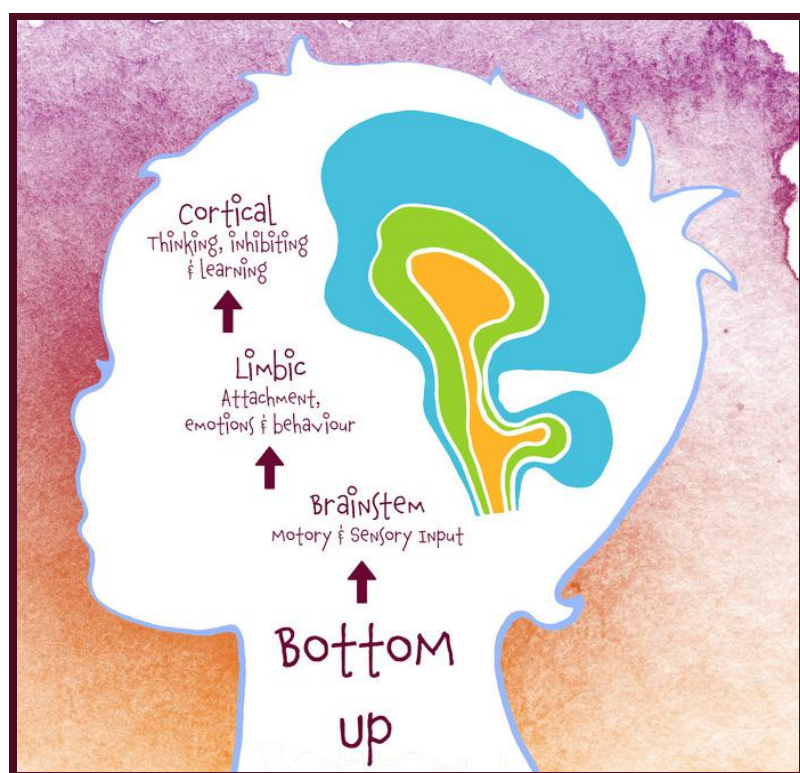


Sensory Processing, Coordination and Attachment

© Written by Ruth Stephens,
Specialist Paediatric Occupational Therapist

Babies and children first learn about the world around them through their senses. Playing and interacting with everything around them **stimulates the senses and creates engagement with others**, which forms a platform from which they see the world and relate to it. It follows that difficulties with sensory processing potentially affect all the skills that a child develops.

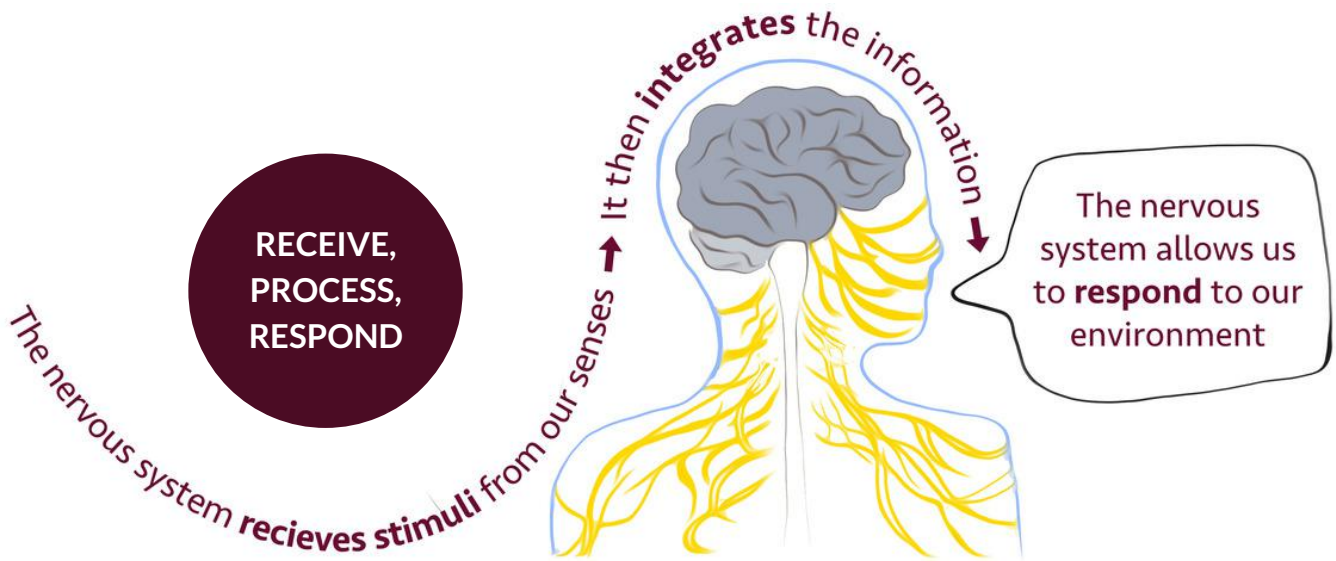


This article* explains how a **good understanding of children's sensory needs** as well as the **impact of early stressful experiences** on the senses can lead to a better understanding of their movement, behavioural and learning needs.

*Readers may also be interested to read 'The Repair of Early Trauma, a **Bottom Up Approach**' found here: www.beaconhouse.org.uk/useful-resources/

