their importance is explored in Chapter 8.

The constitution of our senses, our bodies and of our brains deeply affects what we think about. It also affects *how* we think. This is the second caveat to the rationalist approach, which too often separates the mind from the body: a phenomenon known as Cartesian dualism. The rationalist view of knowledge is focused on the logico-deductive powers of mind. While this may seem reasonable in itself, there is more to consciousness than these particular powers. The brain is

an organic entity that interacts with all the physical states and processes of our bodies. Our health, physical condition and appetites can deeply affect our states of mind.

The academic life tends to deny the rest of the body. In many schools, students are educated from the waist up and attention eventually comes to focus on their heads, and particularly the left side. This is where many professional academics live: in their heads, and slightly to one side. They are disembodied in a certain way. They tend to look upon their bodies as a form of transport for their heads: it's a way of getting their heads to meetings. If you want real evidence of out of body experiences, sign up for a residential conference for senior academics and go along to the dance on the final night. There you will see it. Grown men and women, writhing uncontrollably, off the beat, waiting for it to end so that they can go home and write a paper about it.

In contrast, dancers exult in their bodies and in the forms of knowledge and expression that can only be experienced through physical movement. I used to be on the board of the Birmingham Royal Ballet in England and had the privilege of watching professional dancers at work. The rigor and precision of ballet and of all forms of professional dance is humbling. I mentioned earlier that dance does not have the same status in schools as mathematics and other academic subjects, but dance gives form to ideas and feelings that cannot be expressed in any other way. Martha Graham once said that dance is the hidden language of the soul.

There may be no agreed definition of intelligence, but we might agree here that intelligence includes the ability to formulate and express our thoughts in coherent ways. We can do this using words and in numbers. We can also visualize, we can think in sound, in movement and in all the many ways in which these different modes interact. Musicians are not trying to express in sound ideas that would be better put into words.

They are having musical ideas: ideas for which they may be no words. Visual artists think visually and have visual ideas.

Intelligence also includes the ability to engage effectively with the practical challenges of living in the world. Developmental psychologist Howard Gardner, best known for his theory of multiple intelligences, defines intelligence as the ability to solve problems in a given context. Consider a twelve-year-old Puluwat in the Caroline Islands, he says, who has been selected by his elders to learn how to become a master sailor: "under the tutelage of master navigators he will learn to combine knowledge of sailing stars and geography so as to find his way around hundreds of islands. Or consider the 14-year-old adolescent in Paris who has learnt how to program a computer and is beginning to compose works of music with the aid of a synthesizer." A moment's reflection, says Gardner, reveals that each of these individuals "is demonstrating a high level of competence in a challenging field and should by any reasonable definition of the term be viewed as exhibiting intelligent behaviour."[5] Gardner argues that there are least seven different types of intelligence. In later work he accepts that there are others too. The underlying point is that intelligence is multifaceted, rich, complex and highly diverse.

I mentioned earlier my reservations about Mensa, the organization for people with high IQs. My concern is not that there is an organization for people who are good at and enjoy IQ tests. I'm all for clubs and societies. It's good that people with common interests should get together and benefit from each other's passions. There are clubs for everything: cooking, chess, athletics, politics, philately, dog breeding, astronomy, you name it. Certainly there should be an IQ club. My problem is with the branding of Mensa. It's promoted as the club for the most intelligent people on earth. Really? If there were such a club, no doubt we'd all like to be considered for membership.

But shouldn't there be some other questions on the application forms? For example, can you compose a symphony? Could you play in an orchestra? Could you start and run a successful business? Could you write poetry that will move people to tears? Could you choreograph or perform in a dance that speaks to our inner humanity? All of these are examples of the inherent diversity of human intelligence and of the many ways in which we engage with each other and with the world around us. Shouldn't they count too in any conception of intelligence? And shouldn't people who are exceptionally good at any of these things be welcomed in the club that aims to celebrate the highest levels of intelligence? Human intelligence includes and goes well beyond conventional conceptions of academic ability and IQ. This is why the world is full of music, technology, art, dance, architecture, business, practical science, feelings, relationships and inventions that actually work.

