

Chapter 4

The Sensory System

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Emotions as senses · Channels of information : Human Bottleneck, Sensory Fish ·
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I am not afraid as I descend,
step by step, leaving behind the salt wind
blowing up the corrugated river,
the damp city streets, their sodium glare
of rush-hour headlights pitted with pearls of rain;
for my eyes still reflect the half remembered moon.
Already your face recedes beneath the station clock,
a damp smudge among the shadows
mirrored in the train's wet glass,
will you forget me? Steel tracks lead you out
past cranes and crematoria,
boat yards and bike sheds, ruby shards
of Roman glass and wolf-bone mummified in mud,
the rows of curtained windows like eyelids
heavy with sleep, to the city's green edge.
Now I stop my ears with wax, hold fast
the memory of the song you once whispered in my ear.
Its echoes tangle like briars in my thick hair.
You turned to look.
Second fly past like birds.
My hands grow cold. I am ice and cloud.
This path unravels.
Deep in hidden rooms filled with dust
and sour night-breath the lost city is sleeping.
Above the hurt sky is weeping,
soaked nightingales have ceased to sing.
Dusk has come early. I am drowning in blue.
I dream of a green garden
where the sun feathers my face
like your once eager kiss.
Soon, soon I will climb
from this blackened earth
into the diffident light.

Eurydice by Sue Hubbard
Ghost Station (2004)

A quick journey through the senses

... *experience is always new...*

– Goethe

The purpose of this Chapter is overtly to discuss the various kinds of sensory information available and how the senses work. But most importantly I hope to stir some curiosity about sensory experience. That curiosity, once directed in particular directions that are “useful” is an extremely powerful force for health.

There is something of great importance about the constant renewal of sensory experience and our connection to the world through the senses. This capacity to re-engage with the world and refresh our experience through curiosity has, for various reasons, been supplanted in Western cultures by an attempt to seek greater and greater stimulation. Some of this is through a fashion for travel. I can remember my own travelling experiences 30 years ago with some unusual clarity. One thing I realised about travel to other countries – is that we are forced into a greater sensory awareness. The fact of being thrust into an unfamiliar culture and language automatically places us in a survival situation, where we *have* to be more alert and we *have* to engage with our senses, and we *have* to recognise that life is going to include a steep learning curve. When that heightened awareness, interest and engagement in the world meets beauty, the experience that arises is exhilarating, and can be almost ecstatic.

Sensory curiosity is one way that we connect to Life. Animals do this all the time – to the point that it is strange that many humans do not... My partner adopted a dog from the local rescue home – or more to the point, Rocky quite clearly adopted her – and while he was alive, I learned a lot from that dog. One thing that impressed me deeply was his perpetual and unwavering curiosity and optimism about the world, and what it might have to offer.

It is common to talk about “the five senses”; although most people realise that five is something of an underestimate. It is extraordinary that very little attention is usually paid to the somatic sensory range. In fact the “*five senses*” – sight, hearing, touch, smell, taste – only include the most obvious of the *external* senses and completely ignore all those *internal* sensations that also give us contextual and qualitative information about ourselves. Almost everyone knows when they need to go to the toilet, but maybe don;t consciously log that this is an internal sense that is telling them – in fact, a communication from the deeper more physiological and biological parts of the human organism that reaches all the way up into to the conscious mind.

There are several different ways to categorise and enumerate the senses. One common classification is to divide the senses into Interoceptive (internal) and Exteroceptive (External) – but as you will see, there is often no clear distinction. Rudolf Steiner identified twelve different senses (some of which include multiple sub-senses) : namely Touch, Life, Self-Movement, Balance, Smell, Taste, Sight, Temperature/ warmth, Hearing, Language, Concept and Ego^{2,3}. A New Scientist special issue⁴ on the senses listed about 10 clearly defined senses and another 11 “other” senses available to conscious perception. A very common medical classification found in physiology textbooks is based on a comparison with technical man-made sensors⁵ and transducers such as might be used in an industrial process:

- i. Chemoreceptors
- ii. Nociceptors
- iii. Thermoreceptors
- iv. Mechanoreceptors
- v. Photoreceptors

What is particularly confusing is the tendency in the English language towards disembodied ways of expressing interoception. For instance, it is common to say “*I am thinking about my body*” when what is actually meant is “*I am placing my awareness on my body so that I can feel something*”. “Thinking about” any sensory experience removes the observer to a distance and seriously blurs the distinction between imaginary and the imaginal. Because whereas the senses are information about the real here-and-now – the mind untethered by immediate sensory awareness in the present moment (particularly *somatic* awareness) may flit between the past, the future and never-never-land without even touching anything at all to do with here-and-now.

In reality(!), there is a seamless relationship in everyday and experience between detection of sensory stimulus, interpolation and integration of different sensory “systems”, and interpretation of meaning. It is *normal* for information from many different types of “sensor” to be integrated in complex ways as part of this process of interpretation. So although a transducer-like classification may be one useful reductionist way of describing afferent nerve endings; it can result in a very mechanical, simplistic, and inherently deceptive view of what is a very complex, holistic and fundamentally *organic* sensory system – that is (in ways that are essentially indefinable) enmeshed within the process of consciousness. Therefore one must be careful not to be deceived by the various categorisations of nerves into thinking that “sensing” is purely the assimilation of information via sens-ors.

I have put together below a rough (and necessarily incomplete) list of both internal and external senses that we *potentially* have conscious access to. When viewing this list, there are a few caveats to bear in mind. I have talked to people about their sensory experiences for about 20 years; and frankly, for a time I wondered how on earth we even communicate – so wide is the range of personal experience of embodiment, the embodied connection to the sense of identity and to the external senses (and therefore to the external environment). We do *not* all access our senses in the same way, or use them in the same way, or interpret them in the same way. Which can make meaningful and accurate *verbal or written* communication about anything of an experiential nature extremely difficult, and potentially deceptive. Most languages and language-users assume that information is adequately conveyed by use of that language. But this is not the case with regard to internal and necessarily subjective experiences. Perhaps Sanskrit or Pali might offer an exhaustive categorisation of possible experiences, but even then – there is a difference between an intellectual knowledge of a word, and the experiential basis underpinning it. One can think one understand something, and actually not understand it at all until some internal switch flips to an unaccustomed “ON!” position and *something* is experienced. I am always particularly impressed by the way “Good”, “Fine” or “OK” in English can mean anything from vibrant health and happiness through to being suicidal or on the verge of death – though this is more related to the use of language and sarcasm than the details of experience. The tricky interactions between linguistics and sensory experience will keep returning in future chapters like weeds in an old untended garden.

Very few people indeed have immediate and full access to all of the senses listed below. Some people can consciously access them all. Some people only have access to a few, and even those are somewhat muted – but nevertheless, often have non-conscious or subliminal access to the same information. Some people happen to be able to integrate some of their senses in a synaesthetic way that may massively increase the qualitative experience of living. Many people have access to inner senses – but may have been told that these senses are unreliable (or that body sensations are unimportant) – so they ignore and mistrust them ... and so through lack of use have temporarily mislaid them. The senses are not strictly “lost” in the way that word is usually applied in this context – gone forever. Rather, they are “lost” in the way that a screwdriver might have fallen down the back of a workbench. Finding it again requires that either we accidentally come across it in a period when everything is reinspected and turned upside down – or we realise that there is something missing, and initiate a more systematic search through old memories and experiences.

One critical aspect of accessing any sense is that *we believe that we can*. If there is no belief that the sense even exists (or that it is not possible to sense a particular thing or quality or in a particular way), then effectively that sense cannot exist for that person. So at the very least it is important to be *open to the possibility of the capacity for awareness*. This non-sceptical approach to the senses opens a far bigger world than the one commonly acknowledged in popular culture, which has increasingly tended towards a sceptical, restrictive and in my opinion pseudo-scientific view of human capacity (the position often taken is “*if science hasn’t proved it, it must not exist*”). A secondary aspect of this necessary belief is **trust** that the sense has some kind of *meaning*, and that it is – for the purposes we are using it – *reliable*. So immediately there is one important rule that arises directly from a paradigm of Wellness (Chapter 3). That is that **the senses are fundamentally reliable**. Even if you don't understand the information being offered by them, it is still meaningful, and something is causing your sensory system to give you this information.

I have heard all the sceptical nay-saying that has entered Western culture, increasingly over the past couple of decades, and seen most of the optical illusions supposed to convince us that the senses are unreliable. Let me put it this way... just four arguments out of many possible ones...

- Something deliberately designed to fool the senses is not an indication of their general reliability. Just because there are a few con artists in the world does imply your grandmother is also a con artist. The presence of a few optical illusions does not invalidate all the sensory system – it doesn’t even bring the sense of vision into question in most situations.
- If senses are really unreliable, and we have relied on them for survival for hundreds of millions of years – how come we are alive as a species?
- And if you don't trust your senses, whose do you trust? Because all the information that we have about the external world (and internal world) comes one way or another through somebody's sensory system.
- List times when you do rely heavily on your senses all the time – catching a ball, feeling complex emotions, knowing where your arms and legs are ... So why single out specific senses as being unreliable (or unreliable in certain situations) when you implicitly trust your senses on these other occasions?

All of this debate on the capacity of the senses is in many ways based on a way of

thinking that puts the cart before the horse. Consider a creature in the Cambrian explosion, swimming or crawling in those fertile seas, surrounded by potential food and potential predators. Every fiber of its being must be attuned to its senses so that it can eat and not be eaten. David Bohm⁶ considered that Sensitiv-ity precedes and is primary to all of the senses. It is the will – the intentional capacity to be sensitive that leads any organism to access the greatest richness of information and then to filter that information (through Gestalt and Meaning – see next chapter) so that the most important, immediately relevant, and survival-critical is foremost in its awareness. There would be no formation of sensory organs without the will to sensitivity, and that will must be expressed at the very beginnings of Life – both from an evolutionary point of view, and in the first microsecond after cell fertilisation or division. As the will to sensitivity, so Sensitivity (the maximisation of receptiveness) pushes towards a more hard-wired adaptation (such as the evolution of an eye) and towards the capacity to be selective in what is being sensed.

If somatic/internal sensory experience is included in the category “touch” (both being body/ somatic sensations that reflect or arise in physical processes), then the “five senses” are in fact a list of the means by which we gain awareness of anything and *everything*. So there may be crossover or displacement of one sensory channel by another by habit or conscious/unconscious preference, and many of the more subtle and less well recognised senses are experienced through the medium of the main senses... *Somehow* the information must be conveyed from the peripheral nervous system (and internal pre-processing and synthesis that takes place automatically) into the conscious mind.

I have also attempted to categorise the sensory list below – so far as is possible – into External (**X**), Contact (**S**) and Internal (**I**). What rapidly becomes apparent with some of them is that there is not such a clear distinction between what is sensed/perceived internally or externally. The somatic senses (internal sensations coming from the physical body) are particularly important for the purposes of dealing with trauma – since one aspect of trauma is dissociation, which often involves a loss (or distortion) of internal/somatic senses. In fact, a loss of somatic awareness is one aspect of dissociation.

We don't see things as they are ...

We see them as we are.

- Anais Nin

Sight (X) : The visible electromagnetic spectrum is detected mainly through the eyes, via Cranial Nerve (CN) II. Eyesight consists of two quite distinct senses. Foveal vision, mediated by colour-sensitive cone cells, gives us detail. It takes place the zone of

central focus of the eye – an area less than two millimetres across at the back of the eyeball, containing less than 1% of the optical nerves. However, most of the optical nerves are non-foveal (“peripheral”) rod cells. Peripheral vision sees the world in black and white, works far better than foveal vision in low light conditions⁷, and detects peripheral motion. The full colour images of the world that we “see” in normal experience are not strictly detected by the eyes... The foveal information – a small central spot of colourful clarity – is added to other previously viewed foveal dots (the eye dances around at a rate of about three random jumps per second – “saccades”) and to black-and-white peripheral images ... And what we “see” is actually a constructed composite that is the brain’s best guess from those saccades and peripheral images of what the big picture might look like, pieced together from less than 10% of the actual picture.

The world rests in the night. Trees, mountains, fields, and faces are released from the prison of shape and the burden of exposure. Each thing creeps back into its own nature within the shelter of the dark. Darkness is the ancient womb. Nighttime is womb-time. Our souls come out to play. The darkness absolves everything; the struggle for identity and impression falls away. We rest in the night.

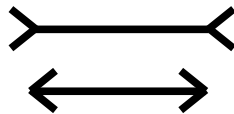
John O'Donohue⁸

With such a high degree of post-processing, interpretative layers, expectation (anticipation) and interpolation in the sense of sight – vision is the easiest sense to trick; and so most sensory illusions are visual “optical illusions”. We definitely have a tendency to see what we expect to see⁹ because that is the very nature of vision¹⁰. It is inherently impossible to see all of anything, and therefore much of interpretative vision (seeing “something” instead of an abstract set of light, dark, lines, colours) requires that the dots have to be joined in a way that does not distract from the *practical application and use* of sight. If you look at a house, the walls and roof facing you can be seen, but nothing else. It is only familiarity with houses and perspective that makes you assume that this is a solid 3-D object of a certain size, that the flat slightly reflective surfaces are transparent, that¹¹ it indeed does have more than just a frontal aspect and is not a Hollywood prop, and that its roof is angled relative to the walls. The subject of visual gestalt is given a more attention in Chapter 5 (Meaning).

The post-processing of vision also enhances certain aspects that are considered to be particularly important, so what is seen by the eyes is rarely what is seen by any kind of optical capture device such as a digital camera or roll of light sensitive film. Anyone who has attempted flower photography can testify that the sense of vision automatically

enhances and increases the saturation of colours¹². A wood full of bluebells may appear to the eye as a glorious display of purple and mauve, because the brain enhances the parts of what you are seeing/sensing that you are attributing particular importance to. But the camera is neutral and hardly shows this glory at all unless the lighting conditions are absolutely perfect.

Culturally, people living in the Western world are surrounded by straight lines and rectangular corners in their normal environment. This in turn creates a sensory *expectation* of straight lines. This *expectation* of linearity is one basis for the sense of perspective. Thus, many optical illusions are based on fooling the interpretative part of the visual cortex which is programmed by our everyday environment to expect straight lines. Presenting curvy lines in certain ways, or messing with lines of convergence and divergence fools the visual expectation of normality. Both the Ames Room illusion¹³ and the Müller-Lyer illusion (see figure below : the horizontal lines are of equal length) have the strongest effect on people from western cultures, and tend not to fool people who have grown up in a more natural, less rectangular and perspective-dominated environment.



The difficulty in judging length in the Müller-Lyer illusion is related to the fact that all information is naturally contextual, and the eyes are always looking for comparative points of reference - for difference. And some things in the natural environment are more contextual than others – in which case the senses tend to be more interested in the context. Length is one of those – if only because apparent length (and size) are affected by perspective and distance. And by expectation. A half-ton ox standing 6 feet high at the shoulder is large but not unexpectedly so – whereas a three-foot long rat is really big!¹⁴ So one could fairly easily estimate the distance that the ox was standing at, but would have to cross-check the rat against other familiar objects and linear relationships – there is a word for that internal exclamation mark – a “double-take”, because of the internal sense of disorientation that the ab-normal can create. On the other hand, angles and proportions are hardly affected at all by context, and so the capacity to visually discriminate angle and proportion is sensitive to extraordinarily detail. Aircraft cockpit instrumentation is therefore based on the use of dials – because a small change in angle can be noticed far more easily than a small change in length. In a similar manner, verticality and horizontality can – with practice – be estimated

almost as accurately as being measured by a bubble level. Proportion is extraordinarily sensitive, and is partly visual but also somewhat visceral in nature. Le Corbusier's brutalist architecture was softened by his use of golden section proportions, and the hanging of a picture on a wall.

One important thing to remember about all optical illusions is that they present geometric combinations to the eye that are not found in the natural world. So there is no good reason why the optical sense should have developed a capacity to discriminate in these situations. Simply put, Ames Rooms and Müller-Lyer figures do not usually exist in the normal world, and even if they do, their presence and an ability to "see" them is not survival-critical.

Runeson¹⁵ explains how, for the specific case of the Ames Room, that even though it was technically possible to build this equivalent configuration, it wasn't ecologically likely enough to have influenced the development of a smart perceptual mechanism attuned to the ecological constraints of its environment; in fact equivalent configurations are so ecologically implausible that it's not even clear how a perceptual system could begin to acquire the necessary assumptions the cognitive approach claims it requires to cope¹⁶ ...

There have been a lot of attempts to model brain function mathematically. Although this has not really revealed how the brain works in any major way, it has revealed some interesting glimpses. For instance, it is necessary for the connections in the brain dealing with visual information to have some regular structure. The reason we know this is that random connections tend create or amplify Turing patterns¹⁷; and if this were happening we would hallucinate every time we looked at a tigers stripes or a leopards spots (or even if were were to look at our own fingerprints).

Part of mammalian evolution appears to have been as small rats scurrying round at night to hide away from dinosaurs. With only night vision being necessary, there was a loss of colour receptors in laterally placed eyes (as is found in birds) - in favour of a binocular (forward-placed) pair of eyes equipped with peripheral vision highly sensitive to motion and only two different colour receptors. Most mammals are therefore colour blind to some extent, primarily sensing blue (and possibly ultraviolet). However, about 30 million years ago primates re-evolved red-green discrimination, leading to modern-day trichromatic human macular (cone) vision¹⁸. Birds, on the other hand, have an evolutionarily more mature and rich pentachromatic (green, blue, red, violet and black/white) cones which in many birds have an optimised random spacial distribution¹⁹ on the retina allowing them to have intensely detailed vision. Thus, an

eagle is able to identify a mouse at about one mile distance.

The visual bandwidth employed by living creatures appears to occupy an extremely narrow range of the electromagnetic spectrum. Of all the possible frequencies we *could* detect, the visible spectrum occupies a tiny range²⁰. Insects and some animals (such as birds) detect ultraviolet (UV) frequencies, but anything higher than near-UV is unlikely to be emitted by living organisms. One might think that infrared (IR) would be a useful sense, and indeed it is at night or during winter, so some nocturnal animals do possess IR vision. However, on a sunny summer day the IR detectors would be blinded by all the emitted and reflected heat, so sensitivity beyond near-IR is a potential liability and not usually a visual sense. Radio frequencies (far-IR) are not emitted by living organisms, and the lower radio frequencies pass through living tissue, so again these very low frequencies are less useful. It may be that some people are sensitive to near-IR and/or near UV. The photodetectors in the eye – particularly the black-and-white peripheral vision rods – are sensitive to single photons; and so extremely low levels of light can (potentially) be processed visually provided that one is open to very ephemeral and indistinct perceptual impressions.

Sight (X & I) : There is also an internal awareness of light other than that found in the eyeballs. The pineal gland senses light penetrating the eyes and skull, deep inside the brain. Most biological structures – even thin bones – are translucent. And all cells of the body – including the skin – exhibit a potential directional awareness of some parts of the near-visual (Infra-red) electromagnetic spectrum²¹ (which seems to go so far as visible light and colour sensitivity in some people)²². The skin is an accurate IR sensor (see Temperature sense below).

Sight (I) : We also possess an internal capacity for “visualisation” or a “mind's eye”. There is a lot of confusion around this point, centred on the difference between imagination (making something up), and the imaginal realm (using the mind's eye to access subtle sensory information in a visual manner). The capacity to visualise and to have visual memories²³ is so common and generally important that its absence – inability to visualise is a recognised condition²⁴ – “*aphantasia*”. As in all cases, the brain and mind are adaptive and creative, and where there is a loss of one sense (be that external or internal), other ways are found to function. It is suspected that aphantasia may have (sometimes?) have some relationship to dissociation due to trauma, because it reduces the emotional impact of memories.