Sensory Processing

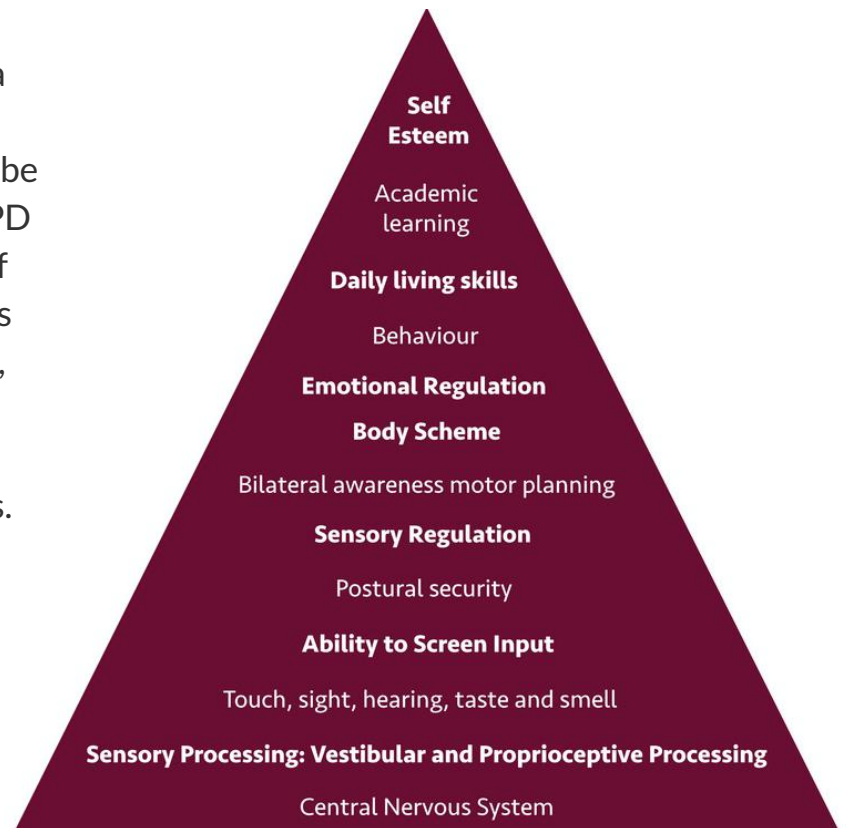
Sensory Processing is the body's ability to **receive** sensory information into the nervous system, **process** it and then allow the body to **respond** appropriately.



Difficulties in sensory processing can **affect every aspect of a person's functioning** - from posture, to catching a ball, focussing in the classroom and engaging in social relationships. However, the good news is that the nervous system has "**plasticity**" which means that with the **right help at the right time, it can heal and repair** as new brain pathways are created when activities are repeated during therapy

Sensory processing difficulties can be a **standalone disorder** called Sensory Processing Disorder (SPD) or they can be **linked to other things**. For example, SPD can be linked to a child's experiences of early trauma or attachment disruptions but it can also be linked with dyspraxia, developmental delay, autism, Fragile X syndrome, ADHD and speech and language disorders among other things.

Sensory processing is foundational to our ability to engage with the world and function in it. If our ability to process sensations is not working properly we will **have difficulty with daily living activities**.



Nervous System Foundations

This diagram shows how the nervous system and sensory development underpins many other skills and areas of engagement with the world around

us
Based on Williams and Schellenberger's model

Sensory Processing (cont)



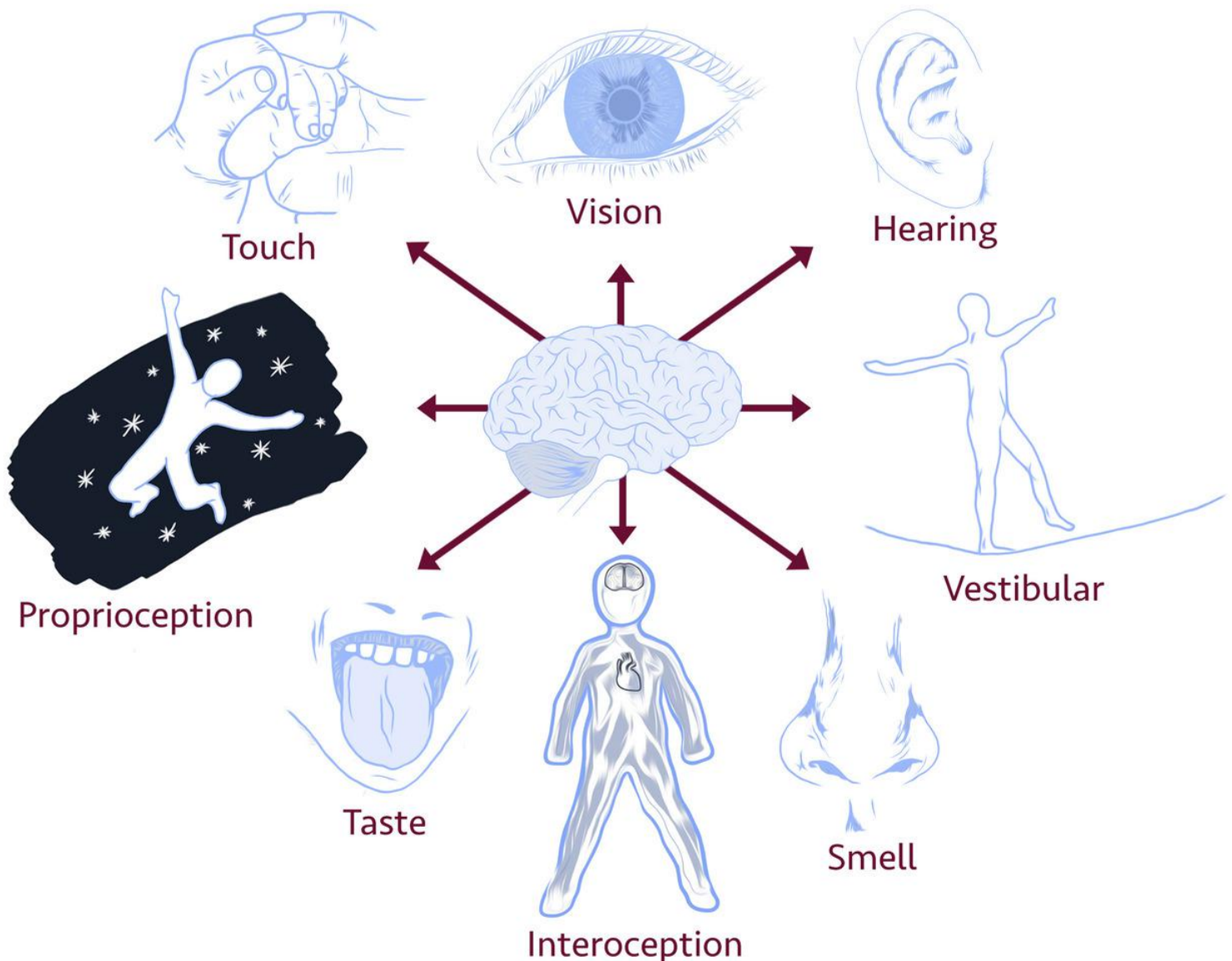
In utero and from the beginning of a child's life, they receive stimulation from one or more sensory systems at a time or even multiple sensory systems.



