To Eugene, my husband
Thank you for your love, support, understanding and keeping my feet on the ground. This would not have been possible without you.

CHAPTER 1

Reconnecting with the senses – your environment from a sensory perspective

Most of us are quite unaware of the effect of our senses when we are trying to make sense of our environment. But the old saying, 'stop and smell the roses' is quite significant when you are considering where you are and what you are experiencing. The senses are the gateway through which information from the outside world is processed and relayed to our brains.

Your seven senses

We access the world around us through seven senses. These are the five 'visible' senses we all know: sight, hearing, smell, taste and touch. But we also have two 'hidden' senses that relate to movement. These are the vestibular sense – sophisticated sense organs in the inner ear that tell us when our bodies are displaced, and help to orient movement for us – and the proprioceptive sense – feedback from muscle movement and joint position. The proprioceptive sense is sometimes also referred to as the 'body sense'. We only explore those parts of the sensory system we can physically identify in the body's anatomy and make up and the function of which we can pinpoint. Therefore, the sense of intuition (although I believe we do have it) is not explored.

At any given time the brain is flooded with sensory information. The brain is a wonderful, yet complicated and advanced piece of equipment we all have, although we don't always use it particularly well. The brain filters, organizes and translates messages from a massive amount of information through the senses and helps us to focus on the important stuff while deciding what is

unimportant. This is necessary as it would be virtually impossible for us to attend to all the information the brain is receiving at any given time. While hearing and seeing things, the brain is also picking up on smell, touch, body position, movement and information from the internal organs. The world we experience is basically a construct that is built from all the sensory information the brain is given. The brain has to continuously edit and prune what it is receiving through the senses. Only what the brain regards as relevant and important is forwarded for action, the rest merely subsides and gets extinguished along the way. And this happens on a primitive, subconscious level.

When was the last time you gave your senses special time and attention? I want you to do it now to experience their power. Take time to orient yourself in your present environment.

SIGHT – THE VISUAL SENSE

What do you *see?* The sense organ for 'seeing' is located in the retina of the eye. It is the most advanced and enormously complex of all the senses. We use it constantly when awake to access the world around us. We recognize the world around us – objects, faces, people – through looking, and the brain forms the 'picture' of what we see.

The brain and the visual sense

The brain gives more of its territory to vision than to any other sense. Light passes through the cornea in the eye (the transparent outer coating), is focused by the lens and then strikes the retina, a three-layered blanket of neurons that covers the entire back surface of the eye-ball. The brain handles the complex process of turning this into an image. The receptors for picking up information for the visual system are located in the retina which contains approximately 120 million rods and 6 million cones. The cones are responsible for colour vision and visual perception in normal or bright light. The rods are more sensitive to low levels of light and provide us with vision when it is dark. Animals, for instance, have far more rods than cones. They can't really see colours, but their night vision is far more advanced than ours.

The intricate brain journey begins where light information is converted into electrical signals carried by special nerves in the brain. The brain maps out colour, intensity, what the eye is seeing, where it is located, the direction, speed and other judgements that the everyday personal computer could just dream of doing. This intricate information is then transferred to a primitive part of the brain which controls our eye movements and reflexes and other information sent to the cortex, the 'CEO' of the brain. These are the top lobes of the brain, separated into a left and right side, called the left and right hemisphere. The cortex hosts millions of 'hard drives' for an almost infinite amount of possible information. Researchers have located thirty-two distinct visual areas in each hemisphere of the brain – an astonishing 64 possible places where visual information can go. This is a complex process between the environment, the eye and the brain so that we can see and connect with the environment. We also have loads of memory stored based on visual information which is accessed continuously while we are trying to see the world around us.

The visual sense in real life

Where and how is seeing important in everyday life? We base a huge amount of our connection to life based on what we see. Personal communication is known to be more powerful when eye contact is made; you have to look at, and see the person you are talking to. The list is endless, but these are some of the most important functions of the visual sense:

- Communicating
- Reading
- Driving
- Watching TV or movies
- Computer usage
- Learning.

Some interesting questions:

1. *Why does working in natural light seem to make people more productive than when working under fluorescent lights?*
2. *Have you ever considered the reason behind your choice of screen saver on your personal computer?*
3. *Why does clutter irritate you? Does it?*
4. *Why are you bothered by moving images on TV, making you feel slightly nauseous? Or when driving, do the telephone poles flicking past make you feel dizzy and disorientated?*

And some of the answers:

1. It is well known through research that natural light has a 'softer' and gentler effect on the eyes, reducing fatigue and making people work better for longer.
2. The choice of screen saver in particular can be based on your individual threshold. When we have a low threshold and tend to be distracted by visual information we prefer a blank screen saver which does not distract us. However, when we have high thresholds and thrive on loads of visual information, we prefer moving, illusionary screen savers, 'feeding' the eye

and brain with more information. Hopefully your screen saver is the right match to your threshold.

