For children of the future

'I returned, and saw under the sun, that the race is not to the swift, nor the battle to the strong, neither yet bread to the wise, nor yet riches to men of understanding, nor yet favour to men of skill; but time and chance happens to them all.'

Ecclesiastes 9:11

Taking Time

When I slow down
I can smell autumn in the air;
Hear the rustle of fallen leaves underfoot
And feel the dampness in my hair.

When I slow down
I feel like a child again;
Excited, curious, strangely alone
in this magical world
which, in this moment
is all mine.

I could be the only person on the planet
in this vast space,
this world of colour,
floating, free.

In a minute, in an hour, tomorrow
it will all be gone
never to be the same again;
like the sun setting in the evening sky,
light on the water reflecting rustic hues as they are now.

In this moment, this now,
I and the world are at one.
I am and I am complete.

Killing Time

I cannot hear the words of my lover
As he calls to speak to me.
His words drowned by the sounds of traffic,
of sirens and people, people everywhere.

A colony of human ants,
swerving at the last moment to avoid contact.
Neither touching, nor speaking
Not looking anyone in the eye.

Ears plugged, phone in hand,
talking into an invisible space
occluding the world outside.
No time to see what lies between,
cocooned in a bespoke world of their own.

Time and space their enemy,
to be controlled, overcome or contained.
Time accelerated the faster they go.
Digital people who have become the unwitting slaves of time.

Life lived in the fast lane,
exciting, cool, important and so, so busy.
Keeping up, staying ahead
Speculating on what is coming next.

And yet, the folly of time is
that the news of today will be of no use tomorrow.
It matters only now.

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Chapter 1

Are You Sitting Comfortably?

First Language

'Are you sitting comfortably? Then I'll begin.' Those are the words I heard every week day in the first years of my life before I started school.

I was one of a whole generation of children who grew up listening to *Listen with Mother* (1950–1982). Few families had televisions in those days, and for those who did, daytime television did not exist. *Listen with Mother* comprised a story and nursery rhymes, and more than 50 years later I can still remember the names and voices of the presenters, the words to the nursery rhymes and some of the stories, even though I was under four years of age and had not learned to read. Why should these early memories have remained and still be so clear more than half a century later?

Today, it is visual technology which dominates our lives, and while visual information, like the speed of light, is processed faster than sound, listening involves a different form of attention. Listening involves translating streams of sounds into visual images to create pictures in the mind (meaning) and working memory to remember sequences of information.

The written word evolved from an oral tradition in which knowledge, wisdom and folk lore were passed down from one generation to the next through the spoken word – the telling of stories and singing of songs. Children of today are no different from our ancestors in the sense that every

child is born from the same pre-natal environment as its forebears, but each generation enters an increasingly complex world in which an ever-increasing range of skills must be learned from scratch.

Children naturally tend to replicate their evolutionary development through play, starting with simple physical activities such as chasing, play fighting and building before progressing to the more recent 'cognitive' skills increasingly required in modern technological societies. In these same societies, there is an impatience to reach the end goal without traversing all the stepping stones along the way. Such accelerationism in learning runs the risk of developing higher skills without first putting firm foundations in place.

Can *you* remember how it felt to curl up at night for a bedtime story, turning the pages, pretending to 'read' from the pictures while listening to your parent telling the tale? How words gradually started to form as pictures in your mind and to make sense from the patterns of letters on the page? Can you still remember the magical thinking of childhood, when you could see pictures in the clouds and believe that anything was possible? This is the language of childhood.

The inner world of childhood is very different from the thinking world we inhabit as adults. It is a world dominated by sensation and constant discovery; of learning how to control the body and to 'make sense' of experience derived from the different senses; of translating sensation into perception, and perception into thought and action.

Learning to crawl, walk, talk, listen and read strongly influence the opportunities a child will later have to improve their own well-being and life chances. Whilst some of these skills are innate, others must be passed from one generation to the next, and this happens through providing a child with opportunity, time and experiences that carefully build their understanding and the neural pathways that support it.

In the first few years of life, a child's brain develops rapidly, driven by a mix of experience, environment and genes. It is known from the field of neuroscience that periods of rapid neural development are accompanied by

accelerated learning, and the pre-school years are unique in this respect. Conversely, these same periods are particularly vulnerable to injury, abuse or neglect, and as children grow older it becomes more difficult to influence how the brain processes information.