12 Not wanting

the five colours
blind our eyes.
The five notes
deafen our ears.
The five flavours
dull our taste.
Racing, chasing, hunting
drives people crazy.
Trying to get rich
ties people in knots.
So the wise soul
watches with the inner
not the outward eye,
letting go,
keeping this

~Tao Te Ching (Lao Tzu, ed. Ursula K Le Guin)

The Inner vision is a portal to many forms of sensory information that cannot be easily classified. For, although I have argued against the idea of “five senses”, in fact the five senses are the means by which ALL the senses are conveyed to consciousness. The inner senses in particular are the way in which we access this “extra-sensory” information. The information provided by inner vision is not truly extra-sensory (i.e. some strange sense that only a few people have and which may or may not exist), but the inner eye (and the idea of vision and the visu-al) is a powerful means by which we can be aware of things that are not within the scope of the plain vanilla five senses to detect. It is a form of communication between *some level(s) of our being that we only have indirect access to*, and our waking conscious awareness. The inner vision and the other inner senses (such as inner somatic movement) can be subtle, and are only of use if they are trusted. Although the external senses may appear to be distinguishable in a nominal fashion from these inner senses, when there is some level of fluency in using the inner sense, there is something of a seamless transition between inner and outer. There is a sense-ing. Asking “how do I know that?” in a way that is curious about the process of sensing and the small details of how it came into awareness – can expand these senses. Asking “how do I know that?” out of incredulity engenders disbelief and they are no longer available or accessible in that form, though people may still have access to some less definable “gut instinct”. But reliable gut instinct is actually access to the body’s sensory system. Again, if that is not trusted and used, it becomes less

available and less reliable.

“Let thy imagination be guided wholly by nature” advises the *Rosarium*. “And observe according to nature, through whom the substances regenerate themselves in the bowels of the earth. And imagine this with true and not fantastic imagination.”

So, first of all let it be clear that our Philosophy disdains what commonly passes for imagination: mere fantasy which is no more than the fleeting passage of dim involuntary images through the mind. True imagination belongs to the Spirit. That small portion of our totality which we have ignorantly come to think of as ourselves can only passively look on as the Spirit creates its images for our delectation or terror.²⁵

Sound (X,I) We can hear frequency (pitch) & quality (e.g. Timbre, Loudness, Intonation) through the ears. The middle ear (CN VII) picks up external sounds direct through the auditory canal, and indirectly through bone conduction in the head. There are also lateral line pressure sensors²⁶ at the sides of the body, which detect deeper sounds, pressure changes, and rhythm. The viscera are also attuned to very deep low frequency vibrations. What we call sound covers the entire range from the high pitched whistling of a shrew or bat and the hissing of grass in the wind (about 30,000 Hz), down to low double bass notes that can be felt in the body (about 20 Hz) down to even lower frequency pulses that we detect somatically and viscerally as physical throbbing, vibration and rhythm... The sense of hearing is similar to the eyes in that what we “hear” is a synthesis of all these different sources (middle ear through the external auditory canal, middle ear through bone conduction, lateral line pressure sensors, visceral/somatic vibration and pressure changes), without us realising this is happening. The habituated impression is usually that it comes through the ears, because we “think” of the ears as being the organ of hearing, and tend to believe that so strongly that all hearing is attributed to the ears.

And like inner vision, there is an internal “self-talk”, which also has the potential to act as a synaesthetic way of accessing “other” senses. It can be less easy to use reliably than inner visualisation, because it is more easily confused with generated thoughts.

Make everything in you an ear,
each atom of your being,
and you will hear at every moment
what the Source is whispering to you...
you are -we all are-the beloved of the beloved,
and in every moment, in every event of your life ,
the Beloved is whispering to you
exactly what you need to hear and know.
Who can ever explain this miracle? It simply is.

~Rumi

Direction and Echolocation (X) is also part of the sense of human hearing – hence the existence of blind football teams²⁷. The directional sense compares arrival times of sounds to the left and right ears, being able to detect variations of as little as a millisecond. Clearly this is not processed consciously – because the conscious mind is only able to run at about 10 Hz, not 1000 Hz. But nevertheless, the directional sense is accessible consciously by deliberately placing our attention in that internal place where it resides. We can *choose to be more aware of direction...* Which again reveals something more of the general state of relationship between cognition and the senses. There is a participation and cooperation. The conscious mind requests information for a particular purpose – and the sensory system responds. Therefore there is no real knowledge of what the senses *can* provide unless there is an active and ongoing exploration of their capacity. Animals do push their senses to the limit all the time. My suspicion is that the reason “*animals senses are more acute than humans*” (which way of thinking almost explicitly categorises hunter gatherers more as animals) is that most humans no longer rely on their senses in the same way for survival, so they are not constantly actively using them. We do still use our senses a lot – but for most people it is more unconsciously – in socialisation, body language etc.

The human capacity for echolocation in particular gives a clear indication of the degree to which post-processing is integral to the senses. It is not the ears that echolocate – but rather the *visual* part of the brain^{28,29} that compares what is coming into left and right ears. i.e. the echolocation sense is inherently *synaesthetic*. Complex non-cognitive post-processing of this kind is dependent on a conscious sense of meaning being used to train the brain to attach significance to certain subtle differences, and then to pass that information back to the conscious mind “when requested”. The feedback process of training the senses is more potent at an early age, but is there throughout life, and the echolocation sense is a fantastic example of its working. There is conscious attention to an abstract principle of “direction”, which is conveyed to the brain by (i) a heightened interest and curiosity or urgency, (ii) movements of the head and neck consistent with a need to know direction, and (iii) heightened attention to a specific sense. The more detail that is considered in this process, the more improbable it appears to be – without some layers of adaptive intelligence in the neural circuits themselves *that is aware of the conscious mind's intention*. Suggesting that consciousness is a holographic phenomenon, and not just constrained to cognition. This can be recognised in all the other senses – the interest in the beauty of the colour of bluebells causes that patch of colour shine out more than would be captured by a camera. There is a subtle and sensitive feedback loop that listens to the conscious

mind's "this is what I want" and then says "here it is".

Taste (S) is usually considered to be another external sense. But actually the tongue is only semi-internal to the body, and provides a chemical sense of contact in that space between inside or outside (think of licking a lollipop). The tongue (via CN V3, VII, IX, X) can detect a handful of basic flavours : salty, sweet, sour/acid, bitter, pungent and Umami³⁰. Even 6 month old fetuses appear to have a sense of taste. An experiment on humans in the early 20th century showed that there was a deliberate ingestion of amniotic fluid if a sweetener was added to it.

It is not possible to consider taste without also stepping into the no-mans land between the real and imaginary, and between the body and the mind, because ...

Smell (X,S) is often confused for taste. Strawberries taste sweet, tangy and acid, but that classic strawberry taste reminiscent of rose-apples is taken in by the sense of smell. "Loss of taste" is in most cases a loss of smell. It has been recently realised that quantum effects³¹ in the olfactory nerve (CN I) give us access to tens of millions of different odours. The main application of smell is in identifying things that are familiar. So smell/taste is only as useful as we have bothered to take the time (and interest) to have curiosity about what this sense is bringing to our attention. Most of the nerves for the sense of smell lie at the cribriform plate at the very top of the nasal turbinates. It is interesting that we have the ability to deliberately direct air up towards the upper nasal passages, so that we can better smell something. If you're not sure about this, try smelling a rose! Richard Feynman, the famous 20th Century physicist, had a party trick where he tracked his guests route through the house by using his sense of smell, with his nose to the floor like a bloodhound³².

There is also a Vomeronasal organ located halfway up the nose, which detects hormones (related to social/sexual signals and emotions in other people), whose sensitivity varies with diurnal cycle. If one considers taste and smell as being chemoreceptors rather than something that gives immediate qualitative information), they extend right through the oesophagus, stomach and most of the digestive tract. Here we are able to detect fats and proteins that are a strong source of energy – and rapidly learn to associate certain combinations of smell and taste with a high likelihood of ingesting high calorie foods. As such, the sense of smell seems to extend through a remarkably wide range of biological levels. On the one hand we can *recognise* complex and nuanced odours, and in order to do this we must have encountered them before and stored that sensory experience as a recallable memory. On the other hand,

smell connects directly through to digestive processes, peristalsis, salivation, activity of the gut microbiota, appetite, and from there (only slightly less directly) to energy metabolism and fat storage.

Overall, the sense of smell is considered the least explicable of the senses. In Latin, “Sagacious”, meant not only a keen sense of smell, but also clever³³, and “*olfactory imagery was employed in Classical Greek and Roman literature in order to describe beauty, ugliness, moral worth and virtue*”³⁴. Taste and smell also figure strongly in modern common phrases that describe the best and the worst – “*she's so sweet*”, or “*it stinks*”, or perhaps even “*the essence...*” The smell of a person or an experience can be the most lingering of memories. I have a particular love of the smell of dust that has been dry for many weeks, and which, on being wetted by the first rainstorm, releases a heavy earthy fug; that seems to also bring with it a complex emotion tinged with of hope and plenty.

*...whereto agreeth the doctrine of Theophrastus. Arise O North-wind, and blow thou South upon my garden, that the spices thereof may flow out; For the North-wind closing the pores, and shutting up the effluvioms, when the South doth after open and relax them; the Aromatical gums do drop, and sweet odours fly actively from them*³⁵.

18. A transcendent Perfume made of the richest Odorates of both the Indies, kept in a Box made of the Muschie Stone of Niarienburg, with this Inscription -

Deos rogato Totum ut te faciant, Fabulle, Nasum

*Just one sniff, Fabullus, and you'd wish you were one huge nose!*³⁶

Touch/skin contact (S) is a hugely adaptive sense. There are particular parts of the body that are particularly sensitive to touch – the face, the hands, the lips and mouth. Fingertips possess about 25,000 sensory nerve endings per square centimetre! The range of information that can be obtained from touch alone is vast, as Helen Keller³⁷ could tell you. Touch may be anything from superficial to deep, and includes sensitivity to pressure, texture (rough, sharp, smooth, slippery, soft, hard, etc.), vibration and moisture. So I can have a pocket full of small items and use my fingers to detect the difference between a plastic button and a small coin. I have seen this discriminatory sense of touch being used in Sri Lanka by people who mine alluvial gravel deposits for semiprecious stones. An experienced gem miner can run his fingers briefly over a handful of pebbles, and the tiny variations in glassy-soapy-waxy-plastic (and similar) textures allow him to know what kind of gems he is holding. Tourmaline feels different from sapphire, and so on. In a modern western culture, slightly different

senses are usually applied for different purposes. The ability to find the gap between two sheets of paper, or to hold a sledgehammer or an eggshell. The complex integration of senses necessary to drive a car on a foggy night on an unfamiliar road.

Once we begin to think about general skin and body contact, it is clear that (much as sound has a continuity of experience across the frequency spectrum that ends up as viscerally-sensed vibration and rhythm) there is a continuity of experience from very light superficial skin contact through to deep sensations of tissue being compressed deeper in the body.

One of the most sensitive parts of the touch sense is in the mouth. I usually know that a pot of fresh nettle tea has brewed because the tea feels to be slightly more viscous. Babies orient to the world firstly through their mouth, and will place everything they find there. It is only later at maybe a year old that the hands start to become more dominant tools for physical investigation. Even now I still find some fascination (since I first started getting interested in the capacity of the senses some 20 years ago) in the process of finding and isolating a small bone in a mouthful of fish and miscellaneous vegetables ... and (considering that the movements of the tongue³⁸ are largely non-conscious) how intelligent is the interplay between the muscles of the mouth/tongue³⁹ and the sensory system. Purely from a survival point of view the nervous system is particularly attuned to whatever goes on in the mouth and nose. We rely on them for air food, water, and social communication; and as openings they are particularly vulnerable parts of the body.

The variations in texture that we can perceive with our fingers (but also with many other parts of our skin) is truly astonishing. We can feel moist and dry, and can even tell if the moisture is slightly slimy or gloopy or sticky. A single quick thumb movement over a blade edge will tell its degree of sharpness. Cats fur feels different from that of a dog, or human hair because of variation in its surface texture on the micron level. Even different types of metal have different “feels” to them.

The sense of touch gets even more interesting. Many people can tell the difference between an invasive or needy touch, and a loving or supportive touch – even when the physical pressure is the same. This capacity to intuit emotional content in touch may come from subtle tells of muscle tone, or there may be another sense that is so far unidentified. Whichever is the case, emotion or mental state or intention result in different qualitative experiences. The sense of touch itself has so much depth and range of perception that it would not be unreasonable to devote an entire book just to this

topic.

Skin hairs are a sensory extension of the skin. They work in a similar way to a cats whiskers, are an extension of skin-touch – and can indicate proximity. They can also detect air motion and static electricity.

Temperature (X,S,I) is detected by several different sensory faculties. Hot and cold skin sensations are detected by two quite different sets of nerves^{40,41}, which at very high or low temperatures also cross over into nociceptive senses (pain resulting from tissue damage). The mediator of the temperature sense is located in the midbrain, which is also the main brain area dealing with emotions.

A *different* temperature sense is the external/non-contact sense of radiant infra red, (which may be more related to the capacity I mentioned earlier for skin to be a light-detecting sensory organ). Jean-Pierre Barral runs courses that teach how to achieve a sensitivity down to a difference of about 0.1 to 0.2°C radiant infra red⁴² – almost as accurate as a hospital infra red camera – by simply using the palm of the hand to “scan”, moving about four inches away from the body. Note that the temperature detected is *relative* rather than absolute⁴³. Radiant infrared occurs across a wide spectral range⁴⁴, and whilst the skin does not appear distinguish between these different frequencies, we tend to detect far infrared simply because that is the frequency band emitted by warm blooded animals.

There is also a deep body sense of warmth/coldness, and a special visceral sense that warns us when the CSF is overheating in the head. Qualitatively, most of the senses of warm/cold are also related to senses of moisture and dryness, so it is possible to distinguish a warm moistness from a dry heat, and dry penetrating cold from a more damp clammy or icy cold.

Pain, tissue damage & inflammation nociceptors (I,S) Itching is the first level of sensation that indicates an inflammatory response in the skin. There are various depths of nociceptor (a nerve that detects tissue damage) – cutaneous, internal (muscle/nerves) and deep visceral. The nociceptive system is innervated via the Autonomic Nervous System, and therefore is strongly associated with minor blood vessels. Pain is a modern epidemic, with about 10% of the UK population having been prescribed opioids (the strongest available painkillers) at some time between 2015 and 2017! The perception of pain is strongly linked to emotional and mental states, and to belief systems about how the body works. The use of attention in certain ways is capable of escalating or de-escalating acute and chronic pain.

Proprioception⁴⁵ (I?) The ability to tell where your body parts are, relative to other body parts is vital for movement. Proprioception includes sensations of muscle movement and joint position, including posture, verticality, movement, and facial expression. Neurologically it is mainly dependent on stretch receptors in muscles and joints. But like hearing and vision this sense is also integrated through several senses⁴⁶ – such as balance. Vision is integral to the sense of proprioception – though not absolutely necessary. If you ask most people what position their left arm is in, they will first look at it, in preference to feeling its location by using interoception. Of course, both of these are being used simultaneously, but the personal and cultural preference tends to be biased towards vision⁴⁷, and culturally we have been taught to believe our vision and have less trust in our somatic senses⁴⁸. Proprioception is also dependent on an internal self-representative map, which (thinking of e.g. anorexia) is *also* connected to the more abstract sense of self-identity (“self-image” – another nod towards the visual sense).

A sense of **Midline** (I) is an extension of (or maybe a precursor to?) more general proprioceptive senses⁴⁹. Steiner’s sensory category of “self-movement” includes proprioception. If anyone has ever had extensive light bodywork or body psychotherapy treatment, they will know that there are *at least* three very distinct forms of movement that each have very distinct qualitative experiences. One is normal voluntary movement. Another is normal involuntary reflex movement, usually associated with rapid turning the head (orientation reflex) or other reflexes (e.g. hand near a flame). The third is a strange, sometimes viscous and slow, non-voluntary movement that is essentially self-corrective and primitive that can be allowed to happen (and access to it is something of a skill that can be cultivated) – and can also be overridden. It might typically unravel congested tissue or maybe expresses some incomplete gestural movement from as far back as embryological gestation.

Direction (X, I?) is a very interesting sense. A very few people in modern culture consciously retain a strong dependable sense of direction. This is usually based strongly on memory of familiar landmarks, but may also include use of other visual clues or even (e.g.) a sense of smell (how close am I to the sea?). But people who live in wilder places tend to have a stronger sense of direction. Sometimes that sense of direction is relative, based on familiar landmarks, and and fairly easy to confuse once these landmarks are no longer available. The sun, moon and stars are always useful points of reference⁵⁰. However, there are “Geographic Languages” in a few parts of the world (e.g. Northern Australian Aborigines) in which people do not say “that ant is to

the left of your foot”, but rather “there is an ant Northwest of your foot”. Speakers of geographic languages can be driven blindfolded in tortuous routes, taken into a building with no windows and still be able to immediately use their directional language with accuracy. This suggests that the geographic sense may be a magnetic⁵¹ sense⁵², and maybe the handful of visual receptors adapted in Robins⁵³ to detect⁵⁴ magnetic fields using cryptochrome⁵⁵ are also present in humans.

It is clear that the geographic directional sense is available in these cultures because it is embedded in the language. In a language that does not rely on geographic direction, the user has no need to direct his/her awareness to this directional sense, and does not learn to use it from childhood. Streets are named, there are many visual landmarks and clues – to the point that a geographic sense of direction is more or less superfluous to anyone in a “developed” country who is not faced daily by impenetrable forest or miles of featureless grassland. Maybe we all possess a magnetic sense, just as homing pigeons⁵⁶, turtles and bees and hundreds of other species (including protists – primitive bacteria) appear to do? As humans, we certainly *all* appear to possess an abundance of proteins in our eyes (cryptochrome or CRY2) that can detect magnetism⁵⁷. It has been known for some time that cells can construct magnetite⁵⁸ (i.e. ferromagnetic) crystals. A recent experiment⁵⁹ has shown that human brain activity responds to shifts in magnetic field direction. Furthermore, it appears to calibrate itself to the normal background magnetic field (strength, angle of dip), so it can tell if there is a sudden change in orientation or dip, and will filter that out. This ability to discriminate between natural “normal” and abnormal magnetic fields (and to deliberately screen out signals that are abnormal, including ones that are far too large) has also been observed in experiments looking at the biological effects of anthropogenic electromagnetic “smog” from radio transmissions and electronic devices (see below).

As an interesting twist, a geographic language fixes the sense of identity inside a broad and timeless landscape. Whereas a non-geographic language is far more egocentric, immediate and ephemeral, with everything being relative to the individual’s personal orientation at any one moment. I was recently surprised to find during a conversation that my sister in law – who struggles to tell left from right – has always oriented herself based on the landscape (external references) rather than having an internal frame of reference. So it could be that “difficulty telling left from right” is sometimes an issue of the person identifying themselves as part of the environment – as opposed to the environment rotating around their identity. When attempting to duplicate this, I find that I automatically drop into something more like de-focussed vision – a state in which

external and internal senses are equally available.

Time (I) There are several internal (biological) clocks, some of which we may be available⁶⁰ to be used consciously. Humans have a structure of about 20,000 neurons in the hypothalamus called the suprachiasmatic nucleus (SCN), which is also present in all vertebrates – and receives light directly from the eyes. The job of the SCN is to synchronise the biological clocks of the body with the solar day, into a coherent diurnal cycle. Biological clocks are present in almost every organ and cell type in various forms, (with e.g. one time-keeping molecule flipping over every 24 minutes⁶¹) and are fundamental aspects of metabolic regulation for every kind of cellular life^{62, 63}. The sense of diurnal (24-hour) time in humans was thoroughly investigated by the American and Russian space programmes in the 1950's-70's. They showed that the synchronisation of this internal clock with the solar day was crucial for all aspects of physical and mental wellbeing^{64,65} – since it controls critical aspects of the metabolism such as cerebrospinal fluid production, activity of the pineal gland, sugar, cortisol, and adrenaline – in addition to mood and cognitive performance. Although particularly sensitive to light, the diurnal clock is also affected by exercise and sensory stimulation. One can think of the entry of light into the brain (or into the cell) as a means to calibrate the “internal” clock with the “external” environment.

The experience of the moment as a meaningful event is not only about “now”. It requires that we also have awareness of a short preceding timeframe so that the present moment exists within some form of recognisable context. This function in a human being appears to be performed by the Insula; though the fact that single cells can decide to retrace their previous movements would suggest that the Insula is merely a more sophisticated version of something that is present in most lifeforms. The Insula is a kind of first-in/first-out (FIFO) rolling memory.