DYNAMISM

Intelligence is not only diverse: it is highly dynamic. In the 1950s the American scientist Roger Sperry (1913–1994) conducted a series of ingenious experiments that involved people whose brain hemispheres had been separated by cutting the corpus callosum so that they operated independently. Sperry found that the 'split-brain' subjects could perform two unrelated tasks simultaneously; for example, drawing a picture with one hand while writing with another. He concluded that the two hemispheres of the brain fulfilled different but complementary functions. The left side of the brain was largely involved in logical procedures including language and mathematics; the right hand side of the brain was more concerned with holistic operations such as the recognition of faces and orientation in physical space.

This research provoked massive interest, not least in education. It suggested a physical correspondence in the brain to the two great traditions in Western European culture. The left hemisphere seemed to relate to the logico-deductive analysis of the Enlightenment and the scientific method: the right hemisphere to the Romantic impulses of beauty, intuition and spirituality. Educational reformers were quick to argue that the academic education system was in effect almost wholly left-brained. James Hemming drew a striking conclusion. Educating people entirely through the left-brain activities of the academic curriculum was, he said, like training somebody for a race by exercising only one leg while leaving the muscles of the other leg to atrophy. Others went too far. I remember reading an article by someone who had half-digested the implications of this research. She said she had written the piece in blank verse because she had only used the right hand side of her brain; a remark that suggested she hadn't used either side. The point is not that the two halves should work separately, but together.

Carl Sagan (1934–1996) captured this exactly. There is no way to tell, he said, "whether the patterns extracted by the right hemisphere are real or imagined without subjecting them to left hemisphere scrutiny." On the other hand, "mere critical thinking without creative and intuitive insights, without the search for new patterns is sterile and doomed. To solve complex problems in changing circumstances requires the activity of both cerebral hemispheres. The pattern to the future lies through the corpus callosum."[6]

Brain-scanning techniques show that the brain lights up in different configurations according to the activity in hand and that even simple actions draw simultaneously on different regions of the brain. Different areas of the brain are strongly associated with particular mental functions but they participate in other processes too. This is obvious in the effects of damage to the brain. The right frontal lobe is focally responsible for

music and, if it is damaged, musical abilities are impaired. But if you were to remove this section of the brain and hold it in your hand it won't hum a tune. It relies on connections with the rest of the brain and body for its proper functioning. Speech is a particularly interesting example of how patterns of brain activity vary. When someone is speaking her native tongue her brain configures in one way: it configures in different ways when speaking a second language learned after infancy.

We experience these dynamics of intelligence constantly. Speech is usually accompanied by a dazzling variety of physical movements, facial expressions and gestures. Dance seems to be quintessentially a kinesthetic form of intelligence but choreographers design dances with a passionate attention to visual design and to the expressive qualities of the music, and often with mathematical rhythms and precision. For the audience dance is a visual art. Mathematics may seem to be wholly abstract but mathematicians often think visually too.

I remember watching a teacher in Hong Kong taking a Saturday morning class in mathematics. The children, aged between eight and twelve, each sat with an abacus on their desks. The teacher called out calculations for them to do: 1289 multiplied by 15822; 22348 divided by 4019. As soon as he finished calling the numbers, a forest of arms shot into the air. Every child had the correct answer. The children used only the abacus for their calculations; flicking the beads across the bars at lightning speed. Another boy was asked to use an electronic calculator for comparison. He lost every time. The teacher then asked the children to put the abacus away. The answers came just as quickly and always faster than the boy with the calculator. The children had clearly internalized the operation, visualizing the abacus in their minds' eyes and seeing the answers.

Perhaps the most extraordinary evidence of the holistic functioning of the brain comes from those who don't have a

normal range of sensory abilities. The extraordinary achievements of Evelyn Glennie and Liz Varlow illustrate the holistic, dynamic operations of human intelligence. Evelyn Glennie experiences the music with her whole being. Playing in bare feet she absorbs the musical patterns, vibrations and rhythms through her body in ways that transcend ordinary concepts of sensory perception. In this sense the mind itself may be likened to an orchestra comprising specialist functions and sections but fulfilling its role by dynamic interaction of these elements in ways that make the whole much greater than the sum of the parts. The brain is not a mechanical object: it is an organic entity. The mind is not a calculator: it is a dynamic process of consciousness. The creative process is not a single ability that lives in one or other region of the body. It thrives on the dynamism between different ways of thinking and being.

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– Martha Graham

DISTINCTIVENESS

We each have great natural capacities, but we all have them in different forms. Each of us is a unique moment in history: a distinctive blend of our genetic inheritance, of our experiences and of the thoughts and feelings that have woven through them and that constitute our unique consciousness. Martha Graham put it like this: "There is a vitality, a life-force, an energy, a quickening that is translated through you into action and because there is only one of you in all of time, this expression is unique. And if you block it, it will never exist through any other medium and be lost."