3. Clutter would potentially irritate the person with low visual thresholds who gets distracted by visual information quickly. It's as if the brain just attends to too much of what is seen, without filtering out any useless information. Neatness and order would be vital for you to maintain a sense of control and be able to work without snapping at your colleague or boss … which might be a career-limiting reaction. How would you explain to your boss that your response was due to sensory overload in the visual sense?
4. The visual and movement systems work together intimately. When there is a low tolerance of movement and seeing, the brain receives conflicting messages when seeing moving images and is thrown off balance. Fortunately, although you may find it nauseating, the brain has a built-in protective system, called the autonomic nervous system. High-alert states occur when conflicting messages reach the brain, and send instant messages to the gut, heart and organs. That's part of the so-called 'stress response' where the brain-body connections increase the fancy footwork done by the brain to protect us from harm. Usually it passes when the conflicting messages are removed or the brain eventually 'gets used to it'. This process is called habituation.

Next time you look at the world around you, the good, the bad and the ugly, acknowledge that your brain is working through an intricate process of taking in information from the environment and 'showing' you what it is. It is the first line of connection to your environment.

How do we rest the visual system?

Sensory overload is a phenomenon that most of us are exposed to on a daily basis. We live in a world that constantly bombards us with sensory input. If you want your brain and systems to work optimally, you have to let them rest.

- Close your eyes
- Practise visualization techniques
- Close your eyes and dream
- Watch fish moving in a fish tank – visit your local aquarium
- Switch on your lava lamp, look at it and relax
- The important thing is, *TAKE FIVE, TAKE A BREAK.*

HEARING – THE AUDITORY SENSE

What do you *hear*? Hearing happens when our ears pick up vibrations or noise in our environment that are transferred to the brain via nerves for identification. We live in a noise-polluted world. Especially if you live in a city, it is very difficult to find total quiet, unless you are prepared to get up at 4 am to spend some time enjoying the blissful peace of hearing nothing and nobody – and even that is no guarantee! Needless to say, getting enough sleep might then be another hurdle. Like seeing, the sense of hearing helps us access the environment in a primary way.

The brain and the auditory sense

Hearing begins in the ear when sound waves are translated into electrical signals to be sent through the auditory 'wires', first to the primitive parts of the brain and then to the 'CEO' in the auditory cortex. Sound is actually perceived by the brain as vibrations differing in frequency and quality and based on these variables being transferred into signals. The inner part of the ear is filled with fluid, the outer two parts with air. It is inside the inner fluid-filled area, inside the cochlea (the inner hearing organ), where the vibration is translated into electrical signals. These are then transferred through various lower brain structures such as the thalamus (grand central station) and brain stem (connections for survival, fight/flight/fright, and attention) before reaching the 'CEO' which gives them meaning. There are two tiny muscles in the middle ear that start to modulate the sounds reaching the cochlea. It is possibly in these lower or primitive brain connections where the under- or over-response to sound is generated.

The auditory sense in real life

Our ears are switched on 24/7. This makes the sense of hearing a very difficult one to rest. Many of my clients complain about noise levels in current society. It is as if we simply cannot find anywhere quiet anymore. Our ears are vital in orienting us to our world through noise and sounds. Hearing aids our communication processes, helps us to absorb information and learn, and also points out potential dangers. If you hear footsteps behind you when walking down a dark alley at night (don't try this at home) it will most certainly send messages to the brain about potential danger. Any life or work environment is filled with noise, some very necessary in respect of our task at hand, but, a huge amount is background noise. And that's where it gets tricky … how much background noise can you cope with? The function of hearing in every day life includes:

- Communication with others
- Talking on the phone
- Music
- Listening to instructions
- Radio, TV
- Attending workshops/seminars/classes.

Some interesting questions:

1. *Why do some people get highly upset and frustrated by the popcorn brigade in the movies, when others are completely oblivious to them?*
2. *Why is the fight between those wanting to have the radio on and those wanting it off creating havoc at the office. And how do we solve this problem?*
3. *Why does music have such a calming effect on some people?*
4. *How come some of us can easily talk on a cellphone while driving while others become disoriented if they do that?*

And some of the answers

1. It's a matter of threshold! The popcorn brigade are chewing and making lots of lip and mouth noises, while scratching like hens in their huge packets. The low threshold individual sitting four rows down hears every sound and cannot filter it out, cannot hear what's going on in the movie and becomes frustrated. The high threshold person, on the other hand, possibly even sitting much closer to the muncher, manages to filter out this background noise without even realizing it. No problem!
2. Another threshold scenario: low threshold individuals often struggle to work with background noise and would prefer the radio off in order for them to focus better on the task at hand. However, the high threshold folks enjoy sound and their brains are actually stimulated by it. They work better with the radio on. The solution? It's often a tricky one. Explain thresholds so that staff will have insight into and understand each other's needs. Keep the two extremes as far apart as possible. Radio's on in the morning (your brain usually copes better with information in the morning because of the rest you had during the night) and radio off in the afternoon (sensory input is accumulative, hence a decreasing ability to cope with sensory overload by the end of the day) is one of the solutions.
3. Music has varying healing, stimulating and organizing effects on the brain. Since each individual's brain is unique in its particular way of transporting information, it explains the variation in using music for calming, learning or therapeutic effects. Studies over the years have clearly noted the positive effect of music on the brain.
4. Again, the answer lies in the process of transferring and filtering of sound information that is unique to each of us. Some brains take a lot of energy to perform a particular hearing task, such as talking on the phone. When combining that with a different task like driving your car (movement and planning task), it may make you feel unsure and yes, in some cases disoriented. If this applies to you, don't talk and drive! (It's against the law anyway!)