Did you know that you have not only got 5 sensory systems...but 8?

The 5 commonly known senses are thought of as the environmental senses and help us get in touch with the outside world: touch, taste, hearing, vision and smell.

There are 3 other senses which are more internal and tell us about our body.



Sensory Processing (cont)

Let's explain the senses in a bit more detail:

VESTIBULAR SYSTEM

- Located in the inner ear, this system helps us know where our head is in relation to gravity. It helps us adopt an upright posture.
- It helps us to move in a coordinated way and works closely with the visual sense to help us move our limbs to reach, grasp and also to focus on tasks. Something called the vestibular ocular reflex helps with this.
- A young baby needs a great deal of good vestibular input such as rocking by primary care-givers.
- The vestibular system is very important in helping to regulate us.
- This important sensory system underpins many other body and mind functions.



PROPRIOCEPTIVE SYSTEM



- This system helps us to know where our limbs are in space and how hard we are pressing, pushing or pulling. For example, it helps us to move in a coordinated way, hold a pencil with just the right amount of force and helps us to judge how hard to throw a ball for example.
- A young baby learns about proprioception even in the tight space they are in utero, then after birth tight, cosy cuddles are vital to develop this sense.

Proprioceptive activities may be either:

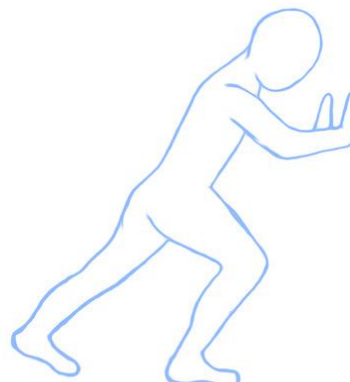
Passive:

Where resistance is applied, e.g. someone/something pressing on the body.



Active:

Where we actively participate in movements involving resistance such as pushing, pulling or pressing. The child is the instigator of the movements.

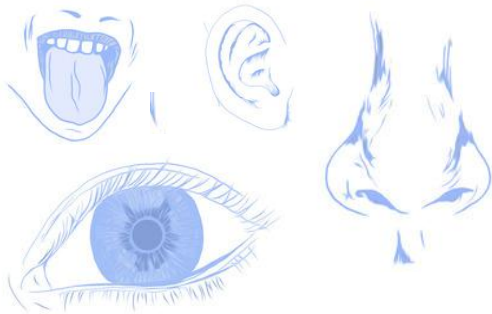


TACTILE SYSTEM

- The tactile system is vital in enabling a child to develop not only awareness of objects around them but to develop a sense of self in relation to others. A child with poor tactile awareness will drop things and lack finer coordination. They may also struggle to know where to put their feet and trip easily.
- Tactile sensitivities will affect a child's ability to engage with the world and to tolerate clothing or a toothbrush in their mouth.
- A child with a lack of good touch or inappropriate touch in early life may well develop tactile defensiveness or tactile seeking behaviour. This means that they will pull back from some touch sensations or in contrast may seek out fidgeting or touching things constantly.



AUDITORY, VISUAL, TASTE AND SMELL



- All the senses help us to learn about the world around them and to engage socially.
- The oral senses (this includes tactile oral and proprioceptive oral: chewing) are vital in secure attachments. Sucking is usually related to nurture and infants usually explore their world first orally.

INTEROCEPTION

Interoception is the body's very important hidden sense which tells us what is happening inside our body, and it is often overlooked.

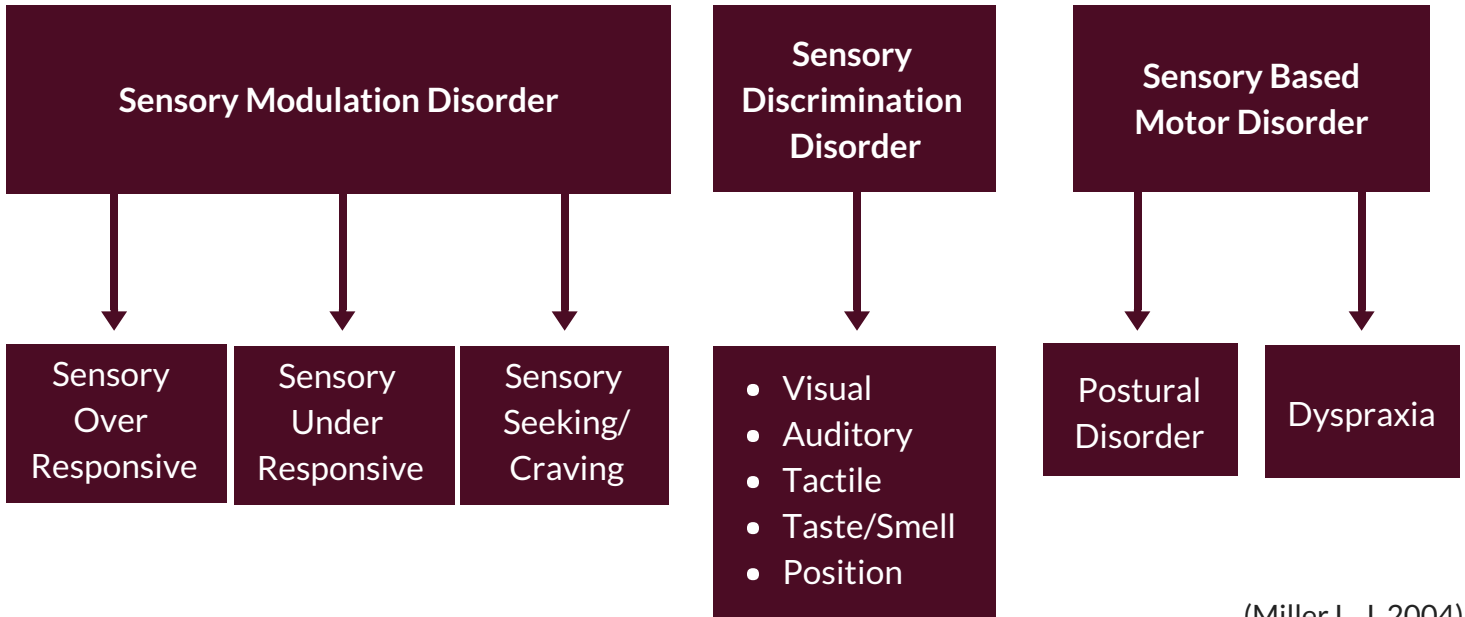
It enables us to know whether we feel hungry, need the toilet or have a headache. It enables us to know how fast our heart is beating or how deeply we are breathing.

