

- **Sensory discrimination and perception level 2a and level 2b:**
- Sensory discriminatory abilities are abilities that are supported by and **dependent on all the different sensory systems**. Discriminatory abilities allow for the individual to ‘interpret and differentiate between the spatial and temporal qualities of sensory information’.
- Sensory discriminatory abilities **add meaning to sensations** and support the forming of perceptions.

- An example of discriminatory abilities within the tactile system would be when a child is able to identify where he/she has been touched, what is it that touched him/her and when did it touched him/her. In the process of discrimination, past experiences and memories need to be utilised to form associations about the spatial and/or temporal qualities of what he/she is experiencing and then act on that information.

- Discrimination within the auditory system can vary from basic discrimination abilities such as knowing from which direction a sound came to abilities such as a soft or a hard sound or hearing a ‘b’ or ‘d’.
- Visual discrimination is the foundation of form and space discrimination and in the development of visual perception skills and visual-motor skills.

- Within the vestibular system, there are two discriminatory processes occurring:
 1. Otolithic processing that is concerned with the pull of gravity and provides types of discrimination that has to do with postural accommodations, together with where the body is in space when vision is excluded, for example, whether vertical or horizontal when in a swimming pool.
 2. Semi-circular canal processing that is concerned with the detection of head movements through space. This type of processing contributes to three-dimensional (3D) spatial experiences and spatial orientation.

- Proprioceptive discrimination is concerned with aspects where muscles, tendons and joints are working and where the brain needs to decide on actions such as adjusting posture when sitting in a chair, how hard to press when writing with a pencil or how far to stretch the elbow to pick up something.
- Discrimination within the tactile system is complex and can range from identifying where touched to manipulation of a small bead to be able to thread it. Within **the mouth area**, tactile discrimination ranges from the food's texture to finding a small piece of bone in food that is in the mouth.

- Taste and smell discrimination also ranges from basic discriminatory abilities to very refined discrimination, memories often playing an important role in function. A child who is a fussy eater and who has had a bad experience with the taste and smell of a certain food will become anxious just by visually seeing the food.
- Discriminatory functions can depend on only one sensory system but can also be dependent on combinations of sensory systems such as the visual and vestibular systems that together provide a stable visual field during head movements.

- Postural–ocular control involves the activation and coordination of muscles ‘in response to the position of the body relative to gravity and sustaining functional positions during transitions and while moving’. Here, the combination of the visual, vestibular and proprioceptive systems supports function.
- **Poor processing of vestibular–proprioceptive input is believed to impede the development of postural and ocular control.** A postural–ocular disorder is described as the behavioural manifestation of a vestibular–proprioceptive processing disorder and is hypothesised to be the basis for the bilateral integration and sequencing (BIS) disorder.