How do we rest the auditory system?

Auditory overload is a very real and known occurrence in everyday life. We envy those fortunate enough to be working in a quiet, outdoor kind of an environment. The farmer tending his vineyards in the Hex River valley, the fieldworker in the Amazon jungle, the deep-sea diver, and so on. Many of us are trapped in cities and city life with its accompanying noise and more noise. Try the following:

- Listen to calming music
- Put on your headphones, and keep the volume down … you don't want to damage your ears with excessive, loud and high pitched sound
- Move to a quiet space to reduce noise
- If all else fails, use ear plugs
- The important thing is, TAKE FIVE, TAKE A BREAK.

TOUCH – THE TACTILE SENSE

What do you *feel?* The sense of touch is located in the skin and physically connects us to the world. It is the sensory system with the widest receptor base: you have skin from the top of your head right down to the soles of your feet. It is also the sensory system which develops first and plays a major role in early development in children. We all know how important and vital the sense of touch is for bonding with a small baby. Although being vital at birth, the sense of touch keeps on developing and remains a key component throughout life in our physical interaction with other people. It is our most powerful and intimate form of communication.

The brain and the tactile sense

Touch is an essential system in terms of survival, bonding, protection, and life and death situations. The basic sensations of touch, temperature and pain all begin in the skin in different specialized receptors for each sensation, each with a specialized pathway to the brain. Sensations of pain and temperature are carried primarily by the protective pathway. This is vital for switching on the 'alarm' systems of the brain as we often respond to pain and/or temperature in a protective manner. When touching a hot plate, you will withdraw your hand instinctively based on the processing of this information via the protective pathway. Light touch and deep pressure together with proprioception (the body sense) are carried via the discriminative pathway in order to help us to determine the qualities of what it is we are feeling through touch. The discriminative pathway is also at work when you put your hand in your pocket and hold and recognize a R5 coin as opposed to a R1 coin. We have more receptors in our hands and mouths as these areas are particularly important tools of touch discrimination.

The sense of touch in real life

Being connected to your tactile system can open a new world to you. Apart from how you communicate with others, your personal space and comfort being in groups can be determined by your sense of and threshold of touch. Daily tasks such as dressing, eating, bathing and grooming are filled with touch experiences.

Some interesting questions:

1. *Why do some of us hate being dirty, and recoil in total 'fear' when approached by a two-year old at a birthday party whose hands, face and feet are just about covered in chocolate cake icing?*
2. *Are you one of those people who will refuse to enter a lift when it is about two-thirds full? And if you enter on the second floor and by the sixth floor your lift neighbours are squeezing you from all sides, would you step out and take the stairs to the 15th floor?*
3. *Do you hate being touched or hugged by other people, especially those you don't know well, and being kissed by a man with a one-day-old beard?*
4. *Does a surprise picnic arranged by your loved one on a beautiful beach with a gentle breeze turn your mood into agitation rather than joy and serenity, with you snapping at him or her for offering you a glass of champagne because there is sand on the rim of the glass?*

And some of the answers

1. It's a matter of threshold. People with low touch thresholds (remember it's skin all over) hate being dirty or being touched by someone who is dirty, never mind how innocent and full of good intentions that two-year old might be. Dirt, especially wet dirt, on the skin switches on the 'alarm system' of the brain and that particular feeling is experienced as extremely uncomfortable and yes, in some cases, even painful.
2. When you are in a full lift surrounded by others your touch system is being triggered continuously. The touch system facilitates your personal space and when invaded too closely this in turn again triggers the alarm system. I often find that individuals with low touch thresholds will stand right at the back of the lift. At least if they can see (and 'scan' for protection) they can anticipate their response more easily. Needless to say, they are much fitter than the high threshold group. Having to revert to stairs a number of times a day will do wonders for anyone's aerobic endurance!
3. People with low touch thresholds are just not your all-time huggers or kissers. They simply do not like that intimate contact with others. They normally are comfortable with intimate contact with their loved ones. When on the receiving end of a low threshold non-hugger we can feel rejected. Relax, they do love you, but don't show it in a physical way. Those with high touch thresholds enjoy touching, hugging and kissing others, even those they don't know particularly well … careful … it may cause trouble in the wrong environment. The bottom line is, it's a matter of personal space and your sense of personal space is often dependent on your touch threshold.
4. Beach, wind, sand … the worst combination imaginable for someone with a low touch threshold. Having to sit on the beach is just not fun. You definitively want a blanket with no holes; grandma's crochet one won't do it, so use the brand new picnic version which is sand and wet proof on one side. You first have to walk over the sand with it sticking to your toes or seeping through your shoes. You can feel every single grain, and it chafes, and hurts, and sets the brain's alarm system to work. Then you have to manoeuvre that picnic basket, the food and wine without connecting with a single grain of sand and that's virtually impossible. To crown it all, the wind that blows brings moving air and extra sand with it. You will just not enjoy it, and then to be offered champagne in a glass with sand on the rim is just the pits. If you cannot do it the 'de luxe' way: a table with white table cloth with those cute little weights holding it tightly in place, a real plate with your food, real glass without sand, a waiter serving you (from a sand-free, wind-free base) and, of course, an absolutely wind free, quiet evening, opt for a restaurant or a fancy dinner for two at home. (I guess Shirley Valentine would agree).