This is very important in being able to care for ourselves properly and meet basic needs so that we remain safe.



Sensory Processing Disorder

Types of Sensory Processing Disorder



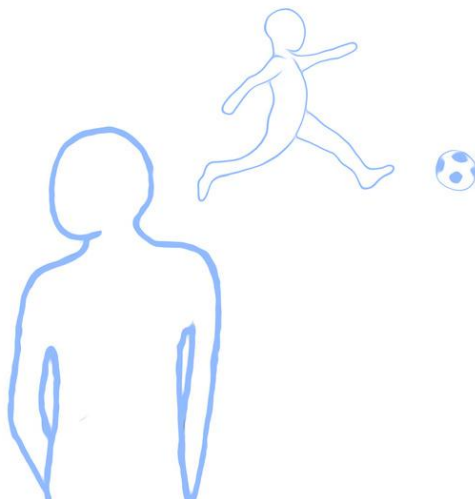
(Miller L. J. 2004)

Arousal, attention and sensory modulation

A child who has difficulties with aspects of sensory processing may have difficulties with regulating their attention levels, which is known as 'sensory modulation/sensory regulation'. A child with sensory modulation difficulties may be very reactive, sensitive or to the contrary - shut down from sensory input in order to protect themselves from the discomfort they experience.

A child may be seeking out sensory experiences which means that they are constantly seeking out movement, noise or tactile sensations. Alternately, they may be sensory-over or sensory-under responsive. Each sense is set differently to what feels "just right"; and the feeling of "just-right" will vary from person to person.

Some senses may be **hyper (over)-responsive** meaning a very little amount of a sensation can be over-stimulating, so person "avoids".



Other senses can be **hypo (under)-responsive** meaning it takes a lot of a sensation before a person feels "just-right", so person "seeks".

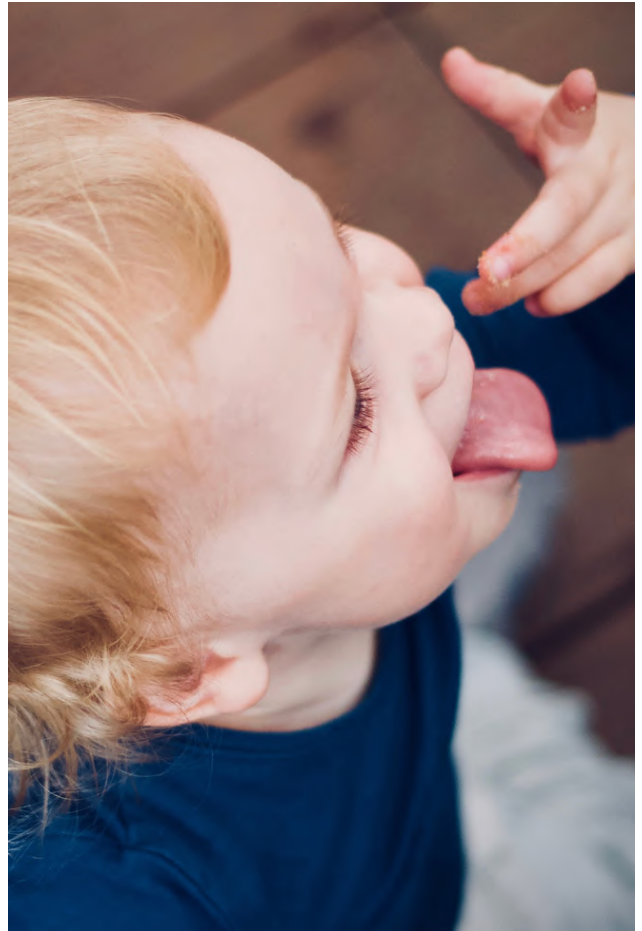


Sensory Processing Disorder (cont)

Understanding sensory over responsiveness and sensory under responsiveness

If a child is **over-responsive** to sensory information, this means that they will have trouble suppressing information that they receive into that sensory system. They will over react to a normal amount of sensory stimulation and therefore will feel overloaded and may experience hyper-sensitivity.

For example with the tactile sense, they will be sensitive to some touch or textures and find that sensation uncomfortable. The effect may be cumulative and by the end of the day they may be unable to process additional information and become distressed. If they have an over responsive vestibular system they will be affected by motion to the point that they may have motion sickness. They may lose balance and avoid sport activities. This will have the long term effect of poor coordination. they will need carefully planned sensory input to help them become less reactive to the uncomfortable input.



If a child is **under-responsive** it means that the nervous system is not receiving enough stimulation through one or more sensory organs. They will need additional input to help them be aware of what is happening in that part of their nervous system.

So for example a child who is under responsive to auditory input may lose focus because they don't register that someone is talking to them. Or they may trip over obstacles because the visual system is not recognising that there are steps or rough ground underfoot and does not send the message fast enough to the muscles and joints to help them adjust their stride to avoid the obstacles. These children will need additional, intentional input to help them to learn to react to stimulus.

Sensory Processing Disorder (cont)

These children may then be easily over aroused or under aroused. If arousal levels are not modulated the following difficulties can occur:

- Distractibility/over excitable
- Sensory defensiveness (dislike of certain noises/touch/light/fear of rocking)
- Need for extra stimulation to senses such as sucking, rocking, repetitive movements



In turn all these sensory disturbances can then lead to developmental delay in a child e.g.