Electrical/Electromagnetic senses (X,S,I) The earth has an electrical environment⁶⁶ with substantial voltages moving through the ground, electrical potentials in the air (about 200 Volts/metre vertically), and a range of natural electromagnetic frequencies caused by resonance of light waves around the Earth's atmosphere⁶⁷, and activity in the ionosphere in response to the solar wind. We have evolved inside this electrical environment since Life first began, and it is inevitable one way or another than its presence has influenced our cells, and that they are responsive to it. I'm not sure that this is specifically a sense in the normally accepted meaning of the word (though some fish and eels use it as one of their primary senses). To quote Stephen Harrod Buhner :

To gain an idea of just how sensitive to weak electrical signals these fish are, if you connected wires to each end of a 1.5 volt flashlight battery and placed the other ends of the wires two thousand miles apart in the ocean, sharks and rays would be able to detect the electric field that it produced ... Some fish have been found to be sensitive to fields as tiny as 2.5 billionths of a volt.. This sensitivity is nearly refined enough for the fish to count individual electrons as they touch the surface of its skin ... Paddlefish (and sharks and rays) can not only detect the weak signals themselves, but can also tell from them just what kind of fish they are sensing and whether or not it is their preferred food. They can tell how many fish there are, their size, age, and level of health; they can also pinpoint the location of the fish so accurately that they can find them in the extremely large ocean in which they are swimming (p. 60)

Oscillating external electromagnetic fields can entrain or phase-lock heart cells so that the organism that we know as ourself moves into synchronicity with those electric fields. We are, in fact, supremely able to perceive and be affected by extremely weak electromagnetic fields from the environment (p. 112)⁶⁸.

“There is no fundamental lower limit with respect to the magnitude of the perturbation that is still capable fo influencing a nonlinear oscillator” (Paul Gailey)

To what extent we humans also possess electromagnetic sensitivity is debated, but it is likely that we use it all the time and simply don't notice because we don't think we have that sense. Some people definitely suffer from a capacity to be sensitive to (conscious of) the invasiveness of radio-frequency electromagnetic (EM) noise. Most people who are this sensitive are aware of their nervous system being jangled – so this may just be that some part of their CNS is more easily entrained by this EM noise. And most of them are unable to switch this sensitivity off, as EM sensitivity often comes hand in hand with distortions of the proxemic sense ...

Proxemic sense (X,I) : Body and social (proxemic) space is the distance from our body that we unconsciously consider to be our zone of safety. I think everyone must know the discomfort that is felt when someone (who is not in an intimate relationship with you) comes just a little bit too close. On one level the proxemic sense is an acute awareness of the balance point between safety (is this possible danger far enough away that I feel safe?) vs support (is this possible source of support close enough so that I feel supported?) The topic of Proxemics will be covered in a lot more detail in Chapter 7. The effect of external space is sensed by most people through an internal (interoceptive) awareness of comfort vs discomfort/unease.

Equilibrioception (X,I,S) is the ability to keep your balance and sense body movement in terms of acceleration and directional changes. It is yet another integrated sense, relying a combination of the labyrinth of the inner ear (the “balance organ”) via CN VIII, stretch receptors in muscles and joints, vision, the Kinaesthetic sense (acceleration), and pressure on the soles of the feet. A circus gymnast would use all of these senses to orient – and indeed, if they could not they would probably not have the coordination to do the job. However, this access to senses does not have to be fully conscious once the skill has been learned – it merely needs to be integrated and available for coordination of movement. I only realised this when I was talking to a patient who was a gymnast. I said how wonderful it must be to have such a wonderful awareness of where her body was as it was performing a somersault – to which she replied “*Oh – it doesn’t work like that at all – I just decide to do a particular movement, and then it happens!*” Maybe there was a time when she was learning to fly through the air that this had to be conscious. After a certain point all movements become semi-automatic and there is no need to be conscious of them at all.

Chemoreceptors (I) of various kinds in the body send trigger and area of the hindbrain (medulla) involved in detecting blood-borne hormones and drugs. The gag/vomiting reflex is a particularly strong signal that often follows feelings of disgust (see section on emotions below). The Carotid Body is a particularly important chemoreceptor. Situated in the side of the neck, it inspects the arterial blood entering the brain to determine oxygen (O₂) content. Carbon dioxide (CO₂) and blood acidity (pH) are sensed mainly in the Medulla Oblongata (brainstem). If the blood Oxygen content and/or O₂/CO₂ ratio goes out of normal range this usually induces faster breathing, along with a feeling of panic. We are also capable of being aware of cerebrospinal fluid acidity⁶⁹. These are all included in the broad category of sensory experiences that Steiner called an awareness of “Life”.

Visceral Stretch Receptors: e.g. lungs (lung inflation), bladder (urination), stomach (fullness), blood vessels (blood pressure), and the gastrointestinal tract (bolus/defecation). Even if someone feels numb, it is relatively unusual to have lost sense of the body so much that they do not know when to go to the toilet or that their lungs are full and they need to breathe out, or they have no sense of how full their stomach is.

Thirst (I) is mediated in the Left Cingulate Cortex (midbrain) and the Hypothalamus. There may also be a conscious access to the chemoreceptors that sense plasma osmotic pressure, so thirst may also be caused by an insufficiency of salt.

Hunger (I) pangs are not just mental – there is a very distinctive sensation that is felt in the sub-diaphragmatic viscera. They are brought about by the contractions of an empty stomach, associated with a local release of the hormone ghrelin. The quasi-emotional feeling of hunger is just one of a series of urgent signals (rather like an internal fire alarm) that the body can give us in certain circumstances. The brain processes hunger through the Hypothalamus, which is also the “seat of emotion”.

General Interoceptive senses (I) : Usually ignored in list of senses, the internal bodily sensations of being alive and having physical presence are a whole world in their own right. Many people in western cultures ignore the body most of the time and only place attention on it when it is in pain, or there is some other strong stimulation. In fact there is a constant ebb and flow of sensation that may be local to a small patch of skin or part of a limb – or global (whole-body). These sensations may arise in the skin, the muscle, the connective tissue, the lymphatic system, the viscera/internal organs, the vascular system (etc.) – and are something like the background noises in a busy city. A few words that might describe the vast range of sensory textures include

Frozen, icy, cold, chilly, cool, wet, sweaty, moist, damp, boiling, warm, dry (dry-mouthed), hot, burning, parched, dehydrated, thirsty • Hungry, ravenous, full, bloated, satiated, satisfied, stuffed • Comfortable, uncomfortable • Dizzy, swirly, woozy, spacey, faint, floaty, giddy, disconnected, ungrounded, floating, light-headed Numb, blank, absent, empty, hollow • Queasy, nauseous, sick • Energetic, wired, buzzing, tingly, bubbly, energised, fizzy, electric • Pulsing, pounding, vibrating, throbbing, pressure Trembly, nervy, twitching, butterflies, fluttery, quivering, shaky, shivery, shuddering • Calm, peaceful, spacious Expanded, expansive, airy, open, floating, relaxed, released, light, soft, cotton-wooly • Solid, grounded, strong • Flexible, fluid • Stiff, rigid, locked, taut, tight, tense, jammed • Exhausted, limp, floppy, damp rag, tired, drained, flat • Squirmy, jittery, jumpy, wobbly • Cloudy, dark, dull • Spongy, congested, heavy, saggy, squishy, squashed, stretchy, Bloated • Clenched, closed, contracted, blocked, knotted, constricted, small, short • Bursting, radiating, stabbing, jabbing, stinging, tight, raw, sore, achy, bruised, hurting, sensitive, itchy, prickly, tickly, jagged • Breathless, suffocated, short of breath, easy-to-breathe, headache, thick-headed Teary, tearful • Urgency, twitchiness, agitation, anxiety.

To these can be added many other descriptive words. Some somatic sensations feel like they have the quality of very specific materials (such as metallic, woody, plastic, glassy, leathery...), often in combination with associated textural sensations – sharp, rough, smooth, etc. This list does not include a full list of emotions – which are also complex combinations of sensations (in specific parts of the body) that we have labelled – see later. But quite a few of the above words may be used to describe

qualities of emotion and/or mental-emotional state, and it is impossible to list somatic sensual experiences without straying into the territory that is usually labelled “emotional”. For instance, the slightly anxious urgency that indicates a very full bladder. The somatic sensations are also related to every single internal (I) and contact (S) sense listed previously, and often add important information to the external senses (X).

Inner motion / urge to move (I) : Whilst the inner interoceptive senses are states of being, and may of themselves lead to an inexplicable desire for particular kinds of movement, there is also an inner sense of movement that arises of itself, and is so intimately tied into the sensory system that movement is inextricable from sensing – the two are a unified action. The body simply moves itself - if it is allowed to do so. There are many possible ways to organise the relationship between the mind and body, but the main axis that these fall on is one of forcefulness (mind over matter) vs cooperation and mutuality (and trust). The body is somewhat animal in nature, and (if allowed to do so) is capable of exercising that more animal somatic intelligence through movement without the need for the conscious will to do anything other than ride – pretty well exactly like a horse-rider can let the horse have its head. Martial arts training (and method acting, and improvised dance e.g.) is designed to train that relationship so that the mind remains capable of exercising control, but does so sparingly and lightly “*like cooking a very small fish*”, usually giving only general direction, and letting the body decide the how-ness of that. Within that very light control the body’s innate intelligence decides what movements it should make and does the moving. There are two extremes of inner movement. One is heavily trained – such as military training – and is a fallback habitual reflex, a Gestalt movement that takes over when the mind fails due to overwhelm. These emergency Gestalts are extremely useful for survival, but often deliberately rely on dissociation to take effect. The other extreme is accessing movements that reside within the cellular and tissue intelligence in the body, as might happen in an Authentic Movement class. In between these two extremes are trained movement patterns that are deliberately cultivated to have a particular effect whilst still being very conscious. Martial arts training constantly repeats a high quality of certain kinds of motion, so that particular motion is embedded in the body, and the body then re-expresses it far faster than the mind can instruct it to do so. Traditional (e.g. hunter-gatherer) dance might be another example, in which there is a cultural pattern of motion that forms the foundation, but then as the dance becomes more ecstatic the body moves itself within that structure. As can be seen from these examples, there is also an axis of degree of ability to re-exert conscious control. The subjects of Pierre

Janet's studies in the Pitié-Salpêtrière Hospital in Paris had lost all conscious control (and even awareness) of this inner self-motion.

Counter-Transference⁷⁰, other more ephemeral and “Extra-sensory” senses (X,I) do not have any obvious set of nerves like the stretch receptors in joints. They are integrative, they are deeply somatic, they are related to consciousness and emotion, and they tend to be imaginal. The Craniosacral practice I have engaged in over the past 20 years has required that I continuously have to open more and more to the possibility of new forms of sensory awareness. As has been noted previously, the conscious awareness of some qualitative aspect of the world is dependent on a lack of disbelief. One must be consciously open to the *possibility* that something may be sensed, and when starting to use senses that are new and unfamiliar, the information is always initially very subtle, and so easy to miss or mistrust. Conscious awareness is almost wholly dependent on the sensory system, which (amongst other things) provides a background “sense” (or maybe an ab-sense!) of “*presence*” – and other qualitative aspects of feeling alive, energised, embodied, and “*here*”. The slightly tingly fizzy sensation that is part of an awareness of being energised and alive *may* be related to lymphatic activity. And/OR may be “something else”... An excitation of cells as they receive just the right amount of oxygen and blood sugar? Or the movement of the capillary bed as it becomes more responsive to the surrounding tissue? Or some kind of bioelectrical activity? I believe that it is important to not disbelieve an impression or experience just because there is (up to now) no simple scientifically recognised way to account for it. There are many senses and experiences that are called “extra-sensory”, as if they are outside of the “normal” senses (and therefore non-sense) – when actually – they are just senses like all the others, just not quite so well used or familiar. Who better than Jim Corbett to have the last word on this?

I had forgotten all about the tigress until I suddenly felt that I was in great danger. Hurriedly grounding the butt of the rifle I put two fingers on the triggers, raising my head as I did so, and saw a little earth from the fifteen-foot bank in front of me, come rolling down the steep side and plop into the pool. I was new to this game of maneater hunting or I should not have exposed myself to an attack in the way I had done. My prompt action in pointing the rifle upwards had possibly saved my life, and in stopping her spring, or in turning to get away, the tigress had dislodged the earth from the top of the bank. The bank was too steep for scrambling, and the only way of getting up was to take it at a run. Going up the watercourse a short distance I sprinted down, took the pool in my stride, and got far enough up the other side to grasp a bush and pull myself on

to the bank. A bed of Strobilanthes, the bent stalks of which were slowly regaining their upright position, showed where, and how recently, the tigress had passed, and a little further on under an overhanging rock I found where she had left her kill when she came to have a look at me.

I have made mention elsewhere of the sense that warns us of impending danger, and will not labour the subject further beyond stating that this sense is a very real one and that I do not know, and therefore cannot explain, what brings it into operation. On this occasion I had neither heard nor seen the tigress, nor had I received any indication from bird or beast of her presence, and yet I knew, without any shadow of doubt, that she was lying up for me among the rocks. I had been out for many hours that day and had covered many miles of jungle with unflagging caution, but without one moment's unease, and then, on cresting the ridge, and coming in sight of the rocks, I knew they held danger for me, and this knowledge was confirmed a few minutes later by the kakar's warning call to the jungle folk, and by my finding the man-eater's pug marks superimposed on my footprints.

– from “Man Eaters of the Kumaon” by Jim Corbett

I hope by now that you have realised that the senses are themselves extraordinary, and consist of a vast ocean that is not usually explored. In the 16th century the known world was only sketched out in very superficial detail, and in between sometimes exotic and imagined continents – there were sea monsters.

Andy Harkin⁷¹ describes how Wellness and embodied-ness are interoceptive senses in their own right – or at least qualities and states of being that we can perceive through the somatic senses. Rest is a qualitative physical-mental-emotional state that is known via a feeling of rested-ness – and is not simply “doing nothing”. He also notes that in Western cultures there are two quite different streams of information about the world. One is based on external instrumentation – a tape measure can gauge how many centimetres tall you are; or a clock measures seconds, minutes, hours; or a set of scales measures your weight in kilograms. This is a linear sequential and very left-brain-hemispheric world of abstractions. But we also have a more right-brain measure that comes to us through the somatic senses – which provide a far more subjective assessment of these properties. So whilst remaining the same height you may feel crushed or elevated, or be “standing tall”. With no measurable change in weight you might feel light and buoyant or leaden. Time can stand still or race quickly, the day disappearing faster than we can grasp it. The cultural norm is that we are told to trust measurement and deny experience. However, experience tells us both about out

internal state and about out relationship to the world. And if the relationship with the world is one of compassion and empathy, our internal state is inevitably attuned to the external world - and so that supposedly subjective layer of information is able to provide a second channel of information, a rich depth of qualitative experience that conveys something very real about the world beyond our skin.

Inasmuch as we can test the validity of intuition by seeing whether or not the possibilities do occur actually, and since millions of these possibilities arrived at by intuition have been realized, it is legitimate for the intuitive type to value his function as a means of understanding one phase of reality, that is, dynamic reality.

~Carl Jung, 1925 Seminar, Page 132

Steiner's additional senses^{72,73} of **Language**, **Concept** and **Ego** deserve some attention, if only because they raise interesting questions as to the scope of our sensory world and how much it interfaces and interlaces seamlessly with other fields of conscious experience. We are actually all familiar with a sense of **Ego**, and may talk of feeling affronted or embarrassed, or belittled, or encouraged or nurtured (etc. etc.) So to take just one of many possible examples, somebody may possess a "sense of dignity" – which they will experience (interoceptively) as an increased capacity for the thoracic torso to self-support, and for the identity and personal boundaries to be respectfully expansive. An external observer may well notice this change in physical posture and in the usage of facial muscles; so it is not uncommon to remark how a particular person has a "dignified bearing" or "dignified countenance". The baseline feeling of *presence* that is changed when these qualitative quasi-emotional states are sensed – is the sense of ego. It's quite difficult⁷² to define, but some sustained mindful observation of it results in an identifiable sense of "*this is how I experience myself*", and to external observers "*this is how I qualitatively perceive this person*". This ego-awareness is often referred to as a "*sense of identity*". Most people equate their body with their self, and therefore equate at least some of what they feel in their body as being part of their identity. Having a good qualitative sense of healthy physical presence tends to result in a strong and resilient sense of identity. Being in constant high level pain doesn't only result in stress in the way we usually think of it, but may also fracture the relationship between the mind and body in a way that creates an equally painful disruption to the sense of identity.

Personally, I am not so sure about **Language** as a definable sense. This is because in my definition of "sense", I conceptually separate the capacity to perceive *qualia*⁷⁴ from the capacity to interpret and derive meaning. Although I have consistently argued that it is impossible to truly separate the sensing of raw data from the derivation of meaning, the problem arises in that derivation of meaning is a capacity in its own right that extends

right up into the cognitive levels of consciousness. So to constrain the fundamental sensory world to non-cognitive levels one must insist that sensing of information requires a certain proportion of qualia – and language goes beyond that level of simplicity. However, I have to agree with Steiner, in that there is in principle no difference between the understanding of language compared to the reading of sounds, shapes, colours when walking through a forest or savannah. The interplay between the human conscious mind/brain and the lower level processes again takes this slightly beyond the zone I would like to constrain senses, simply because I believe senses should be viewed not only from a human perspective, but also from a biological perspective. So a dragonfly would not go through the same cognitive (or even Right brain) processing of sensory information as a human being, but would still be capable of sensing – and a necessary part of that sensing is still enmeshed in some means by which *meaning* is derived. To “see” a fly moving must include a “knowing” that this is food – so meaning (i.e. cognition) is inherent in the sense of sight without the need for cognitive capacity in the complex way that we humans experience cognition. Possibly the main argument for not considering language to be one of the senses is that we use language to label and apply meaning, so language inherently contains meaning. Thus, language is a higher and more universal order of meaning (a **Meta**-meaning).

For the same reasons I would place **Concept** as recognition or experience of *meaning*⁷⁵, placing it in a meta-position in the same manner as Language. As has been noted previously (“sense-meaning-response”), senses are of themselves useless unless they are also connected to some means of deriving meaning and then to some mechanism by which we can respond meaning-fully. We use the word “sense” in many interesting and varied ways. There is a “*sense of beauty*”, which, although drawing heavily on more interpretative aspects of consciousness, and on the *sense of meaning*, is also often an expression of the *sense of proportion* – an often unconscious awareness of how the golden section⁷⁶ is contained in what is being observed. We have evolved in parallel with other life forms, and it is impossible to not be affected by their presence in the field of sensory awareness... The hum of bees and other insects in a garden... The particularly identifiable pattern of sunlight passing through ash leaves... The sound of a lark or song thrush or crow or seagulls, or of wind passing through tall grass.

And men go abroad to admire the heights of mountains, the mighty waves of the sea, the broad tides of rivers, the compass of the ocean, the circuits of the stars; yet pass over the mystery of themselves without a thought

- Augustine of Hippo

Synaesthesia and multisensory integration

In real life situations, the senses are hardly ever used singly. The simple act of walking requires a combination of many senses – proprioception, equilibrioception, visual senses (e.g. motion tracking, peripheral vision, distance judging), and more. But the senses themselves (or perhaps we would be better talking about “channels of perception”) are often already integrated before they hit our awareness. Some of the 20 or more senses listed above (such as verticality or equilibrioception) are wholly integrative from many different places and individual senses in the body. And other senses are selectively integrative of several senses – for instance, the sense of hearing usually integrates sounds from both the ears and lateral line pressure sensors, depending on the particular frequency range or type of noise that is of interest. Not only that, if one sense is lacking information, the other senses will activate themselves. For instance, if the sense of touch is waiting for information, the eyes will attempt to fill the sensory gap scan by saccading⁷⁷ – in fact all senses are joined together in terms of spacial awareness, because “where?” is as important a question as “what?”.