How do we rest the tactile system?

Sensory overload in the touch system results from being exposed to too many people, too many textures, and too many touches for too long. I once attended a weekend conference where the speaker was wearing a polo neck top. From about ten that morning she started to pull away that polo neck from her body, I could see her irritation increasing. I was sure she was going to change her top during lunch time. But not realising that this was one of the reasons for her sensory overload and resulting drop in focus, she continued wearing the top the whole day with increasing signs of irritability and distraction … and it was not a pleasant experience for her nor for anyone attending her presentation. Don't try to hang in there – for your own and others' sake! Rather try the following:

- Remove a touch irritation, whether it is a sock with a funny seam, a label, a scratchy blouse, or a polo neck
- You may sometimes want to remove your partner … it is not recommended, but make sure you have quiet time alone
- A deep massage

- A heavy quilt or blanket
- A big bear hug, not a light kiss
- The important thing is, *TAKE FIVE, TAKE A BREAK.*

SMELL AND TASTE – THE CHEMICAL SENSES

What do you *smell?* What do you *taste?* Smell and taste are the chemical senses reacting to specific molecules in the environment. These are primitive senses: all animals (even single cell organisms) have distinguished smell and taste abilities, often using them for basic survival. The senses of smell and taste are known through human evolution to be crucial for survival. Possibly because these are the most primitive senses involving fewer dedicated brain regions, we find that fewer people are sensitive to smell and taste. There are also fewer sources of confusion and noise, and it is physically easier to adapt to noxious smells and tastes.

The brain and the senses of smell and taste

The smell pathway starts with the response of a smell molecule via the olfactory (smell) bulb in the nose. We have thousands of different chemical detectors in our nose and research shows that the human nose can detect as many as 10 000 odours. After receiving information via the nose, the smell pathway in the brain is short and direct. An important aspect of the sense of smell is that it could be called the 'favourite sense' of the brain, in a manner of speaking. Messages from all other sensory systems have to pass via the thalamus (grand central station in the brain) but smell has a direct pathway, or one could say a 'hotline', to the limbic system. This system is important for emotion and memory and often referred to as the emotional brain. Smells get preference in being sent to the limbic system and then to the cortex which identifies the type of smell in the brain. This accounts for the strong response we have towards a noxious smell and the memory it often accompanies. For this reason also is smell quite potent, as it does not have that additional filter in the thalamus. When something stinks, it really STINKS with a capital S, and makes people run off. The emotional response (from the limbic system) is clear, immediate and profound.

The other primitive sense, taste, accounts for 2 000 to 5 000 taste buds in and around the mouth, detecting taste in four basic categories – sweet, salty, bitter and sour. Full flavour appreciation comes from close interaction between smell and taste. Have you ever tried drinking castor oil while pinching your nose tight and keeping it fully closed? You do not taste the castor oil until you let go of your nose … then the taste hits you … Yaaach! Taste information is carried further via the lower structures in the brain to the cortex for recognition and identification.

An interesting fact about the smell and taste systems is that they regenerate new cells – over a period of 10 days for taste and 30 days for smell. This is necessary because the receptors of these systems are exposed to the environment – hot and cold liquids, spices – and also bombarded by bacteria and dirt, and constantly at risk of drying out. Thank goodness for the wonderful chemistry of the brain that makes new receptor cells for smell and taste all the time.

Temperature also has an effect on taste receptors. If your taste buds are exposed to very cold temperatures, the sense of taste is greatly reduced.

The senses of smell and taste in real life

Our enjoyment or not of food is the most important result of the workings of smell and taste. We rely heavily on these senses to appreciate food. The sense of smell also affects our interaction with others around us. When the smell sense is bombarded with pleasant input, we respond positively to others within the environment. However, when bombarded with a noxious odour, a negative emotional response will be elicited. I recently had a conversation with a human resource manager who interviewed an applicant for a position at their company. During the interview she was so offended by this applicant's body odour that she just could not be convinced to recommend him for the position, despite his qualifications. Yet the other exco members present during the interview seemed oblivious to the smell.

Some interesting questions:

1. *Why do some of us enjoy spicy, hot foods and others are quite put off?*
2. *Why do we have certain memories strongly connected to certain smells?*
3. *Why is aromatherapy a successful method of de-stressing?*
4. *Are flowers and/or perfume always the right gift for that woman you want to impress?*

And some of the answers

1. Again, it's a matter of threshold. Low threshold people prefer known, familiar and often bland foods. I see it over and over in my case studies. On the other hand, people with a high threshold in their taste and smell systems are often those who prefer and enjoy hot, flavourful and spicy foods.
2. Memories often have strong smell associations owing to the direct link between the smell pathway in the brain and the limbic system (the emotional and memory brain). My grandfather had a farm in Namaqualand and whenever I smell Namaqualand daisies it brings back nostalgic memories of

my childhood experiences on the farm. Based on your previous experience, the smell would elicit a positive or a negative reaction.