Of the 100 billion cells that are present at birth, only a fraction of this number will actually be used during the span of its life. Between 15 months and six years of age, the cerebral cortex (the seat of cognition) appears to double in size with synaptic density reaching its peak at about three to three and a half years of age, a level 50% higher than it was at birth, or will be at puberty.

In the beginning, neurons are unspecialised – not 'primed' for any particular function. This is known as 'equal potential', meaning flexibility of function. During the course of development, constant interaction with the environment or experience stimulates the formation of connections within the brain, particularly connections to higher or 'executive' centres that will eventually command the whole. The first years of life are the time for forming and organising these connections.

As neurons migrate, so they become more specialised in their function. In the course of the first three years of life, the brain forms almost twice as many synapses (junctions) than it will actually use. Those that are in constant use will strengthen to form the motorways of the mind; those that are unused will either be replaced by others or will eventually disappear. During infancy, many neurons retain flexibility of function or neural 'plasticity'. In this sense, every human being is truly unique. Experiences shape the architecture of the brain but no two people ever receive *exactly* the same experience even if the genetic blueprint is identical as in the case of identical twins. Experiences may be similar, but position, timing and perspective will always be slightly different, creating a neuronal tapestry that cannot be precisely replicated in any way.

There are several stages in development when the brain goes through a period of neural housekeeping, when inactive or redundant cells are

'pruned' in a spring-cleaning exercise which sweeps away neural clutter and strengthens connections that are in regular use. One such spring-cleaning period occurs between six and a half and eight years of age, another during the teenage years, so that by the late teen years only half of the synapses that were present in the three year old remain. It is perhaps not surprising that the adolescent years are frequently described as ones of turmoil. Such vigorous pruning has both advantages and disadvantages: By removing excess pathways, interference or cross chatter is reduced, allowing for greater efficiency of functioning rather like building motorways for the mind. On the other hand, connections between neurons and their target cells in pathways that have not been used become weaker over time. This process is sometimes described as 'neuronal fitness'. Fitness of neurons is determined by success in establishing contact with other cells and passing information. Something in the process of making contact helps to protect neurons from destruction – a neurological explanation for the old adage, use it or lose it.

Developmental changes in cognition and behaviour are associated with changes in the brain and vice-versa. When looking at a child's capacity for learning we cannot separate learning from development, or development from the structure and activity of the brain. During development, the structure undergoes continuous change with nature and nurture acting as twin sculptors in this process.[1]

At the age of two, connections are being formed at twice the rate of an adult brain[2] and the first three to six years are vital years for language acquisition. The relationship between young children's brain development and the emergence of language skills is mutually reinforcing[3] whereby every new word that a child learns helps to strengthen the architecture of the brain. As that architecture is strengthened, the capacity to recognise and use new words increases, but as we shall see later, language in not an isolated skill. It is closely linked to neurological development, and development during this period is not only determined by genes, but also by the experiences and environments that support this interactive process (epigenetics). Parents and carers help to

build the developing architecture of the brain through the opportunities, experiences and influences they provide, but in the pre-school years it is *preparation,* not formal instruction in reading, writing and numeracy, that children really need. Preparation involves developing the sensory-motor skills needed to support later learning and an understanding of the general before the particular.

Movement Matters

Babies are born to move. Only a few weeks after conception, cradled inside a miniature ocean of amniotic fluid, a tiny acrobat starts to perform. These movements – the first outward expression of developing life – will grow in strength, complexity and refinement over many months and years to become the physical vocabulary, which is unique to the individual.

A basic repertoire of spontaneous movements and reactions is 'hard wired' into the brain stem of all healthy children at birth, but development of movement control is an individual's story, interdependent with experience and environmental opportunity.

'Children learn with their bodies before they learn with their brains,'[4] and in this sense, movement is our first language. Long before spoken language develops we are able to understand our children's needs and moods through a combination of posture, gesture, timing and rhythm of movements and utterances. These bodily expressions of inner needs and responses to outside influences are the elements of early language, also known as non-verbal language.

Non-verbal language continues to contribute up to 90 percent to effective communication for the remainder of life. Deficit in use of non-verbal language is often a feature of autistic spectrum disorders, including Asperger's syndrome. At the lesser end of the scale, children with poorly developed non-verbal language can be at greater risk of being picked on in the playground because they lack an adequate physical vocabulary with which to read the non-verbal language of others and respond appropriately. Body language emits subliminal signals about a person's ability to handle the self, and over time, body language becomes an expression of physical literacy.