People are so much more than either academic or non-academic. Each of us has a distinctive profile of intellectual abilities with different strengths in visual intelligences, in sound, in movement, in mathematical thinking and the rest. Does this mean that no one can be thought of as more intelligent that anyone else? Of course not. Some people have strong abilities in many areas, music, mathematics, verbal reasoning, visual thinking and so on. We typically think of such people as Renaissance-type figures. But high ability in one area does not entail it in others. A gifted mathematician need not be a gifted painter: a gifted poet may have no gift for dance. Consequently, we should hesitate to label someone with high academic abilities as more intelligent than a person with equally high abilities in music or dance.

This is not an argument against developing academic abilities: it is *for* an expanded concept of intelligence that includes but also goes beyond them. If we fail to promote a full sense of people's abilities 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.

I worked once with Robert Cohan the gifted partner of Martha Graham and founder director of the London School of Contemporary Dance. I asked him how he came to be involved in contemporary dance. In the early 1950s he left the US army and was living in New York. He had always enjoyed dancing and had had conventional training. A friend told him of a woman who was running dance classes downtown and suggested he might enjoy them. He went, and his life was changed. After the first three-hour session with Martha Graham, his body was shaking almost uncontrollably with excitement. He discovered in her methods and forms of dance a capacity in himself that he had never suspected. Through meeting Martha Graham he found himself and he spent his artistic life in the world he helped her eventually to create.

He went on to become her principal partner in dance and to promote her methods in Europe in the 1970s and 1980s as principal of the London School of Contemporary Dance.

Many people are diverted from their natural paths in life by the preoccupation in education with academic intelligence and the hierarchy of disciplines. It shows itself especially in the distinction between academic and vocational programs and the idea that doing practical work or studying for a trade is lower grade than taking an academic degree. And yet, the ability to construct buildings, to wire a house, to install plumbing systems, to make things grow, to make things that work, to provide practical services, is exactly what resonates with very many people and all these skills are fundamental to the vitality and sustainability of human life. Sometimes this is literally true.

I was in San Francisco recently for a book signing. One of the people in line was a man in his mid-30s and I asked him what he did for a living. He said he was a fireman. I asked him when he had decided to be a fireman and he said he'd always wanted to be a fireman. "Actually," he said, "in elementary school it was a problem because at that age everyone wanted to be a fireman. But I really did want to be a fireman and as I grew up I couldn't wait to leave school to join the fire service." He said that when he was in his senior year of high school one of the teachers asked his class what they were all planning to do when they left. Almost everyone talked about going to college: he said he was applying to join the fire service. The teacher said that he was making a big mistake; that he was academically smart and had a bright future and would be wasting his life if all he did was to join the fire service. The fireman said it was an embarrassing moment and he felt humiliated in front of his friends but he went ahead with his plans and has been in the fire service and loving it ever since. "But I was thinking about that teacher when you were talking just now," he said. "Because six months ago, I saved his life. He was in

a car wreck and my unit was called out. I pulled him from the car, gave him CPR and saved him. I saved his wife's life too." He said, "I think he thinks better of me now."

Rethinking disability

One of the consequences of a narrow view of ability is a correspondingly wide view of disability. Some years ago, I was involved in a study of art and disability that was chaired by the film director, Sir Richard Attenborough, and funded by the Carnegie Foundation. The study celebrated the artistic capabilities of people with disabilities and argued for greatly improved provision. Some people with disabilities have difficulties with conventional forms of expression, in writing for example, or in speech, hearing or vision. Often they are branded by their disability: they are not seen as people with a disability but as disabled people. People with obvious disabilities, physical or otherwise, naturally have many other abilities that can be overlooked or undiscovered. Their real powers and true identities may lie in these unexplored territories of talent.

Identifying latent abilities is all the more important when conventional forms of communication are restricted. Striking evidence of this principle is given in a unique research initiative at the University of Sunderland directed by Dr Phil Ellis. Touching Sound was the title of a project concerned with music education and new technology and the name of a suite of computer programs incorporating vibroacoustic sound therapy, also known as visual music therapy: a new approach to sound therapy for children who have severe learning difficulties (SLD) and profound and multiple learning difficulties (PMLD).[7] Touching Sound uses low level laser beams and other technologies that are linked to sound synthesizers. When the beams are touched, sounds are automatically generated. Even minor movements can produce powerful

responses. Touching Sound turns the computer into a new musical instrument, providing new ways of creating and shaping sound, of playing sound; overcoming, but not devaluing the barriers of traditional techniques. The iMuse (Interactive MUsic Streaming Engine) technology uses sensors that can be triggered by movements as small as the blink of an eye. This means even people with profound and complex needs can experience being in control of the music and visuals.