This integration and pre-processing is necessarily non-conscious because of the relative slowness of conscious thought. This interpretative and integrative sensory capacity is learned “automatically” (whatever that means) by the infant brain at the very earliest stages of development. And then integrated senses simply appear to our waking consciousness as information in a particular form. The mode of presentation is not necessarily directly related to the sensory organ from which it came. My experience of consciously applying the senses is that – when they are called on to perform outside their normal range or to detect something that is so subtle that it is on the limit of sensory experience – there is some crossover of sensory channels.

So another requirement of sensing with any kind of reliability and depth (in addition to trust / belief / openness) is that the information is *received* rather than forcibly grasped. The trust / lack of questioning approach to senses creates a focus on *what is being perceived*, and making sense of that, or comparing it to memories or finding a particular word that describes the experience. The effort is taken up largely by exploring the “What?” question, and there is very little effort put into the “How am I going to sense this?” You don’t have to think “how am I going to smell his rose?” Rather, you focus on the smell itself, and the nasal sinuses and turbinates automatically re-shape themselves to redirect air laden with the molecules of rose-scent more strongly to the first cranial nerve. It’s exactly like using your hand to pick up a cup. Unconsciously, the movement is easy and fluid. As soon as conscious control is taken,

the movement is less fluid, less certain, and the “How?” occupies most of the capacity for conscious attention. If we moved like that (consciously directing every muscle) all the time, life would grind to a halt.

Similarly, as soon as effort is placed on operating the senses to grab information, they actually become less reliable (because of expectation of what might or might not be sensed) and less open to new information (because the information may not come to us in the manner we expect), and less sensitive (because too much attention is being placed on the “How?” aspect of sensing). I compare it to looking down a telescope. Or even looking down the wrong end of a telescope. What *should* happen is a light and effortless curiosity about something – and then the senses organise themselves and deliver the information in a way that we are most able to receive it. When first accessing unused senses this requires a certain zen-like state of not-knowing, because there literally is a not-knowing how or in what form the information will rise up and meet and interact with conscious awareness. In other words, the sensory system adapts so that the information is passed on in a manner that can be most easily accessed. And this is one of the ways that we experience the world and ourselves individually – and sometimes very differently – from other people around us.

One aspect of this perceptual variation from one individual to another is already widely acknowledged in education. Each person has specific sensory preferences, which for 99.9% of people rotate around the primary senses of sight (“*Visual*” or V), sound (“*Auditory*” or A) and touch/interoception (“*Kinaesthetic*” or K). There is also a very small minority of people whose main sensory preoccupation is (rather like that of a dog) focussed on the senses of taste and smell⁷⁸ (“*Gustatory*” or G). In fact the experience of taste is multisensory/ synaesthetic for almost everyone, and provides a good experiential understanding of how all the other senses are linked together in their own particular ways. It is well known by professional chefs such as Heston Blumenthal that perception of taste is dependent on all of the external senses – sight, touch, smell, hearing – and even internal senses such as nociception/pain. This “crossmodal” and flexible use of senses in everyday movement and perception has received remarkably little attention until very recently, with senses being looked at singly according to the conventional rules of reductionist scientific investigation. The heavy (popularised) scientific leaning toward senses as being single and unintegrated has led to a general widespread belief that they are – to the extent that everyday experience is ignored or even ridiculed. All of this is changing, partly due to celebrity chefs making people far more aware that taste is so contextual. A small but significant set of research into real, complex, adaptive human cross-modal integration of senses has carried out in the past

few decades – e.g. by Professor Charles Spence in the department of Experimental Psychology unit at Oxford University⁷⁹. To give just a few examples⁸⁰, it has been found that sweet flavours are made even sweeter and enjoyable by the colour red (which also suppresses bitter tastes), and round-shaped plates. And sweetness is automatically expected when the food has a silkily soft texture. Particularly when flavours are complex, a low intensity, low frequency background noise (such as muted conversation in a room) increases the taste of sweetness. There are many other associations. For instance, if someone holds sandpaper they tend to taste saltiness (even to the extent that they will taste salt when none has been added). Whereas jagged sharp edges will tend to induce an enhanced awareness of bitter flavours⁸¹ – interesting in that the iron in blood gives it a characteristically bitter flavour, so maybe we taste more bitterness in the presence of jagged edges because there is some inbuilt expectation of blood

During a talk on consciousness given by David Bohm⁸² he talked about the subtlety of the senses, and how the need for sensitivity to the environment drives the way that any organism optimises its available senses. And that sensitivity is damaged by a retreat from the senses caused by repeated violence of one form or another. The experience of violence makes any organism less interested in nuance, and far more over-focused on the (usually) more external senses that might give some warning of further impending violence. Along with this goes a reduced capacity to engage certain senses, not because they are physically (potentially) less acute or that the nerves are somehow damaged, but that the organic sensory organisation assigns them far less priority – to the point of temporarily masking them out or filtering them so that they are less conscious or less high on the stack of possible things we might be aware of.

Caught up in a mass of abstractions, our attention hypnotized by a host of human-made technologies that only reflect us back to ourselves, it is all too easy for us to forget our carnal inherence in a more-than-human matrix of sensations and sensibilities. Our bodies have formed themselves in delicate reciprocity with the manifold textures, sounds, and shapes of an animate earth – our eyes have evolved in subtle interaction with other eyes, as our ears are attuned by their very structure to the howling of wolves and the honking of geese. To shut ourselves off from these other voices, to continue by our lifestyles to condemn these other sensibilities to the oblivion of extinction, is to rob our own senses of their integrity, and to rob our minds of their coherence. We are human only in contact, and conviviality, with what is not human."

-- David Abram, from *The Spell of the Sensuous*

It would be easy to dismiss individual sensory preferences by saying that most of us smell, hear, see and feel. However, the point is that individual perception can be (and often is) heavily biased round one or two senses to the point that the way of

experiencing the world is strongly affected. Given your own particular sensory preferences, sensory skills, aversions and blind spots, it may then be almost impossible to imagine the life experience and mind of another person who lives inside a different set of sensory filters.

Taking people in the VKA range, a small minority of people are equally receptive to information through all or any of those channels. But most of us are either strongly focussed on one particular channel of information (V or A or K), or are less interested in one of these three channels – and work with a combination of the other two. So then there are combination preferences VA, VK and KA, Av, Ka, etc. This has been integrated into education, and most people will have completed a “Learning Styles” questionnaire at some point. However, it gets a little more complex, because the sensory preference may change according to the context of the situation (e.g. is this a social situation or one in which I am relying on myself?) and on stress level. So a stressful memory (“when I felt threatened I ran across the street” is a very Kinaesthetic description) may be different from the same person describing a non-stressful memory more visually (“When I went to Greece, I loved the amazingly blue-green sea and cloudless blue skies”).

In this way, information from one sensory capacity is often routed through another preferred sense... If a visual person says “I see that” after hearing a description – it is because they have played out the information in their “minds eye”, and the hearing sense *also* automatically relays through the inner visual sense. Many of the internal/interoceptive (I) senses above may (or may not) play out through whatever sense or sense combination the person naturally orients towards. This is particularly true when senses are being used at their limit. The tiniest difference in shade of green to a strongly Kinaesthetic (i.e. non-visual) person may be detected more viscerally because it “feels” different. At this level of perception it becomes harder and harder to communicate individual experience (and its reliability!) unless speaking with a person who processes sensory information in very similar ways. A strongly Visual person might experience running in their minds eye, as an internal image of their legs moving. As strongly Kinaesthetic person would be more likely to be aware of visceral, emotional and other somatic responses to anything they hear or see – making the reading of a book something of a physical journey. A strongly Auditory person might not be so in touch (relative to a K person) with sensations of having a full bladder, and would more “tell themselves” that they need to go to the toilet.

There are even deeper versions of sensory crossover, which are so extreme that they

were once considered to be neurological curiosities, and Richard Cytowic's book⁸³ "The man who tasted shapes" is a wonderful way to dip into unfamiliar kinds of sensory experience. In Synaesthesia⁸⁴, there is an *enhanced* crossover of senses. All the sensory crossovers described so far are of relatively small shifts in sensory processing, and are to some degree re-trainable. Someone who processes in a truly Synaesthetic manner has a far greater crossover which is hardwired into their connection between the conscious mind and the areas of the brain that collect, pre-process and interpret sensory information *of one specific sense*. So in the case of the book's title, a particular chef excelled at reproducing flavours because his sense of smell/taste was hardwired directly into his kinaesthetic and visual senses (Gustatory → Kinaesthetic synaesthesia). He did not smell, so much as perceive shapes and textures. The taste of a specific recipe for chicken broth might appear to him as a knobby ball with a slightly furry and spongy surface texture. Minor variations in the recipe would result in a change of surface texture or the shape of the ball. Another person with Auditory → Visual Synaesthesia would experience a particular person's voice as having a specific shade of green with small grey and purple dots. What should be understood clearly from the extreme case of hardwired Synaesthesia – is that these sensory crossovers are a *normal* way in which the senses operate. It's just that each of us performs them differently and to different degrees. And the unforced use of the senses described above taps into this fundamental capacity for synaesthetic processing. A personal investigation into subtle internal nuances would in many people identify vague and hard to define sensory "flavours" – or more often, somatic responses, that accompany memories or words. As noted above, even the slightest hint of an additional and perhaps unexpected sense participating in an experience gives the opportunity for that awareness to be trained so that the enhanced and broader sensory perception is made more available.

True (overt) synaesthesia is often a gift. Richard Feynman, one of the great Physicists of the 20th Century saw equations as colours. Nicola Tesla, the inventor of many aspects of electrical technology, had a photographic memory and was able to construct his machines and theories in his head down to the tiniest detail without needing to commit them to paper – and was synaesthetic. The likelihood is that we all have these crossovers to some extent, but they are more pronounced in someone who is (definitively) synaesthetic. Vladimir Nabokov beautifully described synaesthetic experience in his autobiography "*Speak, memory*":

I present a fine case of coloured hearing. Perhaps 'hearing' is not quite accurate, since the colour sensation seems to be produced by the very act of my

orally forming a given letter while I imagine the outline. The long a of the English alphabet (and it is this alphabet I have in mind unless otherwise stated) has for me the tint of weathered wood, but a French a evoked polished ebony. This black group also includes hard g (vulcanised rubber) and r (a sooty rag being ripped). Oatmeal n, noodle-limp l, and the ivory-backed hand mirror of o take care of the whites.

Given all these senses and the capacity to integrate them – one might ask *what they can be used for?* The answer is – anything you wish. Anything that sustains life or makes it more meaningful. All animals are fundamentally curious when healthy, and exploration – the movement into new territory – is an activity that demands all of our senses to be fully functional. The Polynesians used to navigate the Pacific well before the invention of sextants or GPS by sensing the long rhythmic swells that occur as interference patterns due to large ocean currents flowing past islands and sea mounts. Somehow they charted these interference patterns and passed them on in an oral tradition – so that their ships could navigate the vast and featureless Pacific ocean. How did they sense these slow movements of the sea through the noise of the waves? A navigator would stand at the front of the canoe, naked, and would be aware of the movement of his testicles. Although in some ways it's an amusing story, I think it underlines how un-curious we have become as a society in the capacity of our senses, as more and more we have relied on technology to provide the answers.

A blessing for the Senses

May your body be blessed.
May you realise that your body is a faithful
and beautiful friend of your soul.
And may you be peaceful and joyful and
recognise that your senses are sacred
thresholds.
May you realise that holiness is mindful gazing,
feeling, hearing and touching.
May your senses gather you and bring you home.
May your senses always enable you to celebrate
the universe and the mystery and possibilities
in your presence here
May the Eros of the Earth bless you.

John O'Donohue⁸⁵

The Emotions as Senses

Candace Pert's book⁸⁶ "Molecules of Emotion" is now over 20 years old, and has significantly influenced how we think of the ways that the body processes symbolic information. Before the ubiquitous role and many production sites and receptor sites of peptides were discovered, the brain was considered to be the beginning and end of everything to do with consciousness. Perts' research showed this to be a fallacy, and that the body has more than one communication medium. Even more importantly, that the presence of peptides and neurotransmitters in the bloodstream (and in other bodily fluids and organs) provides some temporal continuity to our lives over periods of minutes to hours. Furthermore, the discovery of the relationship of these chemicals (which clearly had effects on – and were affected by – the experience of emotion) to the functioning of the digestive system, immune system and the brain itself – provided the insight for the formation of the new science of Psycho-neuro-immunology (PNI).

Subsequent writings along these lines (e.g. investigating the "Second brain" of the gut plexi^{87,88}) have further confirmed that the brain and consciousness and awareness are as dependent on the body as the body is dependent on the brain. This mutuality of cognition and biology has also been systematically explored in detail by Francisco Varela and his students⁸⁹ from the perspective of the nervous system. The total picture is one in which we inhabit a completely integrated biological organism which has different levels of organic "intelligence", each level having some means of communication and influence on other levels, but nevertheless maintaining some separateness of function.

The three germ layers of the embryo constitute three major functional divisions in the adult human :

1. ectoderm = brain/nervous system
2. endoderm = gut/vagal complex
3. mesoderm = musculoskeletal system

Although this system collapses when cell division and movements during gestation are viewed in detail, the more general (archetypal and gestural) relationships it presents are impossible to ignore. The gut produces and stores 90% of the serotonin in the body – an important neurotransmitter affecting emotions (the midbrain). A deficiency of serotonin is strongly correlated to depression – and thus the gut (and the ecological balance of intestinal bacteria) has a powerful effect on consciousness and on emotional

state.

Emotions are oddities in that we can have an emotional reaction to an emotion (e.g. distress about feeling distress, or anxiety about the dizziness that sometimes comes with fear). Almost as if we can think about a thought that we have had; and then think about the thought that was about a thought... Emotions are potentially iterative, and are capable of dropping us into a reactive cascade or loop unless we cognitively choose to interrupt them through conscious selection of where attention is directed. It is vital that the possibility of implosive and self-destructive emotional looping is recognised. So far as we know, we are the only animal that is capable of this self-referential feedback, and it would seem that one responsibility of the conscious mind is to NOT enter such a loop – i.e. the conscious mind has a responsibility to intelligently manage the mental-emotional world, rather than creating problems by mismanagement. Emotions are a form of information and are also a means by which that information is processed. Becoming emotional about emotions is to treat them as things in their own right (as opposed to information) – rather like looking at the headlines of a newspaper reporting war, and thinking that the newspaper itself is the war! And this kind of reactivity to emotions interrupts and stalls the self-healing and self-regulating processes that they are expressing. For the body, information always leads to reassessment which leads to re-organisation and remobilisation and redirection of energy, so there is no static state in a truly free somatic world. This mobility of physical movement and emotive expression can be readily observed in animals, and it is the thinking storytelling human brain that creates problems by interrupting it. Stories have huge power both to heal and to prevent healing.

The emotions, like various parts of the nervous system, are also subject to sensitisation (becoming more sensitive than normal in certain circumstances). For example, one particularly visceral emotion is disgust. The disgust reflex is designed to make sure that we do not eat rotten or putrid food and that we stay well away from anyone who might infect us with an illness. So if you are *already* feeling queasy for any reason, the disgust reflex becomes temporarily hyper-sensitised and the slightest whiff of a smell of anything that has even the slightest unpleasantness may be enough to make us vomit. Morning sickness (during pregnancy) is a hyper-aroused disgust reflex and/or immune reflex in the stomach. These two are essentially the same, although the *emotion* of disgust may be de-coupled from the *experience* of nausea. This is a useful hint that emotions play out in several layers... They may be almost cerebral, or be highly emotive, or may be very visceral. Or any combination of these.

Most emotions are not quite so visceral in their nature or in their propensity to generate a reaction. However, disgust is a useful example, because it demonstrates that an emotion has a distinct biological *purpose*. This purpose may not be particularly clear if we are socially disgusted with somebody's behaviour or find the colour of a particular wallpaper particularly unpleasant. In these circumstances, the same reflex (disgust) is being activated, but its strength is (usually) not enough to induce projectile vomiting! Nevertheless, its message is more or less the same – that we want nothing to do with the particular thing and that we would prefer that it was not in our immediate environment. So we will as far as possible, remove ourselves from its presence. Thus, this emotion/reflex generates a particular action, which (as has already been said) has a particular biological function. The question I have is – *do all emotions have a similar functionality?* Fortunately, in investigating this question we don't need to analyse and derive meaning from the chemical message of an emotion, because we can *feel* what effect it has on us and what our response to it might be.

Messages in the blood

The senses are very much concerned with information, and emotions have been given a special place in our ways of perceiving the *experience* of information. They definitely have special characteristics that separate them from thought, and from interoception. A brief look at the generic chemical aspect of emotions is one useful starting point. As each part of the body capable of producing neurotransmitters/ peptides “identifies” a situation in which it should increase or decrease its production, then it will do so. These signalling chemicals are released into the blood stream and then cause both local and global responses as they are taken up at receptor sites. Blood flow in an adult is typically an average of between one and six total volume circulations per minute, increasing with exercise, and so any chemical released will exert a global influence for at least 1 minute when more or less at rest and about 10 seconds when engaged in strenuous exercise. The liver is central to the usefulness of these signalling molecules, in that it breaks them down into basic building blocks (e.g. cholesterol) ready for the next round of signalling. The signalling chemicals are quite complex in their effect, being capable of not only signalling positively in their own right, but also increasing or decreasing the relative extent to which *other* chemical signals are released and/or accepted. This complex cocktail of information in the form of peptides, hormones, neurotransmitters and primary building blocks is constantly being generated, used and reabsorbed.

From the above description, several important features emerge :

- a) Chemical signals affect the body for a far longer period (of the order of 1 minute) than a nerve impulse (about 0.1 seconds) : a 500-fold timescale. Nerve impulses are immediate, changeable, and on the timescale necessary to generate a muscle reaction with speed to an external event. On the other hand, chemical signals are far more durable, and produce a sustained response over a period of time sufficiently long so that the attention can be brought to a situation and that situation may then be assessed. In other words, for an organism as large as a human being, chemical signalling brings the body into a decision-making timeframe rather than a purely reactive timeframe.
- b) On a local level, chemicals diffuse even faster than nerve impulses (!) because of the very short distances involved, and so chemicals provide an extension of the nervous system into cells and connective tissue – down below the physical dimensions (and physical reach) of nerve fibres.
- c) As each local site adds chemicals to the soup that is travelling round the body, it subtly modulates the total message. Then, as the liver reabsorbs and breaks down these signals, the message changes according to the state that the body is on now (rather than what it was in some seconds ago). Thus, emotions are supposed to arise and then pass again.
- d) The neurotransmitters and peptides are not only produced in the brain, but also in the whole of the rest of the body – particularly the Gut. So it is reasonable to state that the particular cocktail at any one moment is an integration over both time and different parts of the organism of the assessment of its *current status relative to both the internal and external environment*.

Now, this kind of moving status report is of no use unless it is put to some use, and I would like to propose that :

- i. it is meant to be put to use
- ii. it somehow has to convey *meaning* to the every organising level – from cognitive mind to cells and connective tissue. Being in touch with the body means that we are supposed to be able to sense this balance more or less continuously – and particularly when its message is particularly urgent
- iii. we experience particular combinations of signalling cocktail as emotions, and **each emotion is directing our response to “an integration over both time and different parts of the organism of the assessment of its current status relative to both the internal and external environment”.**

As such, emotions are another form of information that precipitates internal non-conscious responses; and may be part of cognitive awareness, in which case it may be

used as a basis for response to the world; and usually even contains a response inside itself – provided that the emotion is allowed to lead directly to action (e.g. anger). In fact, in emotions we see an integration of conscious and non-conscious processes, along with an integration of the fundamental biological chain of *sense-meaning-movement*. Considering that single cells use almost as many neurotransmitters and a complex organism (like a human), it would seem that emotions are an ancient means for any organism – from single cells upwards – to be aroused into a single, whole-organism response to events that a large fraction of their parts considers to be significant. Emotions induced through the combination of neurotransmitters and peptides (and maybe other signalling chemicals, such as steroids, hormones) are a democratic process – if a sufficiently large volume of particularly important parts of our biology ask for attention, then our attention is grabbed.