Physical literacy also supports general literacy once a child starts school. Posture, balance and coordination are all needed to support centres involved in the control of the eye movements needed for reading, hand–eye coordination involved in writing and copying, and even the ability to sit still. It has been said that the most advanced level of movement is the ability to stay totally still,[5] with stillness and poise being the end product of the ability to inhibit or suspend unnecessary movement. Mastery of movement develops through experience and practice, with the early years providing a crucial period of training.

Changes to modern life, which include the need for both parents to work, technological devices and a baby equipment industry which is adept at seducing busy parents into thinking the more they spend, the better parents they must be, have all combined to alter the nature of children's physical experience in the early years. While society changes at ever-increasing speed, the process of human development changes at a much slower evolutionary pace, and the biological and development needs of children have not altered significantly over millennia. In common with other members of our species – and humans are members of the species of mammal – the basic needs of children are warmth, nourishment, physical proximity and attachment to the primary source(s) of love, sensory experience and exploration and *engagement*. Some of the best natural playgrounds for an infant in the first weeks of life are entirely free – the mother's body – and a few weeks later, a clean blanket on the floor.

When an infant is held and its needs are met, it becomes attuned to the body language of its carer; if it is placed on a clean, safe surface when awake, it is free to wave and stretch its arms and legs, to learn where its body begins and ends in space; how to hold its head up and begin to support its own weight, eventually to roll, sit, crawl and finally stand and walk. This process of trial and error – of learning how to do something – is very different from being placed in a moulded baby seat and passively entertained by electronic media.

Canadian neuropsychologist Donald Hebb, a specialist in the field of associative learning, first described how 'neurons that fire together wire together'.[6] When areas of the body (and therefore also the brain) are exercised they mature into more specialised regions that are fine-tuned for

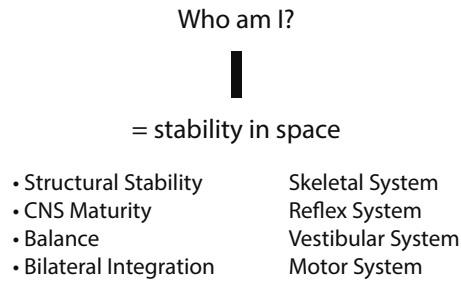
efficient and accurate performance. Regular practice strengthens the neural pathways involved, not only refining skill but also developing specialisation of functioning, resulting in improved performance with economy of effort eventually leading to automated function. The advantages of automated function are that certain skills can be carried out without conscious awareness, only recruiting conscious effort when the situation requires it.

Examples of how movement practice at any level and stage can enhance performance can be seen in athletic training and aspects of musical performance. A study which examined differences in the practice and training techniques of professional javelin throwers found that those who practised a range of physical activities every day in addition to specific skill training showed improved performance, compared to those who had only carried out practice in javelin throwing. Similarly, the oft-loathed discipline of practising musical scales and arpeggios helps to develop finger strength, accuracy, placement (without having to look at the hands), and adaptability in reaching for keys and intervals in any sequence of notes or chords. In this way, practice of motor skills literally increases motor vocabulary as well as dexterity and performance.

We live, think and imagine in movement.[7] Even our dreams are an internalised simulation of action.[8] The sense of *who* we are as effective physical beings in space begins with having a secure sense of *where* the body is in space. This sense, described by A. Jean Ayres as 'gravitational security', develops through movement experience alongside control of balance and posture in a gravity-based environment. The sense of 'body map' (knowing where different parts of our body are at any time) is a product of physical interaction with surroundings, which probably started before birth, continues with the seemingly random movements of the new born, develops into the more purposeful movements of the infant, and eventually becomes secure postural control and balance. Movement experiences help the developing child to understand where he/she is in space and where different parts of the body are in relation to each other. This physical sense of stability is not only important to learn to make spatial judgements but also provides a physical basis for emotional security.

Figure 1.1: Learning where my body begins and ends in space.

Figure 1.2: The sense of 'I'



Human infants make an incredible journey in the first year of life, from being a helpless prone or supine lying creature, lacking in muscle tone or control over voluntary movement, to upright posture. Achievement of secure upright posture releases the forelimbs and the hands from involvement in control of balance, and is one of the developments in our evolutionary past which enabled human kind to use tools and to develop spoken language; but language involves far more than the use of sounds to express thought.

Kohen-Raz, a doctor who spent a lifetime working in the field of specific learning disabilities and postural control, said that control of posture and

independent use of the two sides of the body (particularly the hands) are precursors to fluent language development. When as a species we learned to stand on two as opposed to four feet, the ball of the foot took on the former function of the hands (front paws) in supporting balance and posture, making the development of lateral preference possible – an important factor in language development – as well as freeing the hands to develop the manipulative skills unique to humans.