Sound therapy acknowledges the expressive potential of all sound with the aim of enabling and developing additional ways of communicating and expressing. Music in education can contribute to all areas of experience, including the mathematical, physical, technological, spiritual, the aesthetic, creative, and social. There are many skills of the mind that are developed in this process: imagining, formulating, discriminating, selecting, rejecting, evaluating, ordering, structuring.

The project has worked for children and others with severe learning difficulties, whose movements are limited to only a few muscles or even an eyelid. People with a normal range of movement take for granted the ability to affect their environment and to externalize their thoughts and feelings. Those with limited mobility and muscular control may spend their lives having other people do things to or for them, and have profound difficulties in expressing themselves. Touching Sound enables them to affect their environment and to be expressive. The feelings of liberation are palpable and the developmental effects can be dramatic. As Marie Watts, one member of the teams, puts it: "It allows the individual to take control of the environment. It's all about control and empowerment. The technology was also motivating for staff, as it enabled them to get instant feedback from the people they assist." (Dr Ellis' research has since led to an award for his work, which will result in the establishment of a Sound Therapy Centre in Sunderland.)[8]

More than we know

So-called *savants* are people who display extraordinary capacities in some areas of intelligence and below average abilities in others. Derek Paravicini was born in England in 1979, prematurely, at 25 weeks, weighing just a pound and a half. He is blind, autistic and an astounding musical prodigy. His blindness is thought to have been caused by oxygen therapy given in the neonatal intensive care unit. The therapy also affected his developing brain and caused severe learning disabilities.

He has absolute pitch, can recognize up to 20 notes played at once and can play any piece of music after hearing it only once. But he can also transform them seamlessly into the styles of different musicians. Asked to change into the style of another player, like Oscar Peterson, he will change style mid-song, playing 'My Favorite Things' in Peterson's distinctive style. "It's like he's got libraries of pieces and styles in his head," says Adam Ockelford, Derek's teacher. "He can just whip out a piece book and a style book and bring them together. It just kind of explodes." How Derek's fingers can do this but can't button a button or zip a zipper is not known. If he is asked how old he is now, he does not know.

He began playing the piano as a toddler, when his nanny gave him an old keyboard. His father says, "My daughter suddenly said one day, 'He's just played one of the hymns we heard in church this morning.'" Derek was three years old at the time. "And he didn't know, because he couldn't see, and no one had told him, that you're meant to use your fingers to play the piano. So he used karate chops and elbows, and even his nose, I seem to remember." At first he resisted any of Ockelford's attempts to teach him. But before long, he says, "Derek seemed to get it; this was not someone trying to take away his precious piano. This was someone trying to reach him. I think suddenly it clicked that he could have a conversation in sound. And suddenly he just blossomed," Ockelford

explained. "From all this confusion that he must have experienced as a child, not understanding much language, suddenly here was a language that he could control, he could play with, he could dialogue. All the things that we normally do with words, Derek did with notes."

His progress was astounding. After three years of daily lessons, Derek was invited to play a few songs at a major charity fundraiser. It was there that Ockelford first saw the thrill Derek got from performing and from feeling the love of the crowd. Derek was trembling with excitement and elation and he has been performing ever since – in jazz halls, at benefits, in churches, connecting with audiences in ways most musicians are: taking requests, with a twist. He'll ask an audience member to select a song, then let a second audience member choose what key he'll play it in and then let a third select a style. At one event, Derek was asked to play 'Ain't No Sunshine' in B major in ragtime style. He executed it perfectly. "It's like having three computers all working at once and you could just put them together straightaway, without thinking," Ockelford comments. "Sometimes he does something quite funny musically. You can see a little sparkle. I think he's actually quite pleased with himself what he comes up with."[9]