- Poor postural control
- Poor hand eye co-ordination
- Difficulty with spatial awareness
- Visual perception deficits
- Difficulties with learning
- Poor self esteem



Sensory processing is very much linked to our early experiences in that having inappropriate sensory input may result for example in hyper vigilance. A child may seek out sensory experiences which they lacked as an infant. Or a child, for example, who heard a lot of distressing shouting may be auditory defensive. (That is not to say that all sensory defensiveness is always caused by such things).

Understanding sensory discrimination

Sensory discrimination is the nervous system's ability to interpret information from our senses and compare details. It helps us in making an effective judgement on how we participate and interact with the world around us. Without good sensory discrimination we may struggle with knowing the difference between hot and cold, soft and hard, judge distances between ourselves and another person, know how hard we are pushing or pulling; or with detecting a taste of something we put in our mouth.

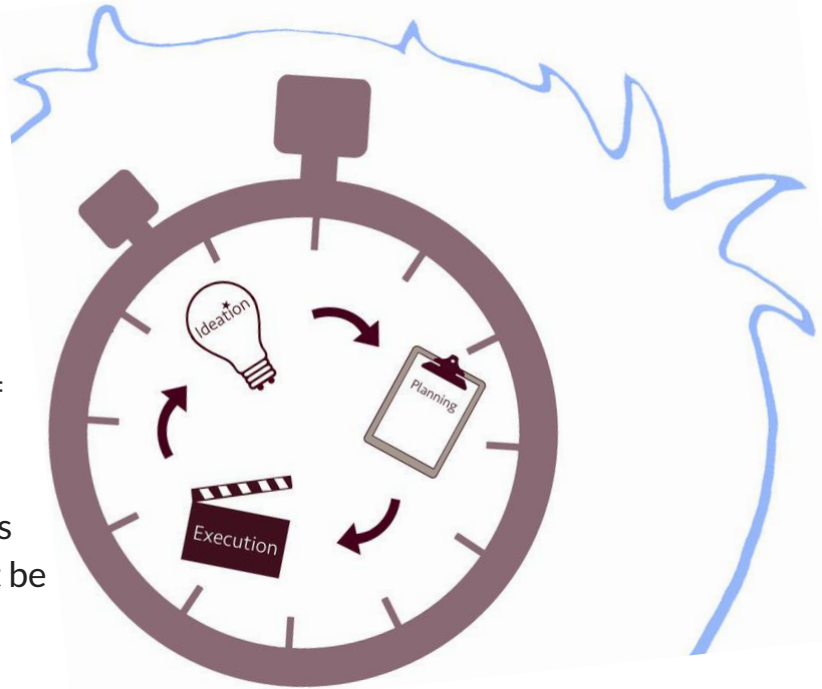


Sensory Processing Disorder (cont)

Dyspraxia and sensory processing

Dyspraxia is a disorder of carrying out controlled movement. There are 3 elements to carrying out a coordinated movement: **ideation, planning** and **execution**. These aspects of movement happen in the cortex of the brain in split seconds.

However if one aspect of these three things is not working properly then movements might be jerky or slow and affect purposeful activity.



A child with dyspraxia will typically have difficulty with learning new skills, needing more practice than other children and will perhaps struggle to ride a bike, catch a ball, learn to write or use cutlery. They may trip and bump into things and find organisation very difficult. Their confidence may be affected and if unsupported they can feel a high level of shame and become isolated.

There are several different types of dyspraxia and an OT assessment can help to identify whether the dyspraxia is bilateral integration (timing and use of left and right sides of the brain and body) based or whether it is tactile and proprioceptive based.

Somatosensory difficulties are a specific type of sensory-integrative issue characterised by difficulties with processing information that comes in from a combination of the tactile and proprioceptive sensory systems. Proprioceptive input refers to information from our muscles and joints and provides feedback to allow us to know where our body is in space, where it is moving, and how much force or pressure is being used.

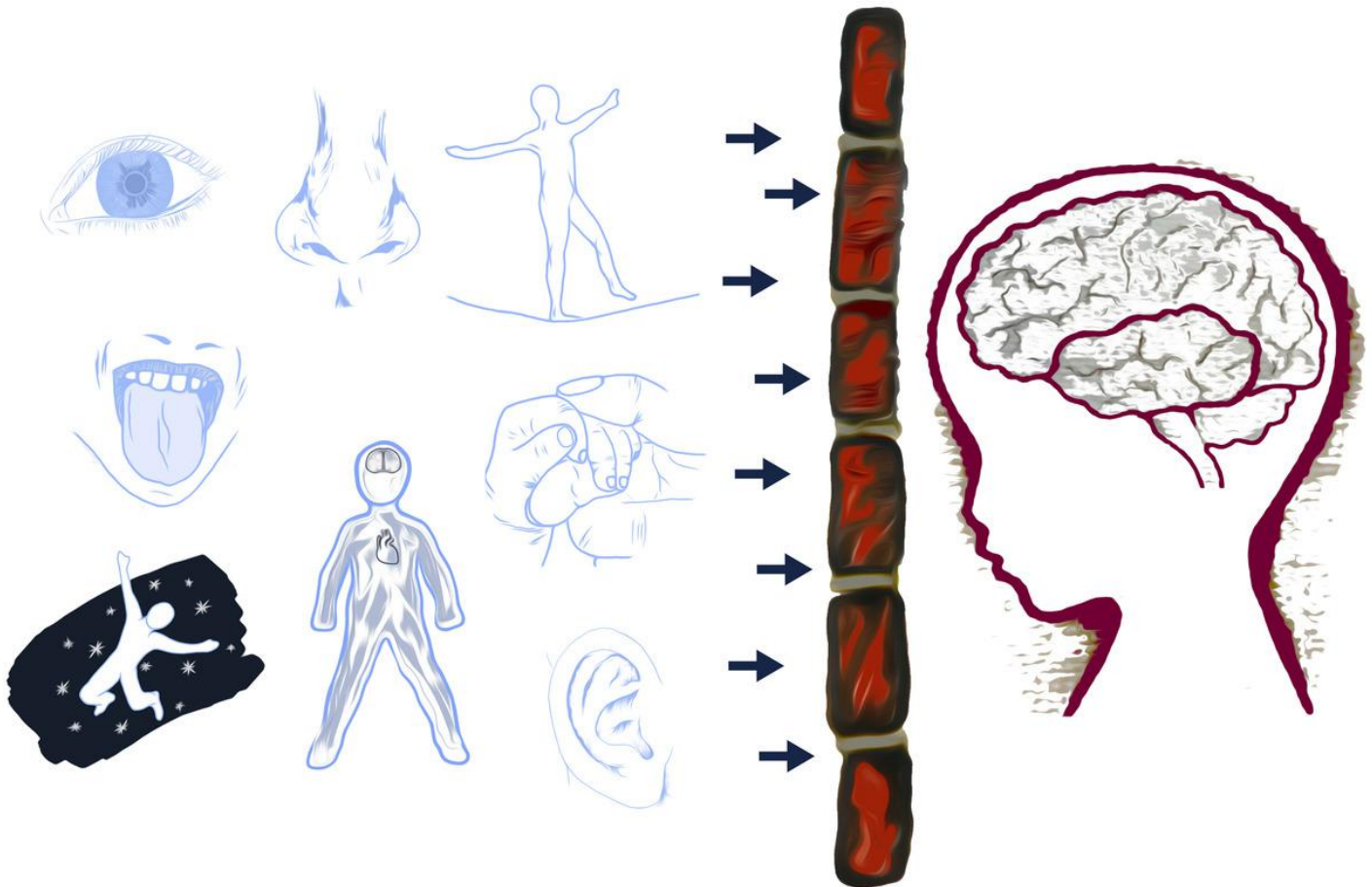
The child with somatosensory difficulties may be receiving inaccurate or unreliable sensory input from their tactile and proprioceptive systems which then causes disruption in responses and their coordination will be impaired. They may have great difficulty picking up small objects accurately or moving over uneven surfaces. They may not notice if they have food around their mouth when eating and may struggle to manage tools such as cutlery or school equipment like pencils and rulers. This has wide implications throughout all parts of their day and affects learning and participation in school.