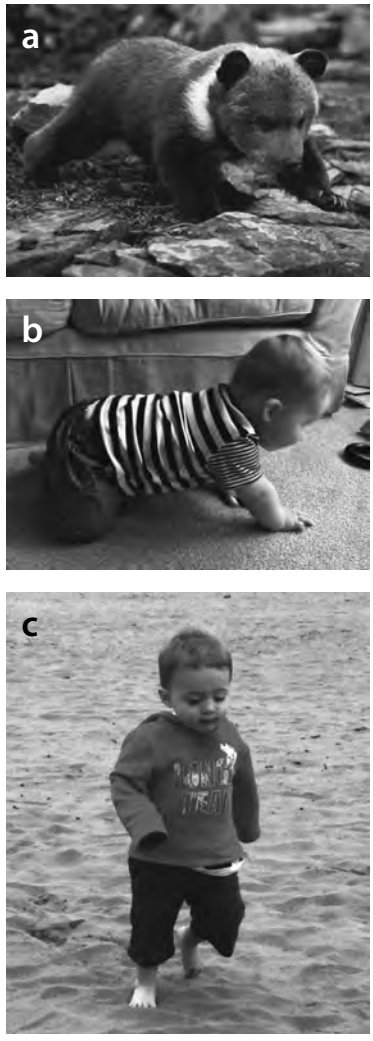


Figure 1.3: Quadruped to biped

The language of gesture precedes speech. If there is an impediment to verbal communication, human beings of every culture fall back on gesture as a means of making themselves understood. Gesture is a universal feature of human communication, although the nature and magnitude of gesture vary between cultures and languages (speakers of Romantic languages, for example, tend to be more physically expressive than speakers of Teutonic languages). A series of studies carried out in the 1980s point to a common brain mechanism for sequential movement and language[9] and it has been proposed that:

> … speech and gesture have their developmental origins in early hand-mouth linkages, such that as oral activities become gradually used for meaningful speech, these linkages are maintained and strengthened. Both hand and mouth are tightly coupled in the mutual cognitive activity of language. In short, it is the initial *sensori-motor* linkages of these systems that form the bases for their later cognitive interdependence.[10]

Adjacent areas of the brain involved in the control of rapid independent finger movements (dysdiadochokinesia) are also involved in control of the fine motor movements of the mouth used in human speech. Clinical observation of school-aged children who have difficulties performing rapid alternative movements with the fingers of one hand has found that these children consistently have a history of delayed speech, suggesting a neurological link between the motor pathways involved.

At birth, oral movements are primarily involved in feeding, but even at this early stage, there is a connection between movements of the mouth and movements of the hands and feet.

Human infants are equipped with a series of primitive reflexes, which develop during life in the womb, are active in the baby born at full term (40 weeks' gestation) and are gradually inhibited and integrated into more mature patterns of response, as connections to higher centres in the brain develop in the first six months of post-natal life. These early reflexes provide stereotyped responses to specific stimuli, are thought to help protect the infant in the first months of life, and provide rudimentary training for later voluntary skills. Early feeding provides an example of this.

Rooting and suckling reflexes develop during life in the womb. The rooting reflex is a reaction to touch to the area on either side of the mouth, which elicits nuzzling or searching with the face to locate the breast or bottle. As the mouth finds the nipple or the teat, contact with the roof of the mouth elicits suckling movements. Connected to these two oral reflexes are grasping reflexes in the hands (palmar reflex) and the feet (plantar reflex), which respond to touch applied to the palm of the hands, or pressure applied to the soles of the feet. In new-born infants, suckling movements of the mouth are accompanied by small grasping movements in the hands and the feet. This reciprocal link between hands, mouth and feet is sometimes stimulated if an infant has difficulty 'latching on' to the breast or bottle. Midwives may encourage the mother to apply pressure to the palms of the hands or soles of the feet, to elicit sucking movements. In this way, hands, feet and mouth are all involved in the sequentially timed movements of early feeding. Eventually this reciprocal link

needs to be uncoupled in order to use hands, mouth and feet independently, but in the beginning all are involved in the motor experience of feeding and form part of the pattern of suck/swallow/breathe (SSB) synchrony, which will influence other areas of development.

Figure 1.4: Infant suck reflex.