Each language has a label for specific combination of somatic sensations and mental states – that we call “emotions” – which is usually taught to us by our parents. And this label (a “Higher level description”) is so familiar to most people that when they say “I am feeling angry” (or any other emotion) they are cognitively unaware of the somatic textures that they have fleetingly been aware of and interpreted. This labelling gives a rapid shorthand access to what can be a complex set of sensations, body postures, mental states. If fluent we can even distinguish subtle flavours of mild emotions or distinguish several different (perhaps conflicting) emotions in a single feeling. Almost like having a sense of smell! There overriding aroma of lamb has a flavour of mint and something warm and spicy in the background – Cinnamon? Nutmeg? If a child is not taught this linguistic identification chart (often because the parents themselves were uncomfortable with some emotions), then emotions become a difficult-to-interpret mess of contradictory messages – because most human emotions are nuanced and complex.

If one chunks back to the original set of somatic sensations that relate to the activity of the emotion *in the body*, then it becomes possible to perceive the experience in several different ways...

- There is a mental storyline that says why we are feeling what we are feeling – which presupposes a known causative chain of events.
- there is the *meaning* of the emotion – which is partly the emotion itself (because emotions inherently carry meaning – “I am angry”), and partly the physical movement/response that we are stirred to by the emotion.
- there is the set of physical somatic textures and sensations (and movements) that can be observed simply as textures and sensations with meaning stripped

away.

- there is the awareness of the current situation – which may provide a cognitive reality check – “Yes – this emotion is congruent with my current circumstances”, or “This emotion is incongruent with (or out of proportion to) what is happening around me”.
- There may be visceral and biologically important layers of experience that are far less easy to be so objective about ... such as the need to urinate or vomit.

Thus, we return once more to the important and fundamental issue of awareness and presence. If one is aware of each moment and able to let go of the previous moment, then emotions are largely a stream of information that comes, has its time, and then goes. We are not un-feeling in this moment-to-moment awareness. On the other hand the emotion is in proportion to the world, and is only ever as big as it really is in that moment; not being fuelled by anything else. Simply put, we are not driven by the emotion, but just experience it at the strength that it truly is for as long as it truly exists. However, once the emotion is attached to a story line which we in turn become attached to, then it continues to play out like a stuck record. With each playing the grooves become deeper. We remember the story; we then feel the emotion; then the story is confirmed by our experience; and so we go on; and on.

Emotions as biological responses

Stripped of the cultural meaning, and placed in a more somatic and evolutionary framework, emotions⁹⁰ are ways that the body conveys important qualitative information to the collective consciousness that runs it. An emotion is experienced by humans as a change in the degree to which particular parts of the body and qualitative mental states of be-ing are present (or not) in consciousness, and specific qualities of sensation that arise with that awareness. These were recently mapped out in the brain⁹¹ and in the body with regard to intensity and “geography” of physical sensation⁹². But these mappings miss out a lot of qualitative information – the “what” that is being felt in that particular part of the body : the qualitative experience. The qualities of restedness, satiety and wellness already mentioned are also emotions in the way that they are experienced... it's just that they are not usually considered to be an emotion in this particular culture. In early life we are supposed to be told by our parents when we (and they) are feeling, so that it is possible to attach a linguistic label to what is a very complex pattern of experience. The linguistic label for simple emotions (“anger”, “sadness”, etc) then allows us to distinguish and discriminate several emotions when we experience more than one emotion at once. Without this linguistic clarification,

complex emotions are a big mess, and can – especially when conflicted – cause confusion. The cultural problem with linguistic labels for emotions is that many people learn to sense an emotion so quickly that they bypass their body and simply “know”(!) that they are feeling an emotion because their mind tells them so. Even when they say “I feel rested” or “I feel angry”, the experience is (or at least appears to be) largely mental.

Wild Geese⁹³

You do not have to be good.

You do not have to walk on your knees
for a hundred miles through the desert, repenting.

You only have to let the soft animal of your body
love what it loves.

Tell me about despair, yours, and I will tell you mine.

Meanwhile the world goes on.

Meanwhile the sun and the clear pebbles of the rain
are moving across the landscapes,
over the prairies and the deep trees,
the mountains and the rivers.

Meanwhile the wild geese, high in the clean blue air,
are heading home again,

Whoever you are, no matter how lonely,
the world offers itself to your imagination.

calls to you like the wild geese, harsh and exciting-
over and over announcing your place
in the family of things.

-- Mary Oliver

It is worth thinking about how *animals* express emotion when reading these notes, and consider that our emotional brain is the mammalian midbrain, not the cortex. Qualitatively and experientially, emotions are different from other sensory information

in at least a couple of ways. Firstly, they are complex – we assign a label to a whole-body set of changes in sensation and other sensible factors such as mental state, alertness, externally directed vs internally directed attention, etc. Secondly, they are almost always likely to precipitate a physical response to the world in the pulsatile manner described by Stanley Keleman. We are moved to push out or reach out, or withdraw. Of course, other kinds of sensory information may also have that effect – but usually there is a distinct sequence of events – we sense, then we derive meaning, then if an emotion arises, there is a corresponding *E-Motion*, a *physical response*. As a source of information their influence bridges the whole of the sense-meaning-response cascade. Thirdly, as a direct result of their interpretative quality, emotions stand out as being far more about relationship – to ourselves, to the environment, to the landscape, and to other living organisms.

The meaningful awareness of emotion can be instinctive – i.e. there is an E-Motion, but it is largely unconscious, and passes from hindbrain/physiology to action with little chance of modulation or inhibition. Provided that our emotional senses are well calibrated to the reality of our environment, there is little wrong with this instinctive reactivity except that there is no opportunity to exercise choice. The exercise of choice requires that it is possible to inhibit this emotion → motion cascade by being a conscious observer of the process. There are several ducks that have to fall in line to achieve this important act of discrimination – particularly important in that if the emotional senses are *not* well calibrated to the present reality, then the reactivity is problematic – be it the anger-violence of fight-flight or the submissive collapse of freeze states. So, for the kind of more conscious response that will allow the emotional senses to be re-calibrated and/or choice to be exercised :

1. We must be *capable* of feeling that emotion (i.e. not dissociated from it)
2. There must be a mental *open-ness* to feeling it – e.g. social or personal mores as to the acceptability of that particular emotion do not detract from us being able to sense and affirm its presence,
3. There must be sufficient curiosity and somatic engagement to identify it
4. It requires a fluency of emotion, enough to be able to identify its components – something that is largely dependent on language
5. There is sufficient awareness of context to be able to put the strength and attributed meaning to the test, so that there is a recognised congruence and proportionality (or not).

6. We are not over-invested in that particular emotion or the meaning we attribute to it as a sign or expression of identity
7. The feeling is bearable, so we don't go into denial or overwhelm
8. There is sufficient sense of immediate safety and/or internal resilience for all of the above to be possible.

With all of these in place, the emotion has meaning and we have a choice to inhibit it, to act on it, to calibrate it (it's not proportionate), and to allow it to course its way through our body-mind uninterrupted and so to evolve and leave us energised and ready for the next experience. Given enough internal resources (see Chapter 9.1) even overwhelming emotions can be safe enough (and so evolve and move through) if we initially feel safe enough in ourselves, or have other (let's say Spiritual) resources that can be called upon. Which always brings me back to extremes like the way that Viktor Frankl identified what drove his internal sense of meaning during his time in Auschwitz; or to the Dresden firestorm survivors who went through overwhelming fear into an experience of existential and transcendent awe.

The following is a very tentative description of a few selected emotions as primitive biological messages...

Anger – the gathering of resources

Anger is the easiest of emotions for which we might identify a biological use. The experience of anger is a gathering of energy, an increase in attention on the muscular potential of the shoulders, neck, jaw, face and hands (fists, claws). If we were a four-limbed animal like a dog, all our resources would be concentrated at the pointy end, which in turn would be pointed at the source of danger/threat/rivalry. So the emotion of anger does not only gather energy ready to use – *it also externally displays our readiness to use that energy*. Blood pressure increases, heart rate increases, cortisol levels increase so that our immune system is geared to dealing with bite wounds (rather than primarily infections through food, water and air). This is preparation for physical defence and repulsion of an invader of our territory – the attention is drawn to the front of the body and particularly to the parts of the body that are needed in a fight – the teeth/head/neck/shoulders) and forelimbs. Anger is externally directed. When in an angry state, it is remarkably difficult to remain internally aware. We are focussed on the external world, and particularly on the threat a short distance in front of us – so the eye focus tends to be close rather than far away⁹⁴. And if we

bring our attention internally, the anger tends to subside. There is a focus on physical muscles, and if allowed to run its course or observed without getting fixated by anger, then it transforms into a sense of physical and personal empowerment and response-ability.

Just like all the other emotions, anger may arise from an external event – in which case we may have a storyline about why we are feeling anger. Alternatively, we may have gathered ourselves for conflict, and then the physical response will be the same. So then we might think that we are feeling anger, but will actually be sitting in the innate chicken and egg nature of emotions. If we feel our body in a specific state, we can choose to interpret that as anger, but actually, it may not be real anger. Instead, it may simply be a very well resourced defence reaction that – if we had not fallen into the storyline of “X and therefore Y and therefore anger”- we would simply have been left feeling physically empowered and externally focussed.

Depression – an ancient form of anger/aggression

This is very much based on my historical experience of depression and also on my experience of dissecting it in a guided therapy session using somatic experiencing tools. The heaviness of depression is often restricted to the frontal bone, and it is as if a solid dense and heavy bone (rather like the visor on a suit of armour) is coming down over the eyes. The exact form of this was only something of a curiosity to me until I really started to think about EvoDevo; and then I realised that much of our internal architecture started off in the bony fish of the Cambrian oceans. Why would fish have an armoured, bony head? Clearly, this was a tool to use in a fight. So – what happens when you gear up to fight using your head as a club or intend to use the armour on it to resist the bite of something bigger than yourself? Focussing on the heaviness produces more heaviness. Being curious about “where do I not feel that?” is a really useful approach. At first it feels as if the heaviness is everywhere, but for the vast majority of people there is always somewhere that feels light. Re-focussing onto this lightness, its qualitative texture and its geography (deep, shallow, thickness, volume, shape, etc.) – instead of being pulled in by the biggest somatic noise – has some interesting effects on way the rest of the body (and mind) feels. Deeper forms of depression may also contain an element of overwhelm and immobilisation, which will be covered in more detail in Chapters 5 and 6.

Contentment – something to smile about

Porges (Chapter 5) has noted that smiling alters the pressure between the jaw joint (TMJ) and the middle and inner ear, and makes it far less easy to hear low frequency sounds of the type that might come from a big predator. So, if I smile, the converse is true – there is both an externalised and internalised demonstration that there is no need to check for danger. I am giving myself and the people around me a sign that I feel safe in this environment. The interesting thing about a true smile (as opposed to a grimace) is that the motion of the facial muscles makes it almost impossible to open the mouth – so although the teeth may be showing (which is used to say “keep away” in primates and other mammals) they cannot be engaged in any form of aggressive manner whilst the “real” smile continues. So the total message from a smile is – “I’m safe, you’re safe, we’re safe”.

Anxiety – where can I go?

Anxiety is about halfway along the spectrum of fear and is essentially a feeling of disturbance – something is not right – I have to move, check, look, get somewhere else. The constant twitchy lack of stillness in a mouse is essentially a state of constant anxiety – and we see mice perpetually looking over their food to check out “is it safe?” Wild animals that have been disturbed prefer to leave the place they were feeding and find another one. It is a feeling that may persist⁹⁵, and it persists if there is insufficient sense of safety and containment in the environment. If the anxiety is preceded by a general state of contentment, then endorphin production is high (in this case dynorphin) and the anxiety goes again. Anxiety is to some degree a “false” emotion in that we only feel it for any prolonged period of time because the movement that it wishes to generate (usually flight) has been suppressed or inhibited through social convention. It is common for humans to feel anxiety. An animal would only feel anxiety if it was aware of danger but physical response was not possible – such as in the situation where the exact location of danger was not known, so random flight might deliver it into the danger it was fleeing. (*This is a good example of the importance of “where-ness” in addition to “what-ness” in our sensory attention to the meaning of the world.*) Or maybe if there was no safe escape exit. So anxiety as a(n apparently) relatively innocuous emotion is – so far as the less

cognitive survival-oriented parts of the brain are concerned - only a short distance from biological overwhelm.

Milder versions of anxiety – trepidation, nervousness, anticipation – are interesting in that they feel almost exactly like excitement. But there is a subtle difference in that the mental-physical gesture underlying them is withdrawal and uncertainty rather than expansion and curiosity. In Daoist philosophy, the “lower” emotions may all transform into higher emotions if we allow them to move through the body. Whereas getting caught up in a storyline creates a feedback loop that prevents this evolution from taking place. These transformations are worth considering. The five emotions are :

- Sadness/Grief *transforms into* Compassion (including self-compassion!)
- Anger/Rage *transforms into* a sense of being physically and mentally Empowered
- Worry *transforms into* a desire for the very best for everyone.
- Fear *transforms into* Awe
- Hysteria *transforms into* Gratitude

The transformation of one emotion into another is essentially a freedom of movement (motion) between different mental and embodied states. Sometimes this motion is so rapid that one has to be quite subtle to perceive the “higher” form before another, different state arises as part of the froth of daily existence. The above list is in a specific “elemental” order (Metal-Wood-Earth-Water-Fire)⁹⁶, and the progression of mental-emotional states tends to follow the natural progression of these archetypal elements.

Sadness and Grief – hiding, coming back together

No one ever told me that grief felt so like fear

- C.S. Lewis

Sadness has a couple of features that relate to possible evolutionary origins. Firstly, it is about loss, and if we are considering a colony of cells, the loss would be part of that colony. There seem to be two major things that have to be addressed. One is the issue of how that loss has occurred, and for a colony of cells that could be a predatory animal – so we stop doing our normal feeding and sensing into the environment, we stop moving and we retreat inwards.

Small, silent, still and with a slightly suppressed breath and heart rate, we are (hopefully) not so easily seen. Secondly, we have to reform and reorganise to adjust around this loss. I first really “got” the biological meaning and “use” of sadness when I read a description of a sponge. Sponges are ordered, structured colonies of millions of simple single celled animals. If a sponge is put through a mincer, the colony has been disintegrated, but many of the single cells are still alive. If this soup of sponge cells is now poured into sea water, the small fragments will recognise each other and will do their best to swim through the water to re-join. Maybe the feeling of reconnection is more a kind of nostalgia, or **longing** – which inherently ask “*How can I return?*” or “*How can we be together again?*”. Whereas sadness and grief ask a question more like “*what do we do now?*”.

Paralytic Fear

There comes a point in the spectrum of fear where we become paralysed – unable to move in escape, and the jaw starts to tremble uncontrollably, but nevertheless quite quickly, rhythmically and lightly. Here we have a very clear vagal response – the sympathetic system is shut down and movement of most of the muscles of the body is not possible. Curiously, my personal (fortunately extremely brief) experience of these states was that the body did not want to curl up, but was elongated. Given the pulsatility of life, there is also a curled up version of fear, still holding on. When I have revisited these states, one interesting aspect is that its memory just does not kick in with any strength at all unless I have entered (embodied) the specific physical gesture⁹⁷. If the total pattern is considered from an evolutionary perspective – where did jaw muscles (and the jaw) originate? – what stage of evolution was so strongly vagal? – then we can appreciate that there is some regression of the jaw to gill-like behaviour. I am reminded of (literally) a fish out of water trying to breathe.

Love – the experience of connection

A home is not simply a building; it is the shelter around the intimacy of a life. Coming in from the outside world and its rasp of force and usage, you relax and allow yourself to be who you are. The inner walls of a home are threaded with the textures of one's soul, a subtle weave of presences. If you could see your home through the lens of the soul, you would be surprised at the beauty concealed in the memory your home holds. When you enter some homes, you sense how the memories have seeped to the surface, infusing the aura of the place and deepening the tone of its presence. Where love has lived, a house still holds the warmth. Even the poorest home feels like a nest if love and tenderness dwell there.

- John O'Donohue⁹⁸

In the illusion of separateness that we live in, Love has taken up an almost mystical quality, something extraordinary and special that transcends the mundane. It may also be slightly confusing, because there are many different kinds of love, which – if conflated and not carefully discriminated – make Love itself confusing, intangible, even unfamiliar; when it should in reality be the most present, real and everyday experience of all.

The Ancient Greeks listed at least seven different kinds of love:

Eros: physical or sexual love. (Eros was the Greek God of sexual desire)

Philia: the Love found in friendship, an affectionate regard, or the understanding and bond between equals

Ludus: Playful love.

Pragma: Longstanding love

Agape: Love of the soul : the love of God for man, and of man for (a good) God. Thomas Aquinas described it as “to will the good of another” - leading to Xenia or hospitality

Philautia: Love of the self

Storge: Love or affection (e.g. of parents for children)

but all of these really are about connection. To understand the simplicity of Love, all one has to do is have a pet dog. Whilst most pet dogs are deliberately infantilised so that they remain to a certain degree in a puppy state (rather than growing up into wolves), and some of a dogs love is very similar to the love expressed by small children, there is also a lot more depth to it.

Everyone who has experienced a feeling of Love will recognise the inner “glow” that defines it, and the simultaneously soft and shiny sensation round the eyes. If you recall the times when you experienced Love, you will on reflection, recognise that these were times when you felt deeply connected to someone or something. The Love that comes with connection is not a single emotion, but more of a spectrum, that includes Appreciation, Gratitude, Compassion; and even Awe, as described by St Theresa of Avila and many other Christian mystics.

Channels of information

The senses can (and do) provide information that is used purely subconsciously – such as the way our feet move along the ground when we are preoccupied with something else. However, our main focus here is ultimately consciousness, conscious sensory awareness and embodiment. It is obvious that nobody reading this will have *simultaneous* access to all the senses above.

So how exactly does the conscious mind interact with the senses?

The answer to this question in part comes down to how quickly we can think and process information. If you consider your experience of being in a body-mind, it becomes clear that the conscious mind cannot usually process many things at once. There are extraordinary altered states in which far more information is present in consciousness, but most of us can only do one thing at a time. This is normal everyday experience. If I think, then I am far less able to be very sharply aware of what is on front of my eyes (or sounds coming to my ears). It’s not that I cannot see or hear – but those senses go slightly to the background and are less distinct. If I add a strong emotional load to the thinking, then the visual details recede even further and become an unfocussed blur. Similarly, most people find that a curiously engaged focus on body sensation tends to calm the thoughts – it becomes much more difficult for random thoughts to enter the mind – instead one has to deliberately choose to think.

It has been known for a long time that there are a maximum of about four or maybe five channels of information that can be consciously present in awareness at any one moment. Thoughts can occupy one of those channels, as can moderate to strong emotions. The way it works is something like having a sea with lots of fish. As one of them rises to the surface, the others sink deeper into the water. So there can only ever be one or two fish visible of the surface (or leaping out of the water), plus a few

swimming close enough to the surface so that one is aware of their presence. The rest are deep in the ocean, below the reach of daylight. Focussing the eyes on an object sends sounds slightly into the background... You can investigate for yourself by simply shifting your main sensory or perceptual focus and noticing what happens to your other senses and to non-central objects in your awareness. If I focus on somebody's voice, I can still see their face, but not with the same clarity. If that focus of very strong I may have completely (temporarily) lost connection with an awareness of the room or of noises of birds and traffic coming through the window, or even a sense of the presence of my own body. If I shift attention to their face, I can still hear their voice, but it takes a substantial effort to remain conscious of the content and meaning of the words. If I think, then it is generally harder to feel – because thoughts also take up room on this limited platform, and displace other forms of information and activity that might present itself to consciousness.

