

Sensory Integration

Kate Rogers

Summary

Sensory integration is the end product of accurate processing by the brain of information received through the body's sensory systems. This information is received through visual, auditory, tactile, taste and olfactory receptors, as well as through the vestibular system which receives, and gives, information about gravity, movement etc. The organisation and integration of sensory information, or lack of it, is reflected in the child's development, his learning capacity, and his feelings about himself. This paper deals with some of the manifestations of sensory integrative dysfunction, the importance of early identification, and the role of the occupational therapist in modifying the dysfunction.

KEYWORDS: Child Development Disorders; Child Development; Child, Preschool; Learning Disorders.

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Curriculum Vitae

Ms Rogers qualified as an Occupational Therapist at St Loyes' School of Occupational Therapy in Exeter, England. She worked in Canada and then at Addington General Hospital. Since 1974 she has worked exclusively with children, starting in CP-schools in Durban and Port Elizabeth, and going on to children with learning disabilities at the Children's Assessment and Therapy Centre, and private practice. In 1982 she attended courses on sensory integration, and now uses only sensory integrative techniques with learning disabled children. She also worked in the clinic of Dr Jean Ayres, the originator and principal researcher into the theory of sensory integrative dysfunction, and its application in treatment. She has been on the Executive Committee of the Natal Association for Gifted Children, and is a faculty member of the South African Institute of Sensory Integration. She spends much time helping bright children with learning problems, but has also enjoyed rearing 5 children and tending Bonsai trees.

Waste not — want not! A common adage, but is it not waste of the most profligate kind if children are unable to realize their academic potential; if those who could be future leaders in the community end up as mediocrities at best, or criminals at worst; if those who should be competent, average citizens become drifters, with the low self-image and negative attitudes of the non-achiever, simple because academic learning was so difficult for them?

It is my belief through reading the literature, and from my own clinical experience over the last ten years, that developmental delay, or developmental immaturity, is the root cause of the learning problems of quite a high proportion of children identified as learning-disabled in our South African schools by the Murray

commission in 1969. And that with the treatment of the developmental problems, using sensory integrative techniques, there is a better response academically than if the remediation focuses in only on the cortical dysfunction.

My main experience in the two years that I have been using sensory integrative techniques has been with learning-disabled children, but I find myself drawn to working more and more with very young pre-primary children. In America, occupational therapists specialising in sensory integration are now working with identified "at risk" babies in the intensive care section of neo-natal units. The importance of early recognition and treatment cannot be overstated — not merely because this may obviate the problems with learning — but essentially because one's neural development is largely complete by the age of 8-9 years. Intervention procedures will naturally take longer to be effective, and the longer the delay the more one has to deal with the secondary problems which arise, such as negative self-image, emotional disturbances, behavioural problems etc.

For 15 or more years SA occupational therapists have been using a perceptual motor approach to the treatment of learning disabilities, but there was little in the literature, and not much more in clinical experience to show convincing relevance of either the test results, or the treatment methods, to the specific problems, particularly reading and written work. Some children responded very well, and others with the same test results, did not.

Treatment results were so arbitrary that they raised more questions than they answered. But we have continued to keep abreast of world trends, and as more research has been published and clinical findings have been written up, the emphasis has shifted to the more far-reaching sensory integrative approach. The South African Institute of Sensory Integration has been formed. It is affiliated to the South African Association of Occupational Therapists, and 126 of the current 498 SAAOT members are also members of the Institute⁷.

Interaction of the sensory systems has a far-reaching effect on motor, emotional, behavioural and language development.

In learning about sensory integration and its role in the maturation process, I began to see sound neurophysiological reasons for at least a proportion of the learning disabilities, and to realise that developmental immaturity should be, and is, observable in the motor and behaviour patterns of very young babies, who should then be considered at risk, socially and academically.

Sensory integration as a specific theory applied to learning-disabled children was developed by Dr A Jean Ayres in

the 1960's and has, since then, been continuously modified through research, by her and others. According to Dr Ayres, "Essentially, the theory holds that disordered sensory integration accounts for some aspects of learning disorders and that enhancing sensory integration will make academic learning easier for those children whose problem lies in that domain. Sensory integration, or the ability to organise sensory information for use, can be improved through controlling its input to activate brain mechanisms ... A sensory integrative approach to treating learning disorders differs from many other procedures in that it does not teach specific skills such as matching visual stimuli, learning to remember a sequence of sounds, differentiating one sound from another, drawing lines from one point to another, or even the basic academic material. Rather, the objective is to enhance the brain's ability to do these things. If the brain develops the **capacity** to perceive, remember and motor-plan, the ability can be applied toward mastery of all academic and other tasks, regardless of the specific content. The objective is modification of the neurological dysfunction interfering with learning, rather than attacking the symptoms of that dysfunction⁸."

Interaction of sensory systems has a strong influence on the learning process.