The language of babies is also essentially musical, with the human infant (infant means 'one without speech') being a master of mime and song able to communicate mood, curiosity and response through a combination of cooing, babbling and gesture. Researchers at the University of Edinburgh have shown how, when analysed in slow motion, the apparently random arm movements of the infant resemble the highly expressive movements of an orchestral conductor, while mother–infant 'conversations' comprise perfectly shaped musical phrases comprising answering melodic sequences, rhythm and timing. These are the non-verbal, primal elements of language, which are universal in nature. They develop in the early years through a combination of trial and error, response and interaction.

Figure 1.5: Grasping and sucking – the Babkin response

The same researchers demonstrated how the desire to communicate using sounds is also dependent on having a sympathetic listener. Video footage was taken of mothers and infants engaged in conversation. When the mother used a short phrase and *waited* for her baby to respond, after a short pause the infant would respond with an answering melodic phrase, and this interaction could continue for several minutes. When an adult entered the room, spoke to the baby and then continued to talk without giving the baby time to respond,

the baby looked away and any attempt at 'conversation' came to an end. Apparently babies understand manners rather well.

What Does Music Do?

Music as we understand it is thought to have developed from a combination of rhythms derived from the experience of movement (dance and marching rhythms, the beating of drums etc.) and sounds descended from the sounds of the natural world, including hunting calls, animal cries and bird song.

These two elements of music are primarily sensed by two components of the human ear – the vestibular or balance apparatus, which specialises in detecting changes in movement (rhythm) – and the cochlea, or hearing apparatus, which senses different frequencies of motion within a specific range (pitch). Paul Madaule, a psychologist who specialises in the treatment of listening problems, described the vestibular system as acting as 'the ear of the body', while the cochlea acts as 'the ear for sound'.[11] These two areas are particularly responsive to training, and while only a talented few will go on to become elite gymnasts, acrobats or musicians, every child needs to receive active stimulation of the two systems through physical interaction and experience to develop good control of balance, coordination and sound discrimination to support many higher skills, including language and, later, literacy.

Before the arrival of recorded music the notion of music involving action would have seemed self-evident because music is the expression not just of a series of sounds in space and time but the motor actions of the performer(s). It depends on the rhythmic measure of expressive movements in time.

> The architecture and narration of moving psychological time is manifested in the measured rhythms of human action, experience and communication, real or imagined – with its emotional qualities and their relation to human functions of the body.[12]

These are key elements of non-verbal language – the aspects of language which lend meaning, intention, emotion and colour to words – vital ingredients of effective communication. The musical qualities of language and how music contributes to language development will be explored further in Chapter 3.

Over the next chapters we will examine some of the origins and underlying mechanisms of movement control in the first year(s) of life and how music can be used to prepare the brain for language and literacy. How simple songs and stories can be used as the basis for movement activities which integrate sensory experience with thinking, and time spent developing the physical skills needed to support academic learning can reap rewards for the remainder of life.

In less advanced societies the instinct to parent is naturally passed down from mother and father to child through physical proximity and the close, shared experiences involved in daily living. Children partly absorb skills through 'modelling' the behaviour of those around them. Children are not shielded from the processes of birth, death and ageing, of hunting, gathering and preparing food, or of caring for younger siblings. These are a part of daily living. As societies have become more complex, so children are further removed from many of these natural processes so that they are ill-equipped to deal with aspects of life when they encounter them for the first time; in this context, in seeking to protect our children from harm we may actually being doing them a dis-service in terms of shielding them from acquiring the resilience needed to deal with real life events and processes.

Despite the many advantages of modern life from developments in medicine, which have eradicated many of the most feared diseases of childhood; education, which has opened up possibilities that were unimaginable for the majority of the population in former times; and technology, which has reduced the burden of labour and entertained and accelerated our ability to process vast volumes of information and access far flung parts of the universe at the touch of a button, the needs of the human infant and developing child remain relatively primeval. Effective learning does not just involve teaching from the top down, but also learning from the bottom up; it is a *process* in which each step along the way informs and secures the basis for later learning.

A system or society which forces young children into formal education and assessment too early, pushes them in one direction too soon, or focuses primarily on outcomes rather than processes, runs the risk of producing splinter skills – sometimes described as 'knowing of' versus 'knowledge' or 'know-how' – the

latter being the result of experience combined with information, something which is understood from without and within, and enables children to apply known concepts to new situations, to solve problems and to be confident that they can adapt in a changing environment.

Of course children need to be taught how to read, write and use numbers. This is what schooling is for, but the seeds of these more advanced cognitive skills are sown and are cultivated slowly in the early years in the fertile ground of attachment, physical development, sensory processing and socialisation.

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