All of this experiential ground is quite consistent with a “bottleneck” of information processing. Research by Richard Epworth suggests that we can only take new information into memory at about 10 bits per second⁹⁹. Clearly if one considers the entire sensory system, this is wrong. However, the bottleneck principle demonstrates the amount of effort that has to go into processing sensory information so that it has *meaning*. So maybe we are only able to process about 10 different pieces of *meaning* per second? There are several ways that this sensory information bottleneck can be put to good use. One is to realise that over-intense focus on any sense will inevitably prevent other senses being available, and will also lock down the ability to think round the information – the level of intensity can increase so much that the whole conscious mind suffers a kind of attentional *rigor-mortis* that also leads to physical immobility. So it is possible to choose to go in the opposite direction, in what the Hawaiian culture calls “*Hakalau*”. This is a practised and cultivated quality of unfocussed sensory presence, allowing the user to (potentially) be freely aware of all of their senses at once, and their conscious attention to be equally freely mobile. It is familiar to martial artists as the zen-like unfocussed state in which the edges between observer and observed may begin to blur, and a qualitative awareness of the full 360 degree space may also be available. There is a tendency to think of de-focussing as being part of a dulled state of awareness. But that dullness only arises when the de-focussed attention does not include the somatic senses. For – if they are allowed to do so – the external senses can play out in and through the internal senses.

The deliberate choice of *sensory* channels in the practice of *Hakalau* creates a quiet mind (because there is no space for mental activity when all the available channels are

being used in awareness). And this is a general rule – as the sensory engagement increases, the level of mental chatter decreases. And *vice versa* – as the level of mental chatter and disturbance and intensity increases, the degree of awareness of the environment and the body decreases. It raises a question as to whether there is an ideal locus towards which the attention should be trained to naturally gravitate. Firstly, it must be realised that we are supposed to have this wide range of possible attention, because all of it is “good” if it is appropriate to the current situation. Beyond that, there is a lot to be said for being in the present moment. And there is no doubt that an awareness of the senses – particularly the somatic, interoceptive senses – brings the mind and attention into the present moment¹⁰⁰. There are further advantages to the body being a habitual place to rest at least a part of waking attention, which we will look at in later chapters.

What is most important about all of this – is that we always have a choice that can be exercised as soon as that availability of choice becomes conscious – because the sensory system obeys the tiniest redirection of focus and will. If the choice of sensory focus is not conscious because we allow our attention to be pulled by the biggest sensory “noise”, then we are no longer in charge. It is particularly useful to train oneself to manage the senses by deliberately shifting between different senses. If this is just done as an exercise, it is meaningless and rather futile. If it is carried out with genuine curiosity, then the degree of control of the sensory system increases, which will be put to use in some of the embodiment exercises at the end of this book.

There is an additional limitation to perception that comes with the thought/emotion sensory channels – in that it is only possible to be aware of one strand at any one time. So a thought may be busy and confused, but at any one time it is only one thought. Similarly, when we place attention on one emotion, the others are not present. That is not to say that emotions are simple, because an emotion may be a complex mixture of apparently contradictory nuances – and as an emotion, it always carries the potential to shift and evolve. But if our body is simultaneously expressing two emotional states from two distinct places, it is only possible to be aware of the contents of one of these at a time. Another analogy might be to think of your capacity for awareness (be that of internal and external sensory information, thoughts or emotions) as something like a torch being used to look round a junk shop that is otherwise pitch black. You shine your torch to the ceiling, and most of what you see is ceiling, but the reflection creates a peripheral awareness of some elements of the rest of the room... you swing your torch towards one of those, and that in turn reduces the light falling on the ceiling. The more focussed your attention (the narrower the torch beam), the less you are aware of

anything not directly lit. Very focussed mental attention is exclusive. Someone can lose themselves in thoughts or memories in the words of a book, and be totally unaware of their external environment. A practiced meditator can be so absorbed by the motion and rhythm of breath that their awareness is wholly on that and might not even be aware of aching knees or other people moving around. And of course, the sensory system also feeds back into this concentration of focus, so exceedingly bright lights or pain or very loud noises can intrude into every corner of our being. Nevertheless, the same rules apply... Wherever the focus of attention rests – whether it is placed there by choice, or is dragged there by the intensity of the experience – will dominate awareness and damp down or even exclude everything else. Areas of sensory (or other) experience that we usually go to become easier and easier to access. And ones that we rarely (if ever) go to remain potentially available, but less and less easily accessible.

Choice of focus (of attention)

The topmost information channel is always the one that we are focussing on. The language of (external) vision is used extensively when talking about perception and attention, to the point that it can become easy to think that focus of the eyes and focus of attention are synonymous. But the real process can be discerned with a little reflection on the visual sense – and this clarifies the generic process that works for all senses and trains of thought-emotion-experience. There is an internal *choice* to look at a particular object at a particular focal distance – and then the eyes (senses) accommodate that decision. The process of accommodation is complex, and its specifics vary from sense to sense, and also for the subject of focus. So focussing on water – choosing to see what is beneath the water, or the shape of the ripples, or the reflections – takes an effort to shift the perceptual focus. In a very similar way, the question of whether to see the pale cube edges as being on top or below the cubes – and to switch between these – takes an effort of re-focus. The same process and the same qualitative use of choice (will) applies to all kinds of perception and all channels of information. If we do not exercise choice, then it is always the loudest sensory noise, the most intrusive or disturbing experience, or the perception that we are most habitually used to making – that takes centre stage.

The appearance of things changes according to the emotions; and thus we see magic and beauty in them, while the magic and beauty are really in ourselves.

Kahlil Gibran

The cycle of sense-meaning-response

I give the name of cosmic sense to the more or less confused affinity that binds us psychologically to the All which envelops us. The existence of this feeling is indubitable, and apparently as old as the beginning of thought... The cosmic sense must have been born as soon as man found himself facing the forest, the sea and the stars.

Pierre Teilhard de Chardin

I would like to look a little closer at just one of those textbook definitions of biological life – **response**. The idea of responsiveness of an organism is non-trivial. The ability to respond (response-ability) is itself a package of different capacities, which include :

- sensing the internal and external environments,
- deriving some kind of “meaning” from that sensory information, and
- using that information to respond in a meaning-full way, externally through movement, and/or internally through shifts in one or more of Homeostatic balance, Metabolism, Adaptation and Organisation (or even Reproduction and Growth¹⁰¹).

The senses have been largely discussed so far outside the sense-meaning-response feedback loop in which they naturally exist in a living creature. There is – on close inspection – a continuous feedback of information through the senses that then modulates not only our actions, but also how the senses are then used. I saw Evelyn Glennie perform in St Andrews Hall in Norwich about 15 years ago. Glennie is an internationally acclaimed concert percussionist, despite being profoundly deaf, and so has a very well developed and experiential understanding of how her senses work. In a 2007 TED talk¹⁰² she gives a beautiful description of the way in which senses and movement and emotional presence are fine-tuned to each other. If a drumstick – or a sense - is grasped too hard, then the natural relationship between sense and movement and response is lost, and there is less information, less beauty, less coordination, less grace, more strain. If they are trusted, played with, danced with, set free almost like birds from a cage - then they begin to sing - and this is the process of expression that she embodies and a master musician. This is not only about being a concert percussionist, but is a wonderful about how the senses, the body, and the attention are meant to be used optimally. As a Craniosacral Therapist I can fully appreciate her description, since that is also my practical experience in my daily job. If I trust the subtleties of my body-mind's ability to sense and respond, then there is much less effort, and the range of sensory perception hugely expands. In fact, my experience is

that the challenge is always to expand that trust and letting go of control *enough*. When the cognitive mind has fully let go, then the body and its sensory capacity and the associated feedback loops are able to work at their best. A good analogy is to think of an olympic level horse rider and her horse. If the rider tries to over-control the horse or holds the reins too hard, then she becomes less aware of the horse, the horse becomes less able to use its senses, and the quality of responsive communication between them reduces. Really, I am talking about Love. Glennie's TED talk also describes how the imaginal world – the ability to create something in the imagination – can also become a part of this delicate and creative feedback loop between movement, emotion, and senses. It is one form of the exertion of will, but instead of demanding a specific outcome, the imaginal will provides space for qualitative emergence.

Usually the idea of “meaning” is briskly skated over, but it deserves a lot more attention. If the external sensory organs are viewed as transducers (such as is used in an industrial process line or laboratory), they can not determine meaning. In one way the biological senses do automatically detect meaning, simply because the senses are all attuned to *relative* rather than absolute information – so we don't detect temperature as being 20 or 40 degrees Centigrade, but rather note that it feels pleasantly warm or excessively hot when compared to our ambient internal body temperature. However, meaning goes deeper than that. A water bear¹⁰³ has to be able to distinguish food from non-food, or the presence of bigger (predator) tardigrades.

Although this possibly goes without saying, there are also many senses that are not necessarily conscious, whose function is more related to control of internal physiological adaptive processes and homeostasis. And some of those senses inhabit the territory between conscious and non-conscious. For instance, the upper respiratory tract is rich in sensory fibers that help regulate breathing and muscular activity in the Larynx during both normal and abnormal conditions, and which help defend this particularly survival-critical and vulnerable area. These include¹⁰⁴ :

- collapse of upper respiratory structures on exhalation (so that inhalation can be initiated)
- temperature (cooling tends to inhibit depth of breathing)
- irritants (chemical or mechanical) inside the upper respiratory tract – coughing, retching, sneezing
- changes in osmolality and ionic composition of the mucosal surface liquid – compensatory mechanisms

The trachea and throat being a transition zone between external and internal worlds, some of these senses are similarly oriented in both directions. The response to these effects may be reflexive, or physiological, and some may be modulated consciously (or any combination of these), and control may come from local reflexes through to the hindbrain through to the cortex. To my mind, this one example (of maybe a million possible examples) gives a nice feel for the way in which the body-mind is a whole organism, integrated at all levels, all of the time.

So it is clear that the **sense-meaning-response** cycle is also continuous between conscious and deeply physiological or cellular processes. So whilst it has been postulated that the entire evolution, structure, embryological and infant development of the brain is focussed on movement^{105,106} – in fact every organism is filled with processes that are based on the same interdependency of sense-capacity, interpretation-capacity and response-ability. It is curiously circular in that the capacity to sense information is utterly useless – unless there is also some means to interpret that information (“meaning”), and also some way of responding. Which implies that both the capacity to interpret meaning and the capacity to move are inherently tied into the capacity to develop sensory apparatus, and at the very least they have a propensity to follow each other. The capacity to respond (move) is dependent on the capacity to sense something that has meaning. And the *control of movement* is also dependent on the internal capacity to sense what that movement is doing both internally and externally (i.e. the proprioceptive ability to gauge self-motion and self-position). Which in turn requires that there is some inherent sense of self-identity and of relationship to the external environment¹⁰⁷. There is no specific point in this loop at which one can definitively say “it starts here”, and one suspects that this apparent ambivalence of mechanistic causality has been there right from the very beginning. Interestingly, if one adopts a more Lamarkian stance – that the need for adaptation feeds back directly into the organism and can (e.g.) affect DNA expression and/or RNA transfer from food or viruses – then the randomness of evolution is as much about availability of building blocks as it is about random mutations, and “where does it start?” is no longer a relevant question.

The world is full of magic things patiently waiting for our senses to grow sharper.

- W.B.Yeats

All this is (at least apparently) somewhat prosaic for adult human beings. Historically, a philosophical difficulty with empathy in Western culture resulted in a belief that only humans (with a specifically adult human brain) can possibly be conscious. Human

babies do not have a nervous system wired like an adult, and so for about 50 years in some medical and philosophical circles they were considered to be non-conscious automatons, whose screaming was a meaningless reflex reaction. This mistaken understanding of human babies came out of an anthropocentric, patriarchal and brain-centred arrogance that still persists in many mouldy old corners of Western science and philosophy. Its legacy is not only a continuing issue in ethics, spirituality and health care, but extends into legal and cultural definitions of humanity, and of life itself. It is at the heart of the debate about animal intelligence, sentience and welfare (when that debate is not just quietly ignored for the purpose of economics and convenience). It was one of the foundations of several generations of advice to “let the baby cry itself to sleep, because (a) the crying is meaningless, and (b) it’s good for its character / it won’t be ‘spoilt’ ”. Anyone who has carefully observed babies and really “listened” to them will tell you – right from the time of birth they exhibit both consciousness and intelligence, and only lack in the means to communicate using a spoken language. In fact, they have heard spoken language during the entire gestation period, and already possess a rudimentary linguistic understanding at birth. So if one speaks simply to a baby and then pauses (allowing their relatively unconnected brain to calculate what it has experienced) they very often demonstrate comprehension and respond in context. And a baby can learn, understand – and use! – a couple of hundred sign language gestures at just a few months old when their brain is definitely not wired like an adult. So – at what level does intelligence arise? And by what medium is it propagated and acted upon?

Having lived with a dog for 10 years, I can confidently state that dogs are intelligent and conscious/sentient, in all meanings of the words. In particular, spacial/geographic and social memory is very difficult to reconcile with a view of animals being pseudo-aware automatons. The more that animal behaviour is studied further convinces us that many animals are intelligent – and conscious. Corvids (the crow family) are well known for their intelligence¹⁰⁸. They are one of many non-human species (including elephants, apes and octopus) that can make and use tools. This tool-using and tool-making capacity requires that the “mind” (whatever that is¹⁰⁹) processes a model of the world based on analogies. Which is in turn a necessary prerequisite of a structured language. Parrots (particularly Grey parrots) are even capable of learning up to a few hundred words of human language and then using them to tell contextually accurate jokes, indicating a level of understanding that cannot be explained away by “instinct”. Dolphins (and all cetaceans) exhibit substantial intelligence and a capacity for playful socialisation and bonding – two other behavioural traits (creative/recreational play and

complex social grouping) that we tend to associate with consciousness and emotional intelligence.

To what shall I liken the world?
Moonlight, reflected
In dewdrops, Shaken from a crane's bill.

- Dogen

And it's not just warm blooded creatures. Fish and other sea creatures exhibit complex behavioural patterns that cannot possibly be "programmed", such as the mating and reproductive behaviours of seahorses, zebra fish and lampreys¹¹⁰ and the profound intelligence of octopuses¹¹¹ (working with "only" half a million nerve cells, half of which are distributed in their arms). And termites exhibit communal intelligence as they construct homes that might extend down to 100 metres to intersect a desert water table – and which rely on a sophisticated passive solar ventilation system. As we gradually go to more and more (so-called) primitive life forms, we continue find behaviours that are almost impossible to account for without some nod towards consciousness¹¹². Meanwhile, research continues to be carried out that assumes "it's all neurology" – such as the paper reporting that the complex behaviour of a snail is controlled by two neurons¹¹³. This, by the way is an animal that can find its way back "home" when moved up to 10 metres, and maybe even up to 30 metres¹¹⁴. But when one starts to consider single celled organisms, or acellular organisms with no neural structure such as slime moulds being able to navigate their environment, it becomes necessary to ask questions. In the early soup from which life emerged¹¹⁵, who knows how the smallest of lifeforms detected the state of their environment – how they *perceived* the world through which they moved.

THE VALLEY WAS in the shadow, and the setting sun touched the faraway mountain tops; their evening glow seemed to come from within. To the north of the long road, the mountains were bare and barren, exposed by the fire; to the south, the hills were green and heavy with bushes and trees. The road ran straight, dividing the long and graceful valley. The mountains on this particular evening seemed so close, so unreal, so light and tender. Heavy birds were circling effortlessly high in the heavens. Ground squirrels were lazily crossing the road, and there was the hum of a distant airplane. On both sides of the road were orange orchards, well ordered and well kept. After the hot day the smell of purple sage was very strong, and so was the smell of sunburnt earth and hay. The orange trees were dark, with their bright fruit. The quail were calling, and a road-runner disappeared into the bush. A long snake-lizard, disturbed by the dog, wriggled off into the dry weeds. The evening stillness was creeping over the land.¹¹⁶

		Visual	Auditory	Kinaesthetic/physical
1	when operating new equipment for the first time I prefer to	read the instructions	listen to or ask for an explanation	have a go and learn by 'trial and error'
2	when seeking travel directions I..	look at a map	ask for spoken directions	follow my nose or maybe use a compass
3	when cooking a new dish I..	follow a recipe	call a friend for explanation	follow my instinct, tasting as I cook
4	to teach someone something I..	write instructions or draw a diagram	explain verbally	demonstrate and let them have a go
5	I tend to say..	"I see what you mean"	"I hear what you are saying"	"I know how you feel"
6	I tend to say..	"show me"	"tell me"	"let me try"
7	I tend to say..	"watch how I do it"	"listen to me explain"	"you have a go"
8	complaining about faulty goods I tend to..	write a letter	phone	go back to the store, or send the faulty item to the head office
9	I prefer these leisure activities	museums or galleries	music or conversation	physical activities or making things
10	when shopping generally I tend to..	look and decide	discuss with shop staff	try on, handle or test
11	choosing a holiday I..	read the brochures	listen to recommendations	imagine the experience
12	choosing a new car I..	read the reviews	discuss with friends	test-drive what you fancy
13	learning a new skill	I watch what the teacher is doing	I talk through with the teacher exactly what I am supposed to do	I like to give it a try and work it out as I go along by doing it
14	choosing from a restaurant menu..	I imagine what the food will look like	I talk through the options in my head	I imagine what the food will taste like
15	when listening to a band	I sing along to the lyrics (in my head or out loud!)	I listen to the lyrics and the beats	I move in time with the music
16	when concentrating I..	focus on the words or pictures in front of me	discuss the problem and possible solutions in my head	move around a lot, fiddle with pens and pencils and touch unrelated things
17	I remember things best by..	writing notes or keeping printed details	saying them aloud or repeating words and key points in my head	doing and practising the activity, or imagining it being done
18	my first memory is of	looking at something	being spoken to	doing something
19	when anxious, I..	visualise the worst-case scenarios	talk over in my head what worries me most	can't sit still, fiddle and move around constantly
20	I feel especially connected to others because of	how they look	what they say to me	how they make me feel
21	when I revise for an exam, I..	write lots of revision notes (using lots of colours!)	I talk over my notes, to myself or to other people	imagine making the movement or creating the formula
22	when explaining something to someone, I tend to..	show them what I mean	explain to them in different ways until they understand	encourage them to try and talk them through the idea as they try
23	my main interests are	photography or watching films or people-watching	listening to music or listening to the radio or talking to friends	physical/sports activities or fine wines, fine foods or dancing
24	most of my free time is spent..	watching television	talking to friends	doing physical activity or making things
25	when I first contact a new person..	I arrange a face to face meeting	I talk to them on the telephone	I try to get together to share an activity
26	I first notice how people..	look and dress	sound and speak	stand and move
27	if I am very angry..	I keep replaying in my mind what it is that has upset me	I shout lots and tell people how I feel	I stomp about, slam doors and throw things
28	I find it easiest to remember	faces	names	things I have done
29	I think I can tell someone is lying because..	they avoid looking at you	their voice changes	the vibes I get from them
30	When I'm meeting with an old friend..	I say "it's great to see you!"	I say "it's great to hear your voice!"	I give them a hug or a handshake

©VKA learning styles self-test: Victoria Chislett MSc and Alan Chapman 2005 :: www.businessballs.com/vaklearningstylestest.htm

Table 3.1 : VKA preference statements

A list (probably incomplete) of potentially conscious senses

X :: Sight : mainly eyes CN II :

- external (foveal) : colour, central focus
- external (peripheral) : B&W, low light conditions, peripheral motion, motion tracking

- Pineal gland (light/dark)
- skin and other cells (?)
- internal “visualisation” or “mind's eye”

X :: Sound : Frequency & Quality (Timbre, Loudness, Intonation & Direction

- middle ear CN VII: direct through auditory canal and indirect through bone conduction
- lateral line pressure sensors : deep sounds, pressure changes, rhythm
- Viscera (?) : deep sounds
- internal “self-talk”, thinking, etc

X :: Echolocation

C :: Taste : tongue CN V3, VII, IX, X (Salty, sweet, sour, bitter, Umami)

X,C :: Smell (often confused for taste) :

- CN I (at least 1 trillion different odours?)
- Vomeronasal organ (hormones, emotional states)

C :: Touch/skin contact

- Pressure
- texture
- vibration
- moisture

X :: Air motion & static electricity (skin hairs)

X,C,I :: Temperature :

- external (radiant infra red)
- contact/skin & internal (Heat, Cold)
- internal head temperature

C,I :: Pain, tissue damage & inflammation (nociceptors):

- Itch
- external/skin
- internal (muscle)
- internal (visceral)

I :: Proprioception (the ability to tell where your body parts are, relative to other body parts : sensations of muscle movement and joint position including posture, movement, and facial expression), includes

- stretch receptors (inc Muscle tension)
- interoception (somatic sensations)
- internal map

- visual clues

X(I?) :: Direction

- Relative direction
- Geographic sense (magnetic?)