SS Gubbay in his article "The Clumsy Child", defines this type of child as "one with normal bodily habits, intellect, physical strength and sensory function, and whose motor coordination is virtually normal by the standards of routine conventional neurological assessment, yet whose ability to perform skilled, purposive movements is impaired⁹". He calls the condition "developmental apraxia", which is perhaps more socially acceptable than "clumsy", and certainly far less threatening than "minimal brain dysfunction". I prefer the American use of the word dyspraxia, with its connotation of dysfunction in, and not total loss of, praxis.

Dr Ayres defines praxis as "skill in planning non-habitual movements", and states that it is the end product of vestibular, proprioceptive, and tactile input processing, with a motor component added⁸.

In order to understand the implications of sensory dysfunction, let us first have a look at some of the sensory modalities; their inter-action with each other, and the effect they have on behaviour, motor development and learning.

I will then give a very brief introduction to the testing done by occupational therapists, some treatment principles and methods used to alleviate the condition, and present a list of characteristics which can be seen by parent, nursery school teachers, and general practitioners.

One of our earliest functioning senses, but perhaps the least researched, is the sense of smell. Functionally the

olfactory system is linked to the limbic system, whose close interconnection with the reticular system was noted by GV Russel, who also suggested that both systems are fundamental integrative mechanisms of the central nervous system¹⁴. Schneider, states that the 4 main functions of the olfactory system are:-

- 1 Protection of the individual.
- 2 Contribution to his emotional life.
- 3 Assistance in digestion.
- 4 Facilitation of recollection — remember how the faint tendrils of perfume wafting from that lady in your surgery last week instantly transported you back to your sister's wedding, and the delectable young bridesmaid who stirred your senses so wickedly?¹⁵.

Cheal stated her belief that infants form associations based on early olfactory experience, and from this stressed the importance of frequent exposure of high risk infants to their parents, as part of the emotional bonding experience⁶. Steiner found that certain odours promote parasympathetic responses, and sucking and swallowing motions¹⁶. Heiniger and Randolph state that there is little doubt that olfaction can guide and direct behaviour before either hearing or vision are developed, but also state the critical need for clinical investigation of the use of smell, and its excitatory and inhibitory effects . . . in early intervention programmes⁷.

In discussing the tactile system, Ayres states: "The process of perception involves the continuous ordering and sorting of sensory stimuli into both temporal and spatial sequences, with an ongoing sensory relationship. Touch is one of the senses that is especially involved in the ongoing process contributing to perception of other types of sensation"¹.

Developmental immaturity is the root cause of many learning problems.

Leboyer expresses the same idea, but far more evocatively. "Life begins at birth . . . Fear and the child are born together. . . Life was rich in the womb . . . rich in noises and sounds . . . movement . . . (Now) All alone, not a sound . . . not a whisper. . . and worst of all there is no movement . . . What is this "thing" inside my belly . . . Hunger . . .

Inside . . . the terrible gnawing "thing" . . . and the remedy . . . outside. Inside . . . outside . . . Space is born . . . Oneness is lost . . . Inside and outside, and in between . . . waiting. Waiting which is pain . . . agony . . . time . . . and so it is that space and time are born with appetite. A baby's belly is hungry . . . its skin is craving, and so is its back, and so is its spine, craving for touch, craving for sensation . . . the terrible nothingness is simply no touching, nothing along my back! Feeding babies with touches, giving food to their skins and their backs is just as important as filling their stomachs"¹¹.

Casler found that light touch pressure stimulation enhanced the Gesell developmental quotient on an experimental group

of institutionalized babies under 1 year of age⁵. Studies by Melzack, Konrad and Dubrovsky found prolonged changes in tonic electrical activity at several layers of the visual and somatic system, the inferior colliculus, reticular formation, and the pyramidal tracts, after brief rubbing of the paws of moderately anaesthetised cats, and it is because of this almost certainly profound influence of the tactile system in humans as well, at so many brain levels, on sensory as well as motor tracts, that we tactile stimuli as general augmentors of sensory integration¹².
integration.

Huss stated that if occupational therapists would begin to use touch in a caring manner, in time they could make a difference in the American culture¹⁰.

Touch and movement are hard to separate from one another, and the tactile and vestibular systems are closely linked. The vestibular system enables us to detect motion, and the earth's gravitational pull. I could not do better in describing the widespread involvement of the vestibular system than to quote WE Richardson¹³.

"Head movement of 1/2° from the vertical⁸ or rotation as slow as 1/2° per second⁴ will stimulate end organs of the vestibular system; via the multiple direct and indirect connections of this system, signals may travel throughout the CNS having effect upon muscle tone (posture, balance, arm function) sensory motor activity (sequencing, praxis) the cranial nerves (especially those concerned with eye movements) — the reticular system (arousal, dampening); the autonomic nervous system, (eg heart and breathing rates, bowel and bladder control), the limbic system, (anxiety, emotions); higher functions of perception and judgement, and perhaps also, integration of the auditory system."