3. Research clearly shows the positive effect of aromatherapy. The olfactory nerves transmit signals that go to the limbic system and the result is that certain smells calm us, others stimulate us, and yet others help us sleep. Since your brain and sensory system are unique, you will have to experience and explore certain aromas to find the right ones for you. But generally there are groups of aromas that calm versus other groups that stimulate us.
4. Flowers and perfume are perfect gifts for women with normal to high thresholds. Handing your low-threshold girlfriend a bunch of strong smelling lilies which makes her sneeze and gives her a headache in her small apartment, may not be good for the relationship. The same goes for perfume. Although perfume is a very personal thing, some people just cannot tolerate the smell of perfume owing to low threshold for smell. I know of many clients who never wear perfume and hate being close to others who do. Perfume is a chemical with a strong smell and for this reason we also recommend to new mothers not to wear perfume during the first few months of their baby's life. It might easily lead to sensory overload in a little baby, resulting in fussing and/or uncontrolled crying.

How do we rest the smell and taste systems?

Fortunately, as mentioned before, sensory overload in these systems is not that prevalent. When there is overload, however, it is quite difficult to address owing to the short link in the brain. You cannot bypass that link with something else; it is a matter of removing or avoiding the sensory input as much as possible.

- Avoid areas or people with pungent or strong smells
- Find and create the smell that suits your system
- Aromatherapy (with smells that work for you)
- Use air fresheners (with an inoffensive or neutral smell)
- Open windows and/or doors to air closed-in areas
- Eat the foods that you enjoy; be daring and adventurous with foods if you have a high threshold and stick to with the known ones if you have a low threshold. It's okay; there are more important things to life than pushing the limits with food
- The important thing is, *TAKE FIVE, TAKE A BREAK.*

MOVEMENT – THE VESTIBULAR AND PROPRIOCEPTIVE SENSES

How do you sense *movement?* When referring to the senses the vestibular and proprioceptive senses are often overlooked. But how could we? Movement impulses reach the brain via the vestibular sense, the gravity sense in your inner ear, and the proprioceptive sense – impulses sent when you use a joint and/or muscle. The vestibular system can be seen as the body's GPS (global positioning system) as it tells us where in space we are, based on movement of the head, and gravity processed through the vestibular apparatus in the inner ear. The proprioceptive system can be described as the 'body sense'. As it processes information from the muscles and joints, this system helps you to walk down a flight of stairs, or tip-toe to the bathroom in pitch darkness at night without having to switch on the light. Your proprioception tells you where your feet and body are and how to move to get to the bathroom without knocking over the dressing table. Hopefully there are no kids' toys lying around to stumble over as your proprioceptive system cannot warn you about that – that's the job of the visual system and if you haven't switched on the light ...

We take movement for granted, but it is a highly important and vital part of human behaviour. It's just that as we get older, motor patterns become programmed and natural – we don't need to think about them anymore.

The brain and the senses of movement

The vestibular process in the brain goes something like this: The influence of the pull of gravity or any change in head position starts a chemical reaction via little hair cells in the fluid in the vestibular system in the inner ear being displaced. From here information is sent to the lower parts of the brain via a nerve that shares information coming from our sense of hearing. There are various connections in this area to the muscles of the body to help you maintain your posture when you are sitting in a chair, for instance, or keeping your head upright. Then the vestibular system has connections with your eye muscles, helping keeping them stable so that you can keep looking at something specific, whether you move your head or not. To see how this works, move your head sideways while reading this. Do the letters move around or can you still read everything clearly? The latter should be true.

The proprioceptive process in the brain works as follows: Information coming from receptors in the muscles and joints is sent to various parts of the body and brain in the form of electrical impulses. Some information travels with information from the sense of touch to the brain while the other bits of information are dispersed to produce fluent movement, plan motor actions and sequence bilateral movements. Information from the two systems (the proprioceptors and the vestibular system) is combined and sent to the cortex to make movement conscious.

There are fewer connections in the cortex for movement, which explains why we are not as conscious of our movement than we are of what we see or hear (with the senses of sight and hearing having extensive cortex chambers).

The senses of movement in real life

The brain turns any learnt movement into an unconscious process so that we only need to think about it when learning a new skill. However, researchers have also established a link between movement, learning and emotion. So even though movement is automatic and not one of the obvious senses, it both affects learning and is indicated by mood. Have you noticed the body posture of someone who's depressed? And the body posture of someone ecstatically happy about something? Learning in the brain requires various forms of sequencing. Sequencing of movement kind of paves the way for the brain to learn how to sequence other things. But movement is basic, like breathing. In real life we use the movement senses for:

- Sitting on a chair
- Moving/walking between objects
- Driving your car
- Exercise, running, biking, walking, etc.
- Using an escalator, stairs or a lift
- Finding a new place
- Bending down
- Dancing.