I :: Time : internal clocks

I,C,X :: Equilibrioception (the ability to keep your balance and sense body movement in terms of acceleration and directional changes) : combination of

- inner ear/labyrinth
- stretch receptors in joints
- Kinaesthetic sense : acceleration
- pressure (soles of feet)
- Visceral Stretch Receptors: e.g. lungs (lung inflation), bladder (urination), stomach (fullness), blood vessels (blood pressure), and the gastrointestinal tract (bolus/defecation).
- visual clues.

I :: Thirst

- Left Cingulate Cortex (midbrain) & hypothalamus
- maybe also plasma osmotic pressure

I :: Hunger

- Brain : Hypothalamus (also related to emotion)
- Hunger pangs in subdiaphragmatic viscera
- Blood glucose?

I :: Chemoreceptors : These trigger an area of the medulla in the brain that is involved in detecting blood-borne hormones and drugs. It also is involved in the vomiting reflex. e.g.

- CSF pH
- Blood Oxygen content & O₂/CO₂ ratio
- Blood pressure : arterial, maybe also venous

I :: Other Interoceptive senses :

- Lymphatic activity
- Moisture
- etc etc

I :: Sense of “presence” & other qualitative experiential aspects of being alive

I :: Somatic aspects of Mental-Emotional states

I,X,C :: Electrical/Electromagnetic senses

X :: Proxemic sense : body space (inc. Sheldrake’s awareness of being looked at)

X,I :: Counter-Transference & Empathy (!)

? :: ESP (etc) and all that stuff

NOTE : Synaesthesia!

NOTE : Multisensory integration (e.g. colour/taste, balance/movement)

(A) Resourced Interoceptive qualities

General Questions...

- What am I feeling/what am I aware of in my body right Now?
- What is the specific texture/quality of this sensation?
- How would I describe it to someone else so they they would understand exactly what I am aware of?
- Where is the sensation/ what is its "geography"? (Skin, muscle, viscera / surface, shallow, deep / front, back / left, right : e.g. do my L and R sides feel exactly the same, and if not, what is the difference?)
- How local is this sensation vs general/ whole-body?
- If it appears to be all over, where is it NOT?

Contact & movement

Pressure, skin sensations (texture, warmth/cold, solidity, moisture, air/space, tightness, softness), support & being held, movement of breathing (ribs front/back/sides, belly, filling/emptying), air flow & temperature of air during breathing (nose/upper respiratory tract), inside of mouth (teeth, tongue, gums, etc), sense of clothing, shape of eyeballs in their sockets, presence of genitalia. Contact texture : bony, soft, etc → shape

Proprioceptive (when lying or sitting still)

Position & shape of body & limbs (Q. are these the same as what you would expect from how you know you have placed your body or can see it?), texture of muscle (mainly limbs, face, belly), muscle tightness & softness, shape & position of bony joints, facial expression

Inner vision, inner movement, inner urge to movement

Temperature

Burning / Hot / warm / cold / icy, and these may have a normal or dry or moist/damp quality

Vibration in the body due to external noise

Subtle & vibratory somatic etc

Pulsing (heart or other), beats, vibration, aliveness, potential for movement, tingling, fizzing, effervescent, bubbling, electrical, flow, cotton-wool, airy, expansive/full (inflated), full of blood (muscles), soft, energised lightness, solidity, weight/heaviness, density, substantial

Somatic component of mental-emotional states

(these will have a somatic texture and specific locations in the body, and in many cases the somatic texture + location is directly interpreted into meaning)

Safety, happiness, contentment, appreciation, love, gratitude, peace, stillness, now-presence, awake, alert, curious (yes! This also has a somatic component!)

(B) Hyper-aroused Interoceptive qualities

Pain (Itch, burning, dull, ache, "toothache", sharp, piercing, cutting, throbbing, electric, crushing, "nervy", tingling.) Tightness, tension, rigidity, excessive vibratory stillness of muscles, "waiting", external senses hyper-aroused/ hyper-alert, restless legs, twitching body.

Peripheral cold

Mental-emotional states : normal non-peaceful emotions : anxiety, fear, anger, sadness, etc; time distortions (time experienced faster or slower), agitation, restlessness

Time distortions (speeded up, slowed down)

(C) Hypo-aroused Interoceptive qualities

Numb, blank, absent, empty, dizzy, disoriented, disjointed, disconnected, clumsy, uncoordinated, low energy, exhaustion, sleepiness, deep cold, very heavy, very solid, dullness

Alien world, world through thick glass or cardboard, or as if seen on TV (depersonalisation).

Mental-emotional states : overwhelm, despair, hopelessness

Time distortions (drifty timelessness), OOB

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- 1 Sue Hubbard (2004) Ghost Station. Paperback: 112 pp Publ. Salt Publishing. ISBN-13: 978-1844710355
- 2 Jeff Green (2011) Sensing the world and ourselves. http://taruna.ac.nz/articles/12_senses_jeff_green.html
- 3 Tom van Gelder : Phenomenology. <http://tomvangelder.antrovista.com/welcome-to-my-phenomenology-site-99m10.html>
- 4 New Scientist (2005) Special issue : Why you have (at least) 21 senses. 26th Jan issue #2484. *"It used to be so simple. There were five senses and they created a picture of the world inside your head. But new ways of probing the brain are transforming this view of sensory perception. For starters, we have far more than five senses: the consensus is that there are at least 21 (page 34). And the boundaries between them are being blurred. Maybe you don't need eyes in order to "see" – other senses may take over in ways that so far defy explanation (page 37). In fact the whole idea that our sensations depend on which sensory organ picks up the information is being challenged. Deep down, it is what we do that counts (page 40)."*
- 5 Dr. Ali Ebneshahidi The General and Special Senses : online PDF <http://www.lamission.edu/lifesciences/AliAnat1/Chap%2011-%20The%20General%20and%20Special%20Senses.pdf>
- 6 The Bohm-Krishnamurti Project: Exploring the Legacy of the David Bohm and Jiddu Krishnamurti Relationship. A series of 10 seminars at Oak Grove School, Ojai, California. <http://bohmkrishnamurti.com/bohm-consciousness-seminars/>
- 7 Jonathan Amos (18 June 2018) Animals with "night vision goggles". BBC News online (Science) <https://www.bbc.co.uk/news/science-environment-44501058> : a review of **"Life in the Dark"**, an exhibition by the Natural History Museum, London, 13 July 2018 until 6 January 2019 <http://www.nhm.ac.uk/visit/exhibitions/life-in-the-dark.html>
- 8 Night-time. Excerpt from John O'Donohue (1999) Anam Cara: Spiritual Wisdom from the Celtic World. Publ. Bantam ISBN-13: 978-0553505924 <https://johnodonohue.com/>
- 9 There is a story that the great wooden ships that the Spaniards arrived in were so outlandishly foreign and unfamiliar to South American people – that they were unable to see the ships at all for some days. How true this is I do not know. Inability to see the unfamiliar is usually a bit more subtle. There's an old Jungle tale of a man who went fishing, riding a chestnut horse to a lonely spot in the forest on the banks of a river. He tied the horse to a tree behind him. After a short time, the horse started making a noise – whinnying, snorting, stamping in panic and trying to move from where it was tied. He went to the horse, and calmed it down, returned to his fishing, but yet again the horse became agitated. After a while, having tried to quiet and calm the horse many times, he just ignored it, and sat fishing. He positioned himself with his back against a tree, so that he was comfortable, and had the chestnut horse just visible from the corner of his eye. To his relief, the horse eventually did go quiet. When the man finally stopped fishing two hours later and looked behind himself, a tiger got up from eating the horse and melted back into the jungle.
- 10 Elena Yu. Zueva & Konstantin B. Zuev (2015) Dominance Concept by AA Ukhtomsky and Anticipation. Researchgate DOI:10.1007/978-3-319-19446-2_2
- 11 Robert A Heinlein (2007) Stranger in a Strange Land. Hodder Paperbacks ISBN-13: 978-0340938348 First publ. 1961, - see the character Ann, who is trained as a "Fair Witness" to not assume any un-sensed information – such as whatever might be behind the front wall of a building (including whether there might be a rear wall!)
- 12 Amelia Settembre (27.Feb.2020) Magenta: The Color That Doesn't Exist And Why <https://medium.com/swlh/magenta-the-color-that-doesnt-exist-and-why-ec40a6348256>

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- 13 The Ames Room illusion explained by Ingrid Wicklegren for Scientific American. <https://www.youtube.com/watch?v=qlhju6nlGt8>
- 14 See the tale of the Rat and the Ox, from Vikram Seth (1991) *Beastly Tales from Here and There*. Publ. Viking ISBN 978-0-7538-1034-7
- 15 Runeson, S. (1988). The distorted room illusion, equivalent configurations, and the specificity of static optic arrays. *Journal of Experimental Psychology: Human Perception and Performance*, 14 (2), 295-304 DOI: 10.1037//0096-1523.14.2.295
- 16 Notes from two scientific psychologists (Wednesday, 6 October 2010) Runeson, the Ames Room and the Irrelevance of Equivalent Configurations <http://psychsciencenotes.blogspot.com/2010/10/runeson-ames-room-and-irrelevance-of.html>
- 17 Turing patterns are technically called diffusive reaction patterns, and arise when there is at least one driving “reaction” and one inhibiting response that interact in space. The resulting patterns can be seen in the distributions of stars in galaxies, or in high altitude cloud formations and sand dunes, the patterning on the skin of a whale shark, trigger fish and many sea shells, the intergrowth of competing bacteria or plants; and in many other areas of nature.
- 18 Natalie Wolchover (July 12, 2016) A Bird’s-Eye View of Nature’s Hidden Order. Scientists are exploring a mysterious pattern, found in birds’ eyes, boxes of marbles and other surprising places, that is neither regular nor random. *Quanta Magazine*. <https://www.quantamagazine.org/hyperuniformity-found-in-birds-math-and-physics-20160712/>
- 19 Yoseph A. Kram, Stephanie Mantey & Joseph C. Corbo (2010) Avian Cone Photoreceptors Tile the Retina as Five Independent, Self-Organizing Mosaics. *Plos One* <https://doi.org/10.1371/journal.pone.0008992>
- 20 https://en.wikiversity.org/wiki/Radiation_astronomy/Electromagnetics
- 21 The investigation into cell intelligence by Albrecht Buehler has identified the orthogonal pair of Centriole organelles as a simple directional EM sensor present in every cell. He has not tested their range of EM sensitivity, but has confirmed that they are sensitive to near IR (the EM range just below the visible red wavelengths). Buehler has published over 20 academic papers on the subject of cell intelligence. The website <http://www.basic.northwestern.edu/g-buehler/cellint0.htm> contains video clips of single cells which are fascinating to watch – as they display clear signs of consciously making decisions. Probably a good place to start with academic papers would be Albrecht-Buehler, G. (1995) Changes of cell behaviour by near-infrared signals. *Cell Motility and the Cytoskeleton* 32:299-304
- 22 “Colour-sensitive fingers” : a scientific conundrum. Notes and Comments in *New Scientist*, 16th Jan 1964, p. 130.
- 23 Adam Zeman, Matthew MacKisack & John Onians (eds.) (2018) *The Eye's Mind - visual imagination, neuroscience and the humanities Cortex | Special Edition 105*, pp1-188 (Aug) <https://www.sciencedirect.com/journal/cortex/vol/105/suppl/C>
- 24 Future Minds Lab, University of New South Wales. *Aphantasia and the Mind’s Eye*. <https://www.futuremindslab.com/aphantasia>
- 25 From Patrick Harpur (2008) *Mercurius: The Marriage of Heaven and Earth*. Publ. The Squeeze Press ISBN-13 : 978-1906069056 | *Congelation*, p.349
- 26 The Lateral Line Pressure Sensors (LLPSs) in humans are remnants of the LLPSs in our ancestral fish. The ear is an adaptation of the most cephalad of these – part of the way that primitive gill arch structures have adapted to form the neck and face. A fish uses

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the LLPSs to detect changes in water pressure – mainly to detect large predators. The remnant versions in humans are also particularly attuned to low frequencies. They are located – as for a fish – on the place where the costal nerves exit from between each rib, on the line of the body that divides front from back.

- 27 <https://www.youtube.com/watch?v=MD7UI2i9-xkw> (Blind football team GB in action)
- 28 Science Blogs (Neurophilosophy) Human echolocation activates visual parts of the brain. Posted by Mo on May 25, 2011. <http://scienceblogs.com/neurophilosophy/2011/05/25/human-echolocation-activates-visual-parts-of-the-brain/>
- 29 Thaler L, Arnott SR, Goodale MA (2011) Neural Correlates of Natural Human Echolocation in Early and Late Blind Echolocation Experts. PLoS ONE 6(5): e20162. <https://doi.org/10.1371/journal.pone.0020162> (Conclusions : These findings suggest that processing of click-echoes recruits brain regions typically devoted to vision rather than audition in both early and late blind echolocation experts.)
- 30 Pungent is the strong dense almost oily taste typical of herbs. Umami is a savoury flavour recognisable in soy sauce, gravy and foods that have been slow-cooked or slightly caramelised in a frying pan or oven (e.g. roast parsnips).
- 31 Jim al-Khalili & Johnjoe McFadden (2014) Life on the Edge : The coming of age of quantum biology. Publ. Bantam Press 368pp ISBN-13: 978-0593069325
- 32 Richard P. Feynman (2018) Surely You're Joking, Mr. Feynman!: Adventures of a Curious Character. Paperback, 400 pp Publ. W. W. Norton & Company; Reissue edition (first published 1985) ISBN-13: 978-0393355628
- 33 I never realised fully what “having a good nose for the job” meant – until I once gave a leaflet to a couple of policemen. I was working with an aromatherapist who was aware of the way subliminal smells can affect people's choices – so, for instance, some shops use very small quantities of aromatherapy oils to attract customers into the premises. She had placed one drop of bergamot essential oil on her finger and run it along the edge of a stack of 500 leaflets – the ones I was handing out. Anyhow, the younger of the two policemen took the leaflet from my hand, and then he suddenly became very alert and started to sniff the paper, stating that it had “an interesting smell”. This was even more extraordinary in that the oils had been on there for several hours on a hot sunny day, and we were standing on a busy road with acrid smells of traffic exhaust all around us.
- 34 Kevin Falconer 30th June 2018 “Dr Brown's Nose” – from Aquarium of Vulcan blog, <https://aquariumofvulcan.blogspot.com/2018/06/dr-brownes-nose.html>
- 35 Sir Thomas Browne (1658) *Garden of Cyrus* (Chapter 4), quoted in Falconer 2018, *ibid.*
- 36 Sir Thomas Browne (1686) *Museum Clausum*, quoted in Falconer 2018, *ibid.*
- 37 Helen Keller became blind and deaf as a result of an illness at 19 months old. She later learned to read, write and speak through the persistence of her teacher, Anne Sullivan; becoming (despite her deafness and blindness) one of the great peace activists and authors of early 20th century America. This is a description of her first experience of discovering the meaning of a word ... “As the cool stream gushed over one hand [Anne] spelled into the other the word water, first slowly, then rapidly. I stood still, my whole attention fixed upon the motions of her fingers. Suddenly I felt a misty consciousness as of something forgotten--a thrill of returning thought; and somehow the mystery of language was revealed to me. I knew then that ‘w-a-t-e-r’ meant the wonderful cool something that was flowing over my hand. That living word awakened my soul, gave it light, hope, joy, set it free! There were barriers still, it is true, but barriers that could in time be swept away.”

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- 38 We still possess a primitive reflex between the oculomotor muscles (that control eye movement) and the tongue muscles. If you consider a cow or other grazing animal, it has to check with its eyes what is in the direction that it projects its tongue (or vice versa). So anyone able to observe their tongue motion and eye motion without consciously getting snarled up with the movements – will notice that the eyes tend to go where the tongue goes when it is pushed out of the mouth and in a left or right direction. Uncoupling voluntary override of this reflex is not easy. If you can observe your breath without taking it over and changing it – then you might be on the way to being able to achieve the tongue-eye trick. I have found this reflex useful sometimes when treating trauma. If the eyes are locked in one position because there is a fear to look in one direction, then one way that the brain can be taught that direction is safe is to *symbolically* inspect it by exploring it using *physical* tongue movements (so the tongue reaches the eyes that looking in this direction is OK).
- 39 Not to forget the teeth! As an ex-geologist, I know that the teeth are capable of distinguishing textures down to about 10 microns (1/100 of a millimetre), which is useful for distinguishing the difference between a silt and a clay without the need for a microscope. It was something of a joke that old field geologists all had worn-down teeth.
- 40 Eric S. McCoy, Bonnie Taylor-Blake, Sarah E. Street, Alain L. Pribisko, Jihong Zheng, Mark J. Zylicka. (2013) Peptidergic CGRP α Primary Sensory Neurons Encode Heat and Itch and Tonicallly Suppress Sensitivity to Cold. Neuron; DOI: 10.1016/j.neuron.2013.01.030 and a simplified description at University of North Carolina School of Medicine. "*Hot and cold senses interact: Cold perception is enhanced when nerve circuitry for heat is inactivated.*" ScienceDaily. ScienceDaily, 8 April 2013. www.sciencedaily.com/releases/2013/04/130408172243.htm
- 41 <https://www.thenakedscientists.com/get-naked/experiments/how-we-sense-temperature> describes a simple experiment in which the hot and cold nerves are desensitised on different hands – to demonstrate that there are two sets of nerves!
- 42 Jean-Pierre Barral (2005) Manual Thermal Evaluation. Hardcover: 128 pp Publ.: Eastland Press ISBN-13: 978-0939616480
- 43 Infra red is an odd sense, and having observed it during treatments for 20 years I have come to the conclusion that I really do not understand its behaviour. Sometimes it is possible to feel cool on the front of the hand pointed towards a patient and simultaneously warm on the back of the hand. Note that we are not a calibrated instrument detecting absolute temperature (or absolute anything else for that matter). The human sensory system detects differences rather than absolutes. So a small 0.1°C difference in radiant temperature between one place on the body and somewhere 5 or 10 centimetres away is detectable, but radiant heat from a general body temperature of 38 degrees might not feel appreciably different to one of 37 degrees. However, it would probably feel unusually warm to *touch*, because the hand touching is (presumably) at normal body temperature (and so again it is difference that is being detected, not absolute temperature).
- 44 Near infrared to far infrared covers about twice the order of magnitude of frequency and the visible spectrum. Animals tend to have a black body radiation centred around 12 microns (far-infrared).
- 45 Fabrice Sarlegna, Chris Miall, Jonathan Cole & Robert Sainburg (February 16, 2021) Proprioception, our imperceptible 6th sense. The Conversation <https://theconversation.com/proprioception-our-imperceptible-6th-sense-150775>
- 46 In my experience of bodywork for over 20 years, I have observed that the body map against which the proprioceptive senses are calibrated is related to some deep acupuncture channels that more or less follow the bony skeleton. These channels are not necessarily hard-linked to body structure, and changes in energetic balance can have a profound effect on proprioception. See

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notes on body vectors in John E. Upledger (1987) *Craniosacral Therapy II : beyond the Dura*. Publ. Eastland Press Inc 259pp ISBN-13: 978-0939616053