Though autism is thought to be the source of Derek's extraordinary musical ability, his blindness may contribute. Because Derek is blind, the part of his brain that would normally be used for sight and light detection could be used for extra auditory ability. Other cases have been recorded of extraordinary visual capacities, of prodigious abilities in memory, or in mathematical calculation. In all of these cases the individual shows extraordinary capacities, well beyond any normal expectations, combined with a generally below average abilities in other areas.[10]

PLASTICITY AND POTENTIAL

Learning is associated with a growing complexity of the neural networks of the brain. It is estimated that at birth the human brain consists of about 100 billion brain cells. During infancy the child's brain is tremendously plastic. To begin with, each neuron has dozens of connections but these connections pare down to just a few strong ones as the brain develops and according to how it is used. Scientists at Harvard are engaged in a program of research to create a detailed map of the circuitry of the human brain. The research is part of a new field called 'connectomics'. A piece of technology called the automatic tape collecting lathe ultra microtome (ATLUM) cuts samples of brain tissue into very thin slices which are then placed under a scanning electron microscope to create images of individual cells and all their connections to other cells.

"As children grow, their brains are customized around the uses they make or do not make of them."

Jeff Lichtman, a Harvard professor of molecular and cellular biology, says that this technology "gives us an opportunity to witness this vast complicated universe that has been largely inaccessible until now." It's estimated that a full set of images of the human brain at synapse level resolution would contain hundreds of petabytes of information: about the total amount of storage in all of Google's data centers. One of the aims of this study is to understand the processes of neural growth and pruning. According to Lichtman, "Each baby nerve cell connects to 20 times the amount of nerve cells that it will have as an adult. We try to understand what the rules of pruning are. If the nerve cell has a hundred connections and needs to prune that down to five, the question is, which five?" The neurons fight to stay connected and each competition affects the outcome for the rest of the cells. "So to understand the competition's impact on one cell, you have to understand all

the competitions." The net effect of all that new neural "hand-to-hand combat" is what we call brain development and it's what transforms a baby who can't walk or talk into a modern adult human being. It's this process that provides us with the flexibility that Lichtman calls "the magic of being human." When a dragonfly is born, he says, it has to know how to catch a mosquito. "But for us, none of this is built-in. Our brains have to go through this profound education that lasts until our second decade. What is changing in our brains?"[11]

The plasticity of the brain is evident in our use of language. If children are born into multilingual households, they learn all the languages they are regularly exposed to. Parents don't teach children to speak in the way they're taught languages in school. Mothers don't teach their babies the principles of grammar. They prompt and guide and teach particular words. But learning a language is so complex that teaching it formally to an infant would be impossible. Teaching them three or four languages would be unthinkable. Yet infants do learn three or four languages and more if necessary. They don't reach a point of saturation or ask for their grandmothers to be kept out of the room because they can't handle another dialect. They absorb them all. This is because they have a language instinct.

Research suggests, for example, that the relationships between speech, song and music are very strong in the process of learning to speak. The technologies of brain imaging provide strong evidence that the areas of the brain that are primarily concerned with music and language overlap considerably. Moreover, according to Diana Deutsch, Professor of Psychology at the University of California, "A person's native tongue influences the way he or she perceives music. The same succession of notes may sound different depending on the language the listener learned growing up."[12] As evidence, speakers of tonal languages including Mandarin are more likely than Westerners to have perfect pitch. In

one study, 92 percent of Mandarin speakers who began the music lessons at or before the age of five had perfect pitch compared to 8 percent of English speakers with comparable music training.

Research also suggests that babies are already familiar with the melody of the mother's speech, when they are born. Audio recordings from inside the womb at the beginning of labor revealed that the sounds produced by the mother can be heard loudly: "The phrases reaching the baby have been filtered through the mother's tissues, however, so that the crisp, high frequencies which carry much of the information important for identifying the meanings of words, are muted, whereas the musical characteristics of speech – its pitch contours, loudness variations, tempo and rhythmic patterning – are well preserved." In addition to forging a nascent connection between mother and child, early exposure to musical speech sounds may begin the process of learning to speak. After birth, the melodies of speech are also vital to communication between mother and infant, according to Deutsch. When parents speak to their babies, they use exaggerated speech patterns, known as 'motherese' which differ considerably between languages.

It isn't that multi-lingual households give birth by good luck to linguistically gifted children. All 'normal' children have the capacity to learn not only one but many languages. If a child is born into a home where only one language is spoken that is the language they learn. Learning a second language in adolescence becomes much more difficult.[13] By then our language capacities are less accessible.