Some interesting questions:

1. *How come some people get such a thrill from amusement parks while others refuse to go? Why are young people in particular drawn to roller-coaster rides and other adrenaline-pumping activities?*
2. *Why do people get sea sick or car sick?*
3. *How come I feel on top of the world after a vigorous run or aerobic exercise?*
4. *Would the senses of movement dictate the type of sport people choose?*

And some of the answers

1. It is (you've guessed it) a matter of threshold. Some of us (excluding me) love going on a roller-coaster ride and have adrenaline and happy hormones pumping for ages thereafter, wanting to go again and again and again. Their brains have high thresholds of movement and can tolerate, excessive amounts of movement while experiencing a positive emotion. Here again the brain establishes a link between emotion and movement. Others with a low threshold of movement get sick and would vomit on a roller coaster. In this instance the vestibular system is working overtime since the position of the head is changed 360° at high speeds. The autonomic nervous system links are triggered much faster and more intensely in those with a low threshold, therefore the resultant nausea. Research also indicates that younger people have more sensation-seeking traits and that these traits diminish slightly as we get older. This also has something to do with the fact that children and young people are very active and challenge their movement systems more regularly and more intensely than older adults. *I don't want to get side-tracked here, but most recent research shows that children today are far more inactive and that obesity among children has become a far bigger problem than decades ago. So parents, get your children out of the house and move!*
2. Nausea resulting from car sickness or sea sickness occurs when there are mixed messages between the vestibular system, the visual system and the brain, resulting in the autonomic nervous system being triggered. Movement nausea is more prominent among individuals with a low vestibular threshold. Remember, the vestibular system is triggered by movement where there is a change of head position and the visual field and eyes are always involved. People with a low vestibular threshold can have high or normal proprioceptive thresholds. Therefore, movement in general is not necessarily a potential area of discomfort, but only where head positioning is involved.
3. The movement system is connected to the reticular activating system. This system in the brain controls your state of wakefulness and determines whether you are awake, alert or sleepy. When you are physically active your brain's state of alertness is heightened, so you feel alive and on top of the world after exercise. Of course, coupled with this is the release of happy hormones, adding to this nice glow of feeling good. John Ratley in his book *A user's guide to the brain* says: "movement is medicine …". No wonder exercise has become a billion dollar industry. Have you joined yet?
4. Without a doubt our movement thresholds clearly dictate our choice of sport. Those with a low vestibular threshold will not do gymnastics, sailing or rock climbing. Other high adrenaline sports such as abseiling, skydiving, bungee jumping, etc. also place high demands on the vestibular system and will be avoided. Canoeing, biking or running might be the sport of choice for people with a low vestibular threshold as there is very little change in head position, with movement more or less restricted to going forward (see page 85).

How do we rest the movement systems?

Movement overload is not that prevalent either, although nausea related to movement in a car or boat is. There are effective ways of reducing movement-

related nausea. The movement system is a very strong self-regulator and often used to calm the other senses when in overload.

- When you feel nauseous or experience motion sickness, look straight ahead. This reduces the conflicting messages received by the brain. Put something in your mouth to suck or chew on
- Smooth, rhythmic movement, like hanging in a hammock, is calming and relaxing
- Get to a quiet spot, find a comfortable position, and be still
- Get some sleep
- The important thing is: TAKE FIVE, TAKE A BREAK.

The brain, the core of the senses, in more depth

Although I've given you glimpses of the pathways of each sensory system within the brain, we also need to look at the mix of senses and how it affects the brain as a whole. The brain is extremely complicated and has been described as the most complex system in the universe. I will attempt a greatly simplified explanation to place the sensory system in perspective. We can never know everything there is to know about the brain which continues to fascinate researchers in many fields.

BRAIN MODULATION IN A NUTSHELL

Let's take a brief look at the general and global way sensory input from the environment is processed in the brain. The important fact to remember is that the brain has hierarchies, like any social system in the world.

The hierarchy

The lowest level is the *brain stem,* also called the primitive brain.

The brain stem is in charge of survival and drives the functions necessary for self-preservation: feeding, fleeing, fighting and reproduction. In the core of the brain stem is the reticular activating system (RAS), the seat for sleep cycles, arousal and attention and therefore consciousness. The RAS extends from the spinal cord to the thalamus, which is the brain's sensory Grand Central Station. All sensory information processed by the brain passes through the thalamus, except sensations of smell.

The *cerebellum* is a structure behind the brain stem acting as the puppeteer of the nervous system. It is responsible for coordinating all our body movements so we can move easily, smoothly, precisely and with good timing.

The next level is the *limbic system,* also called the emotional brain, and is the next station for sensations. The limbic system is the seat of feelings and moods.

It is here, thanks to neurotransmitters and hormones, that we 'feel' and interpret sensations to match emotions. All sensations (except those of smell) pass through the gates of the primitive brain en route to the limbic system. Sharon Heller in her book on brain development, *Too loud, too bright, too fast, too tight*, says that sensations and emotions are forever married. The limbic system and the reticular activating system work together to modulate the nervous system.