I hope that this simple introduction to just the olfactory, tactile and vestibular systems gives a clearer picture of the essential interaction of the systems, and their far-reaching effect on motor, emotional, behavioural and possible language development, with the possibility of interference with the learning process if they are not functioning well.

In assessing children for sensory integrative dysfunction, occupational therapists use the Southern California Integration Tests, and the Southern California Postrotary Nystagmus Test, and make clinical observations of eye-hand usage, postural responses, and other neuro-muscular conditions related to behaviour and learning. The tests were designed to assess visual, tactile, kinesthetic and vestibular sensory processing, as well as motor co-ordination, motor planning, and automatic reflex and righting mechanisms. A more complete picture is seen if the results of intelligence tests and language assessments are known.

In coming to treatment and treatment principles, I would like to mention that in all my working life I have never had so many rewards, so much joy and just plain fun, as I have had in the last two years. It is not that sensory integration is a modern panacea; it is no such thing. But where a child's developmental delay can be found to be related to sensory integrative dysfunction, using sensory integrative techniques in therapy can bring a dramatic improvement in

the quality of his life. His parents relate that he is better organised, and less like an off-course rocket; his teachers report that quality and quantity of written work is improving, and that he is beginning to participate more willingly in sporting activities; and the child himself so often becomes less aggressive, more self-confident, and a much happier human being. In all the photographs taken for record purposes, there is hardly a face without a beaming smile — and this is possibly because the therapy does not focus on the specific problems such as poor handwriting, poor listening skills, or gravitational insecurity, and there is no teaching as such. Each child is encouraged to explore and experiment with the equipment at his own pace, to set his own goals, and to achieve them. Children love to challenge themselves, and one of the most enlightened of Dr Jean Ayres' ideas, is the one which says, "Challenge plus success equals therapy."³ It is only through awakening the self-motivation of a child, who then begins to make adaptive responses to the challenges of his environment, that therapeutic results will be achieved.

Equipment such as scooter boards, barrels, suspended nets and inner tubes are used. These are made of, lined and covered with, a variety of different textures to provide a diversity of tactile sensory input. Activities are carefully monitored by the therapist, particularly those involving the vestibular system, which can have such a profound effect on the body's vital centres, and the children are encouraged to extend themselves. Simply practicing an activity, or repeating one already mastered, requires no adaptive response, offers no challenge and is not therapeutic.

Activities involving slow, linear vestibular stimulation are calming and soothing; we all know how we get fretful babies to sleep, but an over-active child can be calmed in this way, supine in a net, or even prone in the net, or over a big therapy ball, at the beginning or end of a therapy session.

Putting heavy pressure into the proprioceptors of the neck, shoulders and arms, helps in increasing kinesthetic awareness, and has a short term effect of improving motor co-ordination. The prone extension posture seen when a child swoops down a ramp while lying on a scooter board is considered to be based on a vestibular reflex, which elicits that position by impulse flow over the vestibulospinal tract to the extensor muscles, and it is felt that this movement has an augmentary effect on visual perception². But the child who is lying on the scooter board being Spiderman scaling buildings of immeasurable heights, as he pulls himself up the ramp on a rope, has no inkling of what he is doing to his proprioceptors; and as he zooms back down the ramp, racing through a street of winebox "houses", and stealing the plastic block "lights" off their roofs trying not to wake the occupants by knocking the houses, he is not consciously aware of the effort he has put into motor-planning (both the gross motor activity of navigating the streets, and the finer planning necessary for picking up the coloured blocks.) Nor, of course, is he aware that the therapist is increasing sensory input as she calls for him to pick up a red light, or to use his left hand to pick up a green.

Therapy really is fun, but the therapist should have a thorough knowledge of neurodevelopmental sequences, and

therapeutic procedures should be based on this knowledge.

The following is a chart listing the main characteristics, typically seen at home, in the nursery schools and in the general practitioners' offices, of a child with developmental dyspraxia.

- 1 Clumsiness.
- 2 Tires easily; movements are usually performed with excess expenditure of energy.
- 3 Difficulty in motor-planning new skills.
- 4 Disorganised; untidy, with poor work habits.
- 5 History of slowness in developing daily living skills — such as dressing, using eating utensils, etc although developmental milestones were normal.
- 6 Poor tactile processing; can be hypo- or hyper-responsive to touch.
- 7 Poor balance.
- 8 Poor body-schema.
- 9 Poor constructive manipulative play.
- 10 Dysgraphia.
- 11 Articulation defects
- 12 Visual perceptual problems.

Possible emotional components in older children:

- a) May react very strongly to failure; tend to blame objects, or other people, eg. The door was in the way! Who put that vase there?
- b) These children often cannot play pretend-games because of the uncertainty about themselves.
- c) Adolescent problems with identity because of poor body-schema.

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