- 47 This cultural bias runs deep, is embedded in every corner of thought in Western cultures (to the degree that it is so familiar it is essentially invisible), and has come about through a sleight of hand by medieval theologian-scientists. (Until the late 18th century in Europe, science and theology were essentially the same thing, and science was considered to be one way to reveal God). The “really real” was considered to be non-physical. So therefore, in investigating the really real world, it was necessary to see through the mirage of the apparently real physical world. Therefore, whatever could be sensed by the body was not considered to be of any substantial (!) importance. This topic is discussed in more depth in later chapters, because it is a very powerful cultural engine that increases the tendency towards dissociation and disembodiment.
- 48 Which is itself somewhat paradoxical and debilitating – given the modern fashion of using optical illusions to “demonstrate” the unreliability of the sense of sight!
- 49 Sean Gibbons Smarter Rehab Blog : The Body Image Project. <http://smarterrehab.blogspot.com/2016/12/the-body-image-project-part-1-overview.html>
- 50 It was thought for a long time that the pieces of Iceland Spa crystal (very pure, transparent calcite) found in Viking burials were just ornamental. However, it was realised fairly recently that the birefractive properties of calcite can be used to locate the position of the sun on a completely overcast day. See this video on how to use a “Sun Stone” <https://www.youtube.com/watch?v=bkBVxGZNIV0>
- 51 Noboru Ikeya & Jonathan R. Woodward (2021) Cellular autofluorescence is magnetic field sensitive. *Proceedings of the National Academy of Sciences* Jan, 118 (3) e2018043118; DOI: 10.1073/pnas.2018043118 <https://newarlas.com/biology/live-cells-respond-magnetic-fields/>
- 52 I have experimented with the geographic sense for some years. I found that I often got confused by 180 degrees when attempting to think of a magnetic sense. However, when I started to think “where is Polaris (the north pole star)?” I began to be able to locate that direction and elevation quite accurately most of the time. There is a different feel inside my body when I place my attention in that direction. Which is interesting.
- 53 Robins start with a magnetic compass in both eyes, and end up with just one *in National Geographic : Not Exactly Rocket Science : A Blog* by Ed Yong. 28/Aug/2012 <http://phenomena.nationalgeographic.com/2012/08/28/robins-start-with-a-magnetic-compass-in-both-eyes-and-end-up-with-just-one/>
- 54 Thorsten Ritz, Roswitha Wiltschko, P. J. Hore, Christopher T. Rodgers, Katrin Stapput, Peter Thalau, Christiane R. Timmel, and Wolfgang Wiltschko (2009) Magnetic Compass of Birds Is Based on a Molecule with Optimal Directional Sensitivity. *Biophysical Journal* Volume 96 April pp3451–3457 doi: 10.1016/j.bpj.2008.11.072
- 55 Cryptochrome and Magnetic Sensing. NIH Center for Macromolecular Modeling & Bioinformatics | University of Illinois at Urbana-Champaign. <http://www.ks.uiuc.edu/Research/cryptochrome/>
- 56 C Walcott, JL Gould & JL Kirschvink (1979) Pigeons have magnets. *Science* 07 Sep 205 (4410) pp1027-1029 DOI: 10.1126/science.472725

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- 57 Foley, Lauren E., Gegeer, Robert J. & Reppert, Steven M. (2011) Human cryptochrome exhibits light-dependent magnetosensitivity. *Nature Communications* 2011/06/21/online 2 (356) <http://dx.doi.org/10.1038/ncomms1364>
- 58 Heinz A Lowenstam (1962) Magnetite in Denticle Capping in Recent Chitons (Polyplacophora). *GSA Bulletin* (1962) 73 (4): 435-438. [https://doi.org/10.1130/0016-7606\(1962\)73\[435:MIDCIR\]2.0.CO;2](https://doi.org/10.1130/0016-7606(1962)73[435:MIDCIR]2.0.CO;2)
- 59 Shinsuke Shimojo, Daw-An Wu & Joseph Kirschvink (2019) New evidence for a human magnetic sense that lets your brain detect the Earth's magnetic field. *The Conversation* March 18, 2019 5.01pm GMT <https://theconversation.com/new-evidence-for-a-human-magnetic-sense-that-lets-your-brain-detect-the-earths-magnetic-field-113536>
- 60 I know a few people who wake up at exactly the time they decide they wish to wake up, by making the decision just before going to sleep. And a game I have played with my girlfriend on and off is to guess the time. When we were doing this daily we were getting down to an accuracy of a few minutes over an interval of several hours. Definitely a “use it or lose it” sense.
- 61 24 minutes is an interesting number. One 60th of a day. In Chinese medicine there are 12 meridians that go through a cycle each day, and each is more active for a period of 2 hours. There are also 5 elements in the Chinese cycle of natural processes, and 2 hours divided by 5 = 24 minutes. Just a coincidence.
- 62 Norio Ishida, Maki Kaneko, & Ravi Allada (1999) Biological clocks. *PNAS* August 3. 96 (16) 8819-8820; <https://doi.org/10.1073/pnas.96.16.8819>
- 63 Tina Hesman Saey (2015) The origin of biological clocks : The evolutionary story of circadian rhythms is under scrutiny. *Science News* 188 (2), July 25, p. 14 <https://www.sciencenews.org/article/origin-biological-clocks>
- 64 Jagannath A, Taylor L, Wakaf Z, Vasudevan SR & Foster RG (2017) The genetics of circadian rhythms, sleep and health. *Human Molecular Genetics*, Volume 26, Issue R2, 1 October, Pages R128-R138, <https://doi.org/10.1093/hmg/ddx240>
- 65 Chandrashekhar V. Apte (2012) Biological clocks: The coming of age. *Int J Appl Basic Med Res*. Jan-Jun; 2(1): 1-2. doi: 10.4103/2229-516X.96788
- 66 National Research Council of America (1986) *The Earth's Electrical Environment*. Publ. The National Academies Press, Washington, DC. 263pp ISBN-13 978-0-309-03680-1 doi:10.17226/898. Also available free online as a PDF <https://www.nap.edu/catalog/898/the-earths-electrical-environment>
- 67 The electrical environment that we live in is no longer a natural one. George Starr White noted even in the early 20th century that his chickens preferred direction of sleep (and their egg laying) that he had observed for over a decade was permanently disrupted when the first radio transmitter started broadcasting near his home. That effect would be almost impossible to quantify now, given that artificial EM fields are almost universal. It's not only a matter of screening the artificial EM, because there is a geomagnetic EM (Earth Cavity Resonance) and electrical field (the atmospheric electrical potential) that we have evolved in for a couple of billion years. Earth cavity (Schumann) resonances have a fundamental frequency of 7.83 Hz (i.e. light travels round the Earth's equator 7.83 times per second), but exist in a broad spectrum of frequencies from about 3Hz up to over 100Hz. They are transmitted particularly strongly in the more conductive Ozone layer, along with the electrical potentials of hundreds of thousands of volts generated by atmospheric lightning discharges. Since life is incredibly adaptive and creative I would be surprised if these natural EM fields did not have some effect on our metabolism. Having a physiological effect may or may not be

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the same as being sense-able – the senses would have to be interoceptive in some way or another. I am aware that some places on Earth feel more energising and uplifting than others, and one possibility is that this is an electromagnetic effect.

- 68 Stephen Harrod Buhner (2004) *The Secret Teachings of Plants: The Intelligence of the Heart in the Direct Perception of Nature*. Publ. Bear & Company ISBN-13: 978-1591430353
- 69 New Scientist (2005) op. Cit.
- 70 Counter-Transference is the awareness in ones own body-emotions-mind of something that is simultaneously happening in another person's body-emotions-mind. This is a resonance between two people, most usually when they are in the same room together, but sometimes it happens because they are very strongly connected emotionally (e.g. parent and child). It is not easy to know that a feeling is Counter-Transference unless (a) the circumstances are fairly simple, and (b) the recipient is very clear about their own internal state and what is going on around them, and how they normally respond in these circumstances. If an unexpected emotion or feeling arises and it cannot be directly attributed to internal processes, then it may be a resonance with somebody else's experience. It usually takes substantial self-awareness and experience in to be able to know that what is being experienced truly is Counter-Transference, and that this is not Projection. Exactly "How" Counter-Transference arises is a very interesting question – and this is one of several fairly common experiences that point to consciousness not being located purely in the brain.
- 71 Mind the Gap: Moving From Brain to Body | Dr. Andy Harkin | TEDxBunbury <https://www.youtube.com/watch?v=yfcnRzcpTd4>
- 72 Jeff Green (2011) op. cit.
- 73 Tom van Gelder op. cit.
- 74 *In philosophy and certain models of psychology, qualia (/ˈkwɑːliə/ or /ˈkweɪliə/; singular form: quale) are defined to be individual instances of subjective, conscious experience. The term qualia derives from the Latin neuter plural form (qualia) of the Latin adjective quālis (Latin pronunciation: /ˈkʷɑːlɪs/) meaning "of what sort" or "of what kind" in a specific instance like "what it is like to taste a specific orange, this particular orange now". Examples of qualia include the perceived sensation of pain of a headache, the taste of wine, as well as the redness of an evening sky. As qualitative characters of sensation, qualia stand in contrast to "propositional attitudes",[1] where the focus is on beliefs about experience rather than what it is directly like to be experiencing. (<https://en.wikipedia.org/wiki/Qualia> 19/Jun/2018)*
- 75 ... and as *meaning*, "Concept" is more in line with Douglas Hofstadter's view of conscious/linguistic processes as being applications of *analogy*. See the slightly dry 2016 lecture by Douglas Hofstadter – *Analogies are the core of thinking* <https://www.youtube.com/watch?v=vORB92BU7zk> or the slightly less dry 2009 lecture *Analogy as the Core of Cognition* <https://www.youtube.com/watch?v=n8m7lFQ3njik>
- 76 Scott Olsen (2006) *The Golden Section: Nature's Greatest Secret*. Publ. Wooden Books, Hardcover, 64pp ISBN-13: 978-0802715395
- 77 Badde, S., Myers, C.F., Yuval-Greenberg, S. et al. (2020) Oculomotor freezing reflects tactile temporal expectation and aids tactile perception. *Nat Commun* 11, 3341. <https://doi.org/10.1038/s41467-020-17160-1> and at <https://neurosciencenews.com/eyes-touch-16611/amp/>
- 78 Patrick Süskind (2010) *Perfume: The Story of a Murderer* (Penguin Essentials) Paperback. 272 pp ISBN-13: 978-0141041155
- 79 <https://www.psy.ox.ac.uk/research/crossmodal-research-laboratory>

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- 80 Spence, C (2015) Multisensory flavor perception. Cell 161 (March), pp24-35 doi:10.1016/j.cell.2015.03.007
- 81 Ruby Deevoy (2018) Feed your senses, in Breathe Magazine, issue 13 pp38-39. ISSN 2397-9747
- 82 The Bohm-Krishnamurti Project: Exploring the Legacy of the David Bohm and Jiddu Krishnamurti Relationship. A series of 10 seminars at Oak Grove School, Ojai, California. <http://bohmkrishnamurti.com/bohm-consciousness-seminars/>
- 83 Richard E. Cytowic (2003) The Man Who Tasted Shapes (A Bradford Book) Paperback, 296 pp ISBN-13: 978-0262532556
- 84 John Harrison (2001) Synaesthesia: The Strangest Thing. Publ. OUP Oxford ISBN-13 : 978-0192632456
- 85 John O'Donohue (1997) Anam Cara. Publ. Bantam. 281pp hardback ISBN: 0593-042018 (poem from page 105)
- 86 Pert, Candace B (1997) Molecules of Emotion: Why You Feel the Way You Feel. Publ. Scribner. ISBN: 0684831872
- 87 Think Twice: How the Gut's "Second Brain" Influences Mood and Well-Being : The emerging and surprising view of how the enteric nervous system in our bellies goes far beyond just processing the food we eat. By Adam Hadhazy Scientific American, February 12, 2010. Available online at <http://www.scientificamerican.com/article.cfm?id=gut-second-brain>
- 88 Michael Gershon (1998) The Second Brain : The Scientific Basis of Gut Instinct and a Groundbreaking New Understanding of Nervous Disorders of the Stomach and Intestines. ISBN: 0060182520
- 89 Michel Le Van Quyen (2003) Disentangling the dynamic core: a research program for a neurodynamics at the large-scale. Biological Research 36, pp67-88, Available online at <http://www.scielo.cl/pdf/bres/v36n1/art06.pdf>
- 90 <http://atlasofemotions.org/>
- 91 Kragel PA, Knodt AR, Hariri AR, LaBar KS (2016) Decoding Spontaneous Emotional States in the Human Brain. PLoS Biol 14(9): e2000106. <https://doi.org/10.1371/journal.pbio.2000106>
- 92 Lauri Nummenmaa, Riitta Hari, Jari K. Hietanen & Enrico Glerean (2018) Maps of subjective feelings. Proceedings of the National Academy of Sciences Sep, 115(37) pp9198-9203; DOI: 10.1073/pnas.1807390115 <https://www.pnas.org/content/pnas/115/37/9198.full.pdf>
- 93 Mary Oliver (2004) Wild Geese - selected poems. Bloodaxe World Poets Series, No. 2 ISBN-13: 9781852246280 ... and to hear Mary Oliver reading this poem see https://www.youtube.com/watch?v=lv_4xmh_WtE
- 94 This close visual focus ready for combat seems to be very hardwired into the capacity to feel and express the emotion of anger. It is very difficult to remain truly angry if the focus of the eyes is directed to a distant object, or the eyes are de-focused.
- 95 When Anxiety Won't Go Away (Science Daily) <http://www.sciencedaily.com/releases/2012/07/120706105430.htm> : a summary of Andras Bilkei-Gorzo, Susanne Erk, Britta Schürmann, Daniela Mauer, Kerstin Michel, Henning Boecker, Lukas Scheef, Henrik Walter, and Andreas Zimmer. Dynorphins Regulate Fear Memory: from Mice to Men. The Journal of Neuroscience, 4 July 2012, 32(27):9335-9343; doi: 10.1523/jneurosci.1034-12.2012
- 96 The Chinese “**Five** Elements” of Metal, Wood, Earth, Water and Fire are a description of a cycle of **processes** (rather like the hydrologic cycle - evaporation, dispersion, condensation, rain, flow in rivers, settling in the sea/lakes). In contrast, the system of *four* elements (or humours) more familiar in Western culture is a set of ingredients that combine together in different proportions,

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rather like the way that the basic ingredients sugar, flour, eggs and fat can be combined in a myriad of different ways to produce scones, angel cake, sourdough bread, puff pastry, pancakes, waffles, and many other traditional foods. The Five Elements are given a (necessarily very brief) consideration in the Appendix, because they crop up experientially during interoception; and can be a useful tool to navigate and understand some somatic experiences.

- 97 I deliberately did not use "... acted the gesture ...", because when the memory activates fully there is non sense at all of anything being "acted" (as in "made-up"). The gesture may be *approached* through mimicry, but at a certain point "something" takes over.
- 98 Where Love has Lived, from John O'Donohue (2004) Divine Beauty: The Invisible Embrace. Publ. Bantam ISBN-13: 978-0553813098 <https://johnodonohue.com/store>
- 99 Richard Epworth (2013) Bottleneck – Our human interface with reality: The disturbing and exciting implications of its true nature. Kindle Edition. 414pp Publ. Goforich Publications. ASIN: B00H2RE710 Also available in paperback <http://www.humanbottleneck.com/>
- 100 Eckhart Tolle (2001) The Power of Now: A Guide to Spiritual Enlightenment. Publ. Yellow Kite 192pp ISBN-13: 978-0340733509
- 101 For instance, it has recently been found that the gestation period of many insect-eating birds lengthens and shortens according to decreasing or increasing ambient temperature. The key is that the chicks must hatch at the correct time so that there is maximum food availability, and insect development is affected directly by temperature (possibly itself being driven by temperature-related changes in plant growth). One example of this is in Cresswell, W. and Mcleery, R. (2003), How great tits maintain synchronization of their hatch date with food supply in response to long-term variability in temperature. Journal of Animal Ecology, 72: 356-366. doi:10.1046/j.1365-2656.2003.00701.x
- 102 Evelyn Glennie (May 14, 2007) How to truly listen | TED <https://www.youtube.com/watch?v=IU3V6zNER4g&feature=share>
- 103 Tardigrades (or water bears) are about half a millimetre long, and are amongst the hardiest living organisms known, being able to withstand compete dehydration, and even some minutes exposure to the deep vacuum and high ultraviolet levels of outer space. They eat bacteria and other smaller tardigrades, and are important pioneer species in water habitats.
- 104 Giuseppe Sant'Ambrogio, Hirokazu Tsubone & Franca B.Sant'Ambrogio (1995) Sensory information from the upper airway: Role in the control of breathing. Respiration Physiology (Frontiers Review) 102(1) October, pp1-16 [https://doi.org/10.1016/0034-5687\(95\)00048-1](https://doi.org/10.1016/0034-5687(95)00048-1)
- 105 Schwartz, A. B. (2016). Movement: How the Brain Communicates with the World. Cell, 164(6), 1122-1135. <http://doi.org/10.1016/j.cell.2016.02.038>
- 106 Hermundur Sigmundsson, Leif Trana, Remco Polman & Monika Haga (2017) What is Trained Develops! Theoretical Perspective on Skill Learning. Sports 5(2), PP38-49; <https://doi.org/10.3390/sports5020038>
- 107 In which case one has to question whether the individual senses – sight, temperature, etc – have any meaning outside the capacity do derive meaning, and it is the higher interpretative levels (such as a sense of safety) that are our true senses.
- 108 Esther Woolfson (2009) Corvus: A Life With Birds. Publ. Granta Books, Paperback, 352pp ISBN-13: 978-1847080806
- 109 When considering that other creatures may have a conscious "mind", care must be taken to not assume this is how your mind

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works. There are vast differences between humans who use different language structures, so to imagine the processes of an animal that has a different physical form is pretty well impossible. Experiencing that may not be impossible ...

- 110 One of the most primitive of vertebrates, sea lampreys swim up to a hundred miles inland up freshwater rivers to lay their eggs. Two males accompany a female. When they reach a suitable site, they will dig a hole about two feet in diameter and up to one foot deep – if any stone is too big for one of them to move alone, they will cooperate to move it. Once the eggs are laid, all the material is replaced, and the adults swim back to the sea.
- 111 <http://www.bbc.com/earth/story/20160527-eight-reasons-why-octopuses-are-the-geniuses-of-the-ocean>
- 112 I have observed a family of house spiders for about 10 years, and despite them occasionally eating each other when food is scarce, they show distinct social behaviour. The matriarch gave birth again recently. For almost two months she held a ball of web-silk containing several dozen babies smaller than the eye can distinguish lightly in her jaws. Once they reached sufficient size – about a millimetre across their leg span – the babies swarmed out onto a specially constructed nursery web, so they they rested equidistant from each other and all within about an inch of the mother. During this period, the previous generation of youngsters made regular trips to visit, each then returning to their particular corner of the room.
- 113 Snails use 'two brain cells' to make decisions, Sussex University discovers – BBC news story <http://www.bbc.co.uk/news/uk-england-sussex-36443264> and the original paper is Crossley M, Staras K & Kemenes G (2016) Nature Communications 7, Article number: 11793 doi:10.1038/ncomms11793
- 114 <http://www.bbc.co.uk/radio4/features/so-you-want-to-be-a-scientist/experiments/homing-snails/results/>
- 115 In the Hoyle-Wickramasinghe model of **panspermia**, life began in interstellar space. Microbes were found in the almost non-existent atmosphere 41 kilometers above the surface of the Earth in two sampling experiments carried out in 2001 and 2005, including three species that had never been seen before. However this still left the unanswered question as to whether these had come up from the Earth or had fallen from space. We already know that the building blocks of life exist almost everywhere in outer space. And there are identifiable simple/bacterial life forms (*extremophiles*) that can survive in a full vacuum, temperatures as low as 1°Kelvin (-272°C), and the destructive forces of ultraviolet radiation. Bacterial spores 40 million years old have been found to be “viable” (i.e. they come to life in the presence of water and food). There are even complex life forms (*tardigrades* or “*water bears*”, a creature up to 0.5mm long genetically related to Arthropods and Nematodes) that can survive these extremes for minutes or days. Their extreme hardiness means that *extremophiles* and *tardigrades* are pioneers, entering new environments, altering them and creating a proto-ecology.
- 116 Krishnamurti (1956) Commentaries On Living Series I Chapter 12 'Experiencing': found online (with all of Krishnamurti's texts) at http://www.jiddu-krishnamurti.net/en/commentaries_on_living_series_1/1956-00-00_commentaries_on_living_series_i_chapter_12_%27experiencing%27.html