The third and highest level is the *cortex,* the 'acting CEO' of the nervous system. Our executive functions of thinking, reasoning and doing are generated here. This part of the brain enables you to write, speak, plan, make decisions, do calculations and get you into university. It gives you some control, or willpower, over the primal lower commands.

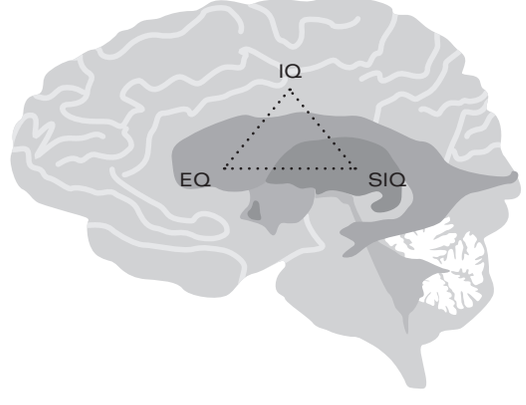
Communication between the levels

There is a smooth three-way communication process between all these levels.

In a smoothly functioning nervous system the primitive brain sets up the integrity of the entire nervous system. To function well and allow for more complex and specialized information, the cortex CEO must rely on adequate sensory organization and management at the lower, less complex levels. When this happens, the connections between the three parts of the brain work in harmony and effective sensory modulation and integration occur automatically. You spontaneously adjust your actions to signals from the environment, and your senses create curiosity and excitement. Your brain responds by creating the necessary mental set for the activity at hand and your behaviour is efficient, goal-directed, and purposeful.

So how does sensory intelligence (SIQ) relate to intelligence quotient (IQ) and emotional intelligence (EQ)? I believe the answer lies to a degree in how we look at the different processing levels in the brain.

IQ involves the cortex of the brain, the top CEO part, as the vital link for facilitating executive functions of action, reasoning, abstract thinking, etc. This is a major brain component that we utilize to perform at our best.



The top executives and CEO cannot function without the people below them supporting their role and vision. The same applies to the human brain. When we look at a diagram of the brain we see that there are numerous structures in the middle and lower parts of the brain playing a vital role in processing sensory information. It is at the primitive lower level of the brain, the brain stem and midbrain that a large part of sensory processing occurs (the section marked SIQ). Of course we tap into the CEO of the brain, that is ultimately our goal, but it is through the lower, primitive structures that we modulate and regulate sensory information for action and performance. Emotional intelligence is mainly seated in the limbic system, hence its indication in the midbrain.

The triangle is an indication of the three-way interaction between these three intelligences. They all affect one another and work in collaboration to optimize brain capacity and function.

NATURE VS NURTURE

How the brain processes information and how much the brain can tolerate based on thresholds are based on two main factors. The first is *nature*. We are born with a certain genetic predisposition to either over- or under-respond to sensations from the environment. Clinical practice clearly demonstrates the fact that sensitive children are often the product of sensitive adults. That explains the power of genes. We are just born a certain way. Research clearly shows traits to be genetically passed on from generation to generation. Therefore, you are born with your threshold. This should already make you feel better. The core neurological threshold we refer to in occupational therapy in sensory integration is genetic predisposition. It is not something you've chosen or become. You are born with it.

But we must also consider the second factor, namely *nurture.* This refers to our upbringing based on environment, culture and role models. Obviously our gene pool weighs heavily, but thresholds are moulded through the way we are brought up. If you were brought up in a small suburban house with five siblings, your tactile thresholds will certainly be higher than someone who grew up on a farm, in a huge homestead, with one sibling. Your system was challenged while you were growing up and your brain just had to habituate, or get used to, all the people and noise around you. A very interesting bit of research quoted by John Ratey in *A user's guide to the brain* also illustrates the impact of culture very clearly. He refers to a study on adults in social settings that counted the number of times people touched each other casually (patting or touching a friend's shoulder). They found that in cafés in France touching between people occurred 200 times in 30 minutes, as opposed to only twice in the United States. So be warned: stay away from France if you have been classified tactile defensive!

Nature and nurture are extensively moulded in individuals, each contributing a great deal to the development of thresholds. Valuable information regarding this will be discussed in the relationship sections (see Chapter 4), among others to caution parents not to deprive their children of sensory stimulation owing to their own low threshold patterns. Have you ever seen a tactile sensitive mother with a dirty child? No, they're squeaky clean from head to toe! But getting dirty is part of growing up and provide important and valuable sensory stimulation opportunities which facilitate a child's development.

DEFENSIVE VERSUS SEEKING SENSORY SYSTEMS

Throughout this book we will explore the two extremes of sensory threshold. On the one end we have people with low thresholds who are sensitive, categorized 'defensive' when sensitivity is extreme. Sensory defensiveness is characterized by averse or defensive reactions to what most people would consider non-irritating sensory stimuli.

A low threshold or low tolerance results in the brain over-reacting or over-responding. It often leads to tension, anxiety, avoidance, stress, anger and even violence. Basic sensations have the potential to put the brain into 'high-alert', which coincides with a stress response.