Professor Susan Greenfield gives a startling example of the plasticity of the brain.[14] She tells of a six-year-old Italian boy who was blind in one eye. The cause of his blindness was that at a crucial period in his infancy his eye was covered with a patch. The result of this was that the neural networks, which facilitate sight from that eye, became redeployed, causing permanent blindness. As children grow, their brains are

customized around the uses they make or do not make of them. If the language capacity is not used it may fade as the brain's neural capacities are turned to other uses. The same can be true of music or mathematics or any other capacities.

In the South Pacific many young children are accomplished underwater divers. They develop the ability to swim underwater for long periods so that they can gather pearls; a vital skill for economic survival both for them and their families. In New York, most children do not have this ability. There are very few skilled pearl divers in the Bronx. There isn't the demand. But it's reasonable to assume that the average New Yorker translated at an early enough age to the South Pacific would learn the necessary skills. Living in the Bronx they may have the capacity but not the need and, as a result, not the ability.

"Now, more than ever, human communities depend on a diversity of talents not on a singular conception of ability."

DARRYL'S DANCE

In Chapter 2, I argued that conventional forms of education often fail to recognize and tap into the deep resources of talent and creativity that lie hidden within everyone. One result is that more and more people are alienated from the whole process. Statistically, the chances are higher that those who pull or fall out of education may fall in to the criminal justice system. The conventional strategy is to incarcerate offenders. This is usually seen as the logical, linear solution; even though it so often involves immense personal, social and economic costs and recidivism rates are so high (see also Chapter 3).

There are more creative approaches to education that are based on an implicit understanding that human ability is diverse, dynamic and distinct and that our strategies for dealing with disaffection and alienation should be equally

sophisticated. One that I admire particularly, expresses a special irony in our current approaches to education. It brings together young offenders – those who have often been singularly failed by education; and dance – the discipline that lies at the lowest point in the hierarchy of educational priorities. The results are extraordinary and serve only to illustrate how often both the young people and the discipline are underestimated in education as a whole.

Dance United is a professional contemporary dance company based in Bradford in the United Kingdom. The company provides a dance-based education program called The Academy, as an option for young offenders within the local criminal justice system. The Academy is designed specifically for young people who have failed in conventional educational settings and who may be offenders or at serious risk of offending. The participants have included young people convicted of robbery, drug offences, burglary and assault. Referrals to The Academy are made by a range of agencies, currently including the Bradford Youth Offending Team (YOT) and Nacro (National Association for the Care and Resettlement of Offenders), who refer young people on Intensive Surveillance and Supervision Programmes (ISSP) or other community orders. Some referrals also come from school exclusion units.

The aim of The Academy is not simply to help young people to avoid re-offending; but to help them to discover their real potential and their innate capacity to succeed. The Academy aims for profound changes in the participants primarily by raising their beliefs in what they are capable of achieving. The program itself is based on methods that are used to educate and train professional contemporary dance artists. The physical and creative demands of dance itself are at the core of the program, which aims to promote work of a high artistic standard. The program helps them to learn to trust and support others too.

The Academy team is made up of professional dance artists and teachers working alongside support workers from the Bradford Youth Offending Team (YOT) and other agencies. Importantly, the young people on the program are treated not as offenders in remediation but as professional dancers in training.[15] The Academy program is very disciplined. For example, the ground rules include the requirement to dance in bare feet. Wearing jewelry, hats or other personal artifacts is not allowed.

The Academy works with up to fifteen young people at any one time on a program that takes 25 hours each week, for a period of twelve weeks. Each twelve-week cycle begins with an intensive, three-week performance project, at the end of which the production is presented in professionally staged performances, either in The Academy studio theatre, or at a local or regional theatre venue. From the fourth week, the program expands to include a broader dance and educational curriculum including jazz, African dance, capoeira, circus skills, choreography and more. The program also includes input from visiting artists, including photographers, film-makers and musicians.

Many people greeted the idea of the Academy program with flat skepticism. How could dance possibly have any effect on people who had shown no regard for other people or property? Wasn't this just groundless romantic nonsense that pandered to the offenders? Surely, the obvious answer was prison. For Jim Brady, a professional member of the Bradford Youth Offending Team, who knows something about these issues, the obvious answer was wrong. "If prison worked," he says, "that would be the solution to youth crime. Unfortunately all the evidence suggests that prison doesn't work."[16] To begin with, his colleague, Dave Pope was skeptical himself about the power of dance. He says now that he has seen many other strategies for dealing with young offenders, but none that are as powerful or as effective: "I've seen offenders working on

building sites, offenders joining in team sports, offenders doing offender behavior courses and I've seen offenders doing anger management courses. Contemporary dance, much to my surprise, has turned out to be the one thing where I've seen people make the most progress over the shortest period of time."