Diagnosing dyspraxia (known mainly as Developmental Coordination Disorder in the UK) should always be done by a multidisciplinary team and should be based on evidence from assessment by an OT (or Physio) and a physician combined.

Treating Sensory Processing Difficulties

Treatment will depend on the type of sensory processing difficulty. As already mentioned, there are various types of sensory processing difficulty and a child may have difficulties in processing information from one or a combination of senses or all senses. Their sensory difficulties may be due to various underlying causes such as neurological damage. At Beacon House we first carry out an assessment to determine what the underlying issues are and we may select to use Sensory Integration therapy to help the child.

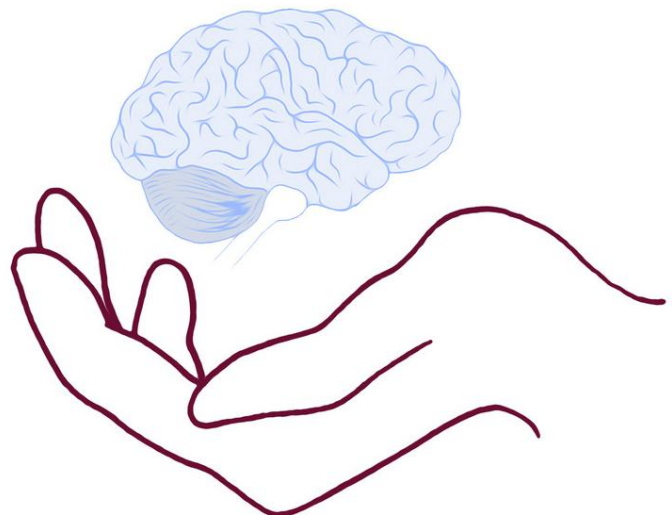


What is Sensory Integration (SI)?

The founder of SI theory is Dr. Jean Ayres, who devised this theory of brain-behaviour relationships. It is based on the theory that enhancing and modifying sensory input enables us to make adaptations to our responses and then improves the ability to process sensation so that the child can engage better with learning, daily living skills and relationships.

It is a developmental approach, therefore unless the basic sensory systems have been functioning correctly and stimulated appropriately in early life there will be difficulty forming higher skills such as:

- Motor skills
- Social and Interaction skills
- Sense of self
- Academic skills



What happens in a Sensory Integration therapy session?

There will be lots of movement activities carefully chosen for the child and moving equipment such as swings will be used to help children to gain more body awareness. Activities will be chosen to help stimulate what is called an "adaptive response", in other words to help the child's nervous system to adapt to the difficulties that they have in receiving incoming sensory input.



The activities we set for the child in a session will be chosen to provide a "just right challenge" for them. Not too demanding for them but enough to be achievable with some effort. In sessions the child is an active participant, helping to choose some of the activities (within a carefully selected set of tasks). We may be asking the child to make and move around an assault course for themselves for example. On the swing the child may be asked to throw a ball at a target and as they progress the target may become a moving target. Sessions are lots of fun!



What are "Sensory Diets" (sometimes known as Sensory Lifestyles)?

These are basically a personal activity plan and involve practical daily living modifications usually set up by an OT. They can help with modulating the child's senses so that they feel comfortable and can engage with their environment better.

In the process of making a sensory diet it is important to think about what sensory experiences up-regulate (make the child feel more alert or even over excitable) and what sensory experiences down-regulate (make the child feel less-excitable or perhaps make them too slow) Don't forget that overstimulation may cause stress and inappropriate stimulation could also cause stress. With carefully planned sensory activities throughout the day, the child may be able to modulate and feel comfortable about the sensory input around them.

Sensory diets may include one or all of the following three elements:

Sensory Nourishment

We know that sensory input is necessary for brain functioning so an enriched environment can actually change brain structure. Some children have had too little sensory input due to sensory deprivation.

Sensory nourishment may be in the form of extra sensory input where a child is under-responsive or not very alert. These children may need a lot of stimuli like rousing music, colourful rooms, high impact active movement and clear louder voices speaking very directly to the child to ensure they are heard. They may benefit from lots of tactile play and physical touch.