Degrees of sensory defensiveness can be mild, moderate or severe. The higher the degree of defensiveness, the higher the impact on your quality of life and the resulting stress. Defensiveness can be evident in one or more sensory system. If someone is defensive to auditory stimulation, sounds and noise will potentially overload the brain.

Although largely unrecognized, sensory defensiveness is not uncommon. Studies in the USA showed that 15% of normal adults have a nervous system that is overly sensitive to sensation. They potentially become irritable, distracted as their brains keep going into fight/flight responses. The following adjectives may describe someone who is potentially a sensory defensive person: difficult, picky, perfectionist, anti-social, demanding, fussy, finicky, fastidious. Understanding these behaviours is the key in order to implement appropriate coping strategies.

At the other extreme we have people with high thresholds who tend to under-register what goes on in their environment and can often be sensation seeking. This group of people responds to a 'sensory hunger' based on too little information being processed. Research has found some correlations between sensation-seeking traits and substance abuse patterns.

In my experience, however, it is the low threshold group who seems to have more difficulty coping with life and its stressors and this book will focus mainly on this group. This is heavily based on case studies and in my current exposure I work with far more people with low thresholds than with high thresholds.

However, when we explore relationship dynamics and goodness of fit profiles between individuals it is vital to consider all profiles across the threshold continuum.

SENSORY STIMULATION OF THE BRAIN ACROSS ALL AGES

Have you ever tried to count how many somersaults and cartwheels a five-year old could do in the span of one day? Quite a few, if you can succeed in dragging them away from the computer and the TV. Have you counted how many somersaults and cartwheels most adults do in the span of one day? Not one! I do believe we should, though I guess we may end up in hospital with all sorts of injuries. And don't even mention the looks of utter disbelief in the eyes of bystanders! This is unfortunately or fortunately a fact of life. As we grow older we become less active on a sensory level.

Generally looking at pensioners in retirement homes one might say that they are at a point of being sensory deprived. They don't move, touch, see or hear as much as they used to. Their world becomes smaller, often due to deteriorating health and their sensory input diminishes greatly. Together with less sensory input a sense of worthlessness and depression sets in. An important lesson to learn from this is to stay active and seek sensory stimulation for as long as you can. Your typical sensation seekers are the ones whose stories you read in the newspapers when they do bungee jumps and parachute jumps at the age of 70 and even 80. Well done, keep it up, but please proceed with caution and let safety prevail.

PLASTICITY IN THE HUMAN BRAIN

One other amazing thing about the brain is that contrary to myth and general belief, the brain continues to grow and form certain new cells until the day that you die. Although seriously complex your brain is the best tool you'll ever have! So use it well.

According to the theories of neural plasticity, your brain can be stretched and challenged forever. I know that change is difficult but it is possible. It also confirms the fact that our neurological thresholds, what we can tolerate, can change. If we are in a good space we can usually tolerate more. When stressed, ill or going through major life changes, our thresholds diminish and we feel that we can tolerate even less than usual. The threshold point of a brain is therefore not a specific point but should rather be seen as a shifting band. We rarely have dramatic shifts, but thresholds do move and are based on our current situation and personal predisposition.

Summary of the senses from a scientific perspective

So now you have been introduced to the world around you through the senses. I hope that it has brought you a bit closer to the sensory you and has possibly already explained some weird patterns and/or strange behaviours. In the rest of this book we will explore the process of *sensory modulation* in considerable depth. When referring to sensory modulation I need to take you a step back into where this daily phenomenon fits into the scientific world. Sensory modulation refers to the processing of sensory information from the senses at any given time. The brain is bombarded with sensory information via the seven senses and also through the internal organs. The brain filters this information to help you attend to the important information while ignoring the unimportant information. This process of modulating sensory input is therefore crucial for us to function optimally on a daily basis. It has a huge impact on our productivity, focus, attention, communication and social interactions.

Sensory modulation is a sub-theory of sensory integration, a model of therapeutic intervention developed and pioneered by an American occupational therapist, A. Jean Ayres. Traditionally and originally sensory integration had its development in the neuroscience approach to child development and became the treatment of choice for children with learning and perceptual difficulties. The sensory integration process also has a strong neuroscience basis. In other words, how the brain is structured and functions, supports the theory and application of sensory integration.

Sensory integration remains a specialist field in the occupational therapy profession. Although still mostly centred on child development in South Africa and across the world, the application of this powerful technique is growing rapidly to incorporate individuals across all lifespans, cycles and ages. Clinical experience and the latest research have taken the theory of sensory integration to a new level. Based on child development research, we know this process is crucial between the ages of two and eight for children. However, we now utilize this powerful and unique approach to babies from birth. The same applies to adults. Sensory integration is not solely a paediatric application anymore. Sensory integration is a daily, unique and very necessary process we *all* use in order to make sense of our world.

This book will explore and highlight the sensory modulation process for all of us. We are continuously processing sensory information but everyone does so uniquely. That is why this tool is so useful. Looking at the world through your eyes does not mean this is what the world looks like. Your partner, child, colleague, friend or employee in all likelihood processes information from the environment totally differently from the way you do. This insight and knowledge together with suggested facilitating strategies (your sensory intelligence) will help you understand yourself and the people around you better and lead to improved interaction.