Why is this? Why should this program make such a difference where others have not? Tara Jane Herbert, the artistic director of Dance United is clear about what the program really does. Although the participants are treated as professional dancers and put through a comparable regimen, The Academy is not fundamentally about turning all of them into performers: "It's about giving those young people the opportunity to do something practical and the skills to be able to choose. Most of the young people that we work with don't make clear choices. They react. Dance training gives them the opportunity to actually think and then make an action. You have to be able to sit still before you make a choice, before you make an action." She says that typically the young people on the program do not know how to focus their own physical energy. The program teaches them how to focus. "They're very fidgety, or very floppy. They're not grounded. There's not a strength and a stillness behind them and that's what focus is about. It's about actually stopping before you begin something. It's like an orchestra. It's the silence before you begin playing and it's exactly the same in dance and in life."

The program helps to build their sense of self worth by facilitating real creative achievement. As one member of the team explains, "They've often been told they're worthless and can't really achieve anything. They learn here that they can. By getting up in the morning they've achieved structure, discipline, being able to take orders, the confidence in themselves to go out and approach difficult situations. It's not easy for some of them because they've never danced before."

Dance is a highly collaborative process. As Helen Linsell, one of the dance artists explains, "There are different people they have to get on with: people who are older, younger, and different members of staff that they might not connect with." Rhiana Laws, another of the dancers emphasizes that "There is no room for them to hang out or lean against the wall or sit down because they're tired, or giggle in the middle of an exercise because they did it wrong. We're absolutely rigid and that is what I experienced when I was training professionally."

Tara-Jane Herbert says that the public performance at the end of the first three weeks is a massive step. "We invite friends, family; and for most of them it's the first time that they'll be seen in a positive light. It's vital that the quality, the standard of work is excellent, so that they can shine. At the end of the performance their confidence has grown enormously and they suddenly understand why we've pushed for focus, why we've demanded cooperation and all the things that we've been pushing at them suddenly become clear."

One of the participants on the program was a young man named Darryl. When Jim Brady first met Darryl and his mother to consider his options as a young offender, it was hard to know what Darryl might have been thinking. "He didn't engage. He virtually didn't speak," says Brady. "Mom did all the talking. In among the menu of choices I said would be available, was dance." His mother said immediately that Darryl would not dance. Darryl said nothing. In the event, he went to The Academy. And Darryl danced. The results were remarkable, says Brady. "He's physically transformed by it. He's now concerned about nutrition and diet and general health. He's articulate and he's speaking. He carries himself very differently. He's confident and that all happened in the space of three weeks. That's quite a transformation."

Darryl himself is in no doubt. "You do one good session here," he says, "and you ache. But it's a good ache because you know you've done something good. After a few weeks

you start to notice your body getting healthier, muscles are coming up and you can feel them growing. It makes you think that there is something you can do and enjoy and it passes time away." The physical and artistic rigors of dance have changed Darryl's view of himself. They have also changed his view of other people; "I've probably learned to consider what other people think," he says, "and look at things from the other person's point of view."

Darryl's father has noticed the difference too. "We really had a lot of friction with Darryl. Now we all have a really good relationship and we're just looking forward to the little spell at college and hoping he motivates himself that little bit more to try just that little bit harder."

The parents of one of the other young men on the program saw a change in him too. After the performance, they were a little overwhelmed. "He was just full of life," said his father. "He said it was brilliant and that he'd go back and do it again." His mother agreed. "He's a changed lad. I can't believe it's my son. I feel like that cloned him and made him good."

For the Chairman of the Youth Justice Board, Professor Robert Morgan, the moral of The Academy is clear: "We need to treat these young people as people with potential. Anyone who has observed the sort of work that is being done here realizes the huge untapped resources that we need to develop."

After a young lifetime of failure and conflict, Darryl sees the potential in very personal terms. "You can make a difference," he says. "Depending on how you look at it. If you want to keep an open mind and leave everything behind you, it'd be like a new world."

REALIZING WHO WE ARE

We all have great natural capacities, but we all have them differently. If we fail to promote a full sense of people's abilities

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.