Sensory Breaks:

- Opportunity for stretching
- Opportunity for calming deep pressure, proprioceptive input.
- Include activities which involve resistance, pushing or pulling ("heavy work" activities)

Protective sensory strategies such as:

- Using ear defenders if, for example, the child is sensitive to sound
- Cutting off labels in clothes if the child is sensitive to these.
- Providing a calm area in the classroom/outside the classroom with a bean bag or tent
- Bland walls and low stimulation areas in school



Sensory Processing and Early Trauma

Sensory processing difficulty can be linked to exposure to early childhood trauma; or 'adverse childhood experiences'. Because of the strong relationship between integration of the senses and attachment, it makes sense to look at children with sensory issues through an attachment perspective. Infants have not developed the necessary language with which to categorise memories by. However infants DO remember what happens to them in their senses. These sensory memories are imprinted in the autonomic systems of the brain. **While the mind may not remember as the child grows up, the body remembers.**

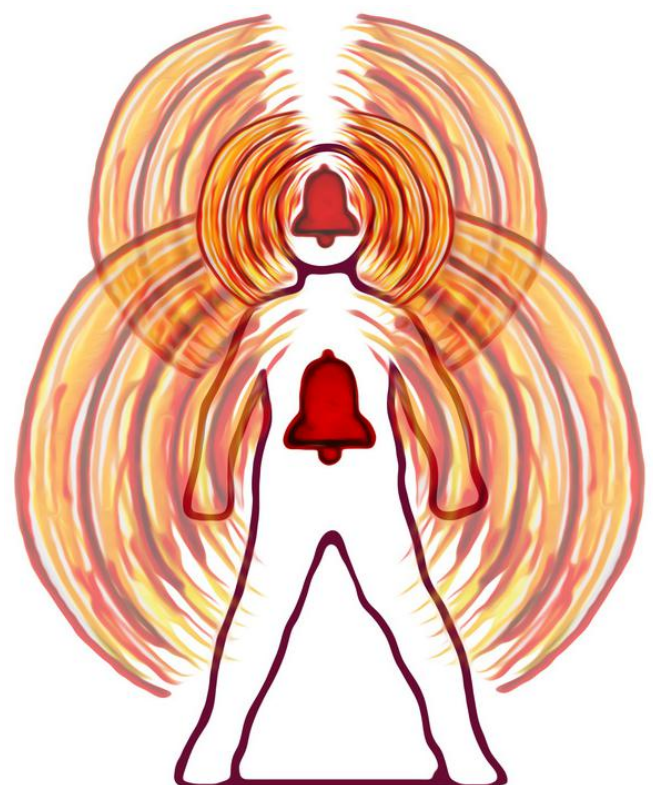
The early baby has no language therefore all their memories are sensory memories



The Limbic system in the hind brain stores these sensory memories

Many children with sensory processing difficulties are noted to have emotional difficulties which are sensory based because the senses form a large part of the infant's early attachment experience. They will often present as being very dysregulated and led by their senses. Or they may be shut down to some sensory experiences and find some sensory input overwhelming. This sense of overwhelm may be so deep that they struggle to engage with their environment and hold back from the nurturing care that they need.

A child who has been through trauma in early life may not have had the tactile or other sensory input necessary for healthy development. In addition, any extra anxiety can result in constant over arousal of the senses to prepare for 'fight or flight.' Their inbuilt safety alarm system may be set on high alert for much of the time and therefore their sympathetic and parasympathetic nervous systems may be highly active. This is because they are predominantly using their primary brain (their brainstem) to help themselves to feel safe as they feel that there is still a threat to their safety. This will impact on both their ability to regulate and also their ability to carry out coordinated movements.



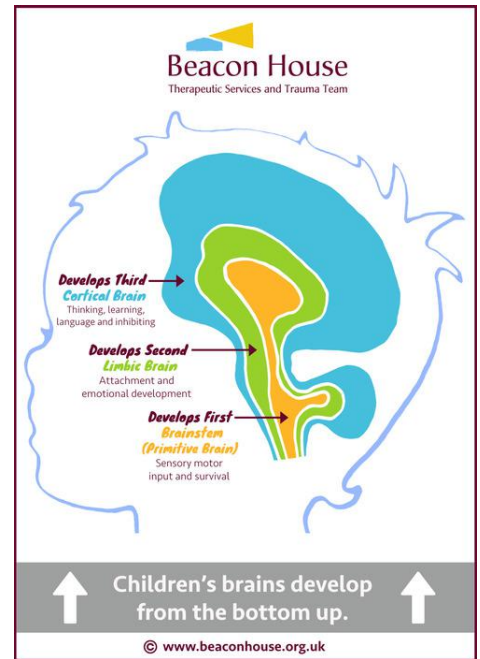
What is Sensory Attachment Intervention?

Sensory Attachment Intervention is a type of therapy we use in Beacon House to help with these difficulties.

Dr Bruce Perry, who formulated the Neuro Sequential Model of Therapeutics, said that

"Therapeutic approaches must appreciate the persistent fear state that traumatised children experience and must be directed at the areas of the brain which mediate this alarm fear continuum".

Sensory Attachment Intervention does just this; and aims to repair the traumatised brain from the bottom up.



Sensory Attachment intervention (SAI) has been pioneered by the work of Consultant Occupational Therapist, Éadaoin Bhreathnach. It draws from Dr Jean Ayres' work in Sensory Integration (SI) and the theory of childhood trauma and attachment (Perry, Schore, Van der Kolk, Crittenden and Bowlby) as well as Dr Stephen Porges' whose polyvagal theory has helped us to understand the body's fight/flight/freeze/collapse and social engagement systems.

Sensory Attachment Intervention sessions are aimed at helping a child to co-regulate with their key carers. Sessions may use principles from SI therapy but they will always involve the primary carers in sessions. The child and parent are active participants.

Therapy may be video recorded to enable the parents to recognise how and when the child becomes dysregulated. Video feedback sessions are part of the therapy and the therapist will help parents look at the triggers to dysregulation and find strategies to help with calming and achieving a "Just Right" state. SAI helps the child and parent to engage in **shared joy and pleasure** which is said to play a large part in helping **reduce the fear responses**.



Sensory Attachment work begins with a Sensory Attachment Assessment which will involve:

- A questionnaire for care-givers. This looks at a child's sensory and behavioural responses to various situations such as his or her survival strategies in anxious situations, ability to cope with routines, tactile responses including orally with feeding and motor skills.
- A pre assessment telephone call /meeting with parents.
- Observation of the child in relation to their ability to respond to sensory input in all the 8 sensory areas, and triggers to dysregulation.
- Observation of motor skills including some standardised assessments.
- Observation of the child with their primary care-giver, often with the use of video so that further analysis can be carried out later.
- To establish regulation of arousal states i.e. to shift from the Autonomic Nervous System bias of either freeze dissociation or flight fight responses (Schoore 1994).
- The triggers to regulation / dysregulation in terms of the relationship are noted.
- The two sets of information are put together and analysed in terms of the child's sensory modulation and praxis.
- A written report is provided.



After an assessment, a plan of intervention is formed, tailored to the child's individual profile. There will be high importance given to nurturing activities such as deep pressure (proprioceptive) to promote calming. Many children are functioning at a high arousal state and the priority in treatment is to *"facilitate a controlled and regulated response to sensory stimuli and engagement with others"* (Bhreathnach 2013). Intervention will always consider the child's sensory and motor skills together with the parent child relationship.

What a treatment session might look like:



- Appropriate sensory input to promote calming
- Proprioceptive activities which are said to be calming
- We will work to help children's motor skills to improve by using graded activities and providing the "just right" challenge.
- Use of video work to provide feedback to parents/caregivers. This will look at the moments which trigger a stress response or alleviate a stress response.
- Lots of activities to promote shared joy and pleasure.
- Feedback sessions with parents in between child engagement sessions.
- Advice on enriched environment provision or sensory strategies and "sensory diet" for home school/nursery.
- We might use the "Scared Gang" story books in sessions which are designed to help children understand their own stress patterns. (written by Éadaoin Bhreathnach)
- The "Just right State" programme or we may incorporate parts of the Zones of Regulation programme to help teach children how to notice their bodily responses to stress and to notice triggers as well as find a common language to describe how they are feeling.

What we expect to see after treatment:

After a few sessions of SAI, parents often comment that their child is more regulated and calm.

They have a much better understanding of what helps their child to become calm after a meltdown; and the parent and child's ability to play together is more relaxed and natural.

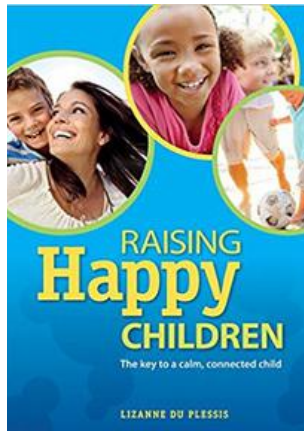
Motor skills improve as parents have more understanding of what activities can help their child to grow in this area. Parents know how to adapt play to be achievable and confidence building rather than shaming and therefore dysregulating.



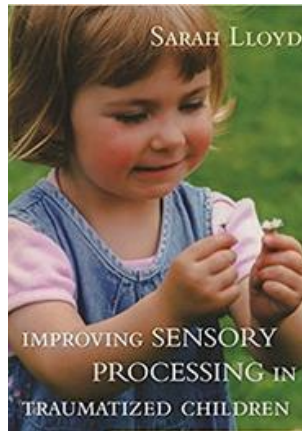
Useful resources

Always check that a therapist is properly trained in Sensory Integration and/or SAI, as relevant to your child's needs when you are choosing a therapist to work with them

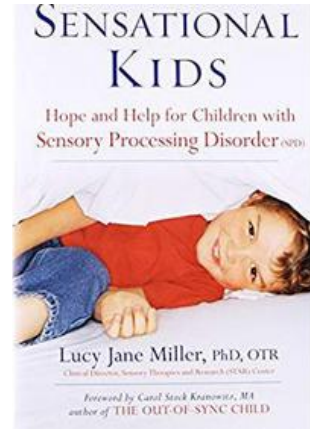
If you would like to find out more about sensory processing and attachment, here are some useful resources:



Raising Happy Children:
Lizanne duPlessis



Improving Sensory Processing in Traumatized children: Sarah Lloyd



Sensational Kids:
Lucy Jane Miller

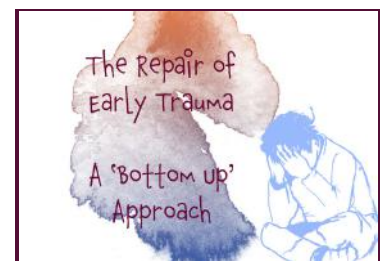
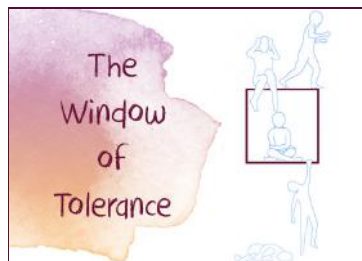
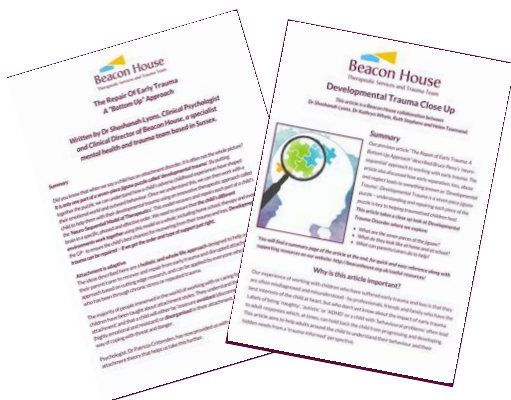
Visit the Sensory Integration Network website for more information on Sensory Integration:
www.sensoryintegration.org.uk/

Visit the Sensory Attachment Intervention website for more information on SAI:
www.sensoryattachmentintervention.com

Visit the Zones of Regulation: www.zonesofregulation.com/index.html

Beacon House offers a specialist, multi-disciplinary team who work extensively with children and adults who have experienced early trauma. To find out more about our services please visit us at www.beaconhouse.org.uk or get in touch on admin@beaconhouse.org.uk.

Readers may also be interested to read our other articles, 'The Repair of Early Trauma: A "Bottom Up" Approach' and 'Developmental Trauma Close Up' along with our animations on 'The Repair of Early Trauma' and 'The Window of Tolerance'. These can be found at: www.beaconhouse.org.uk/useful-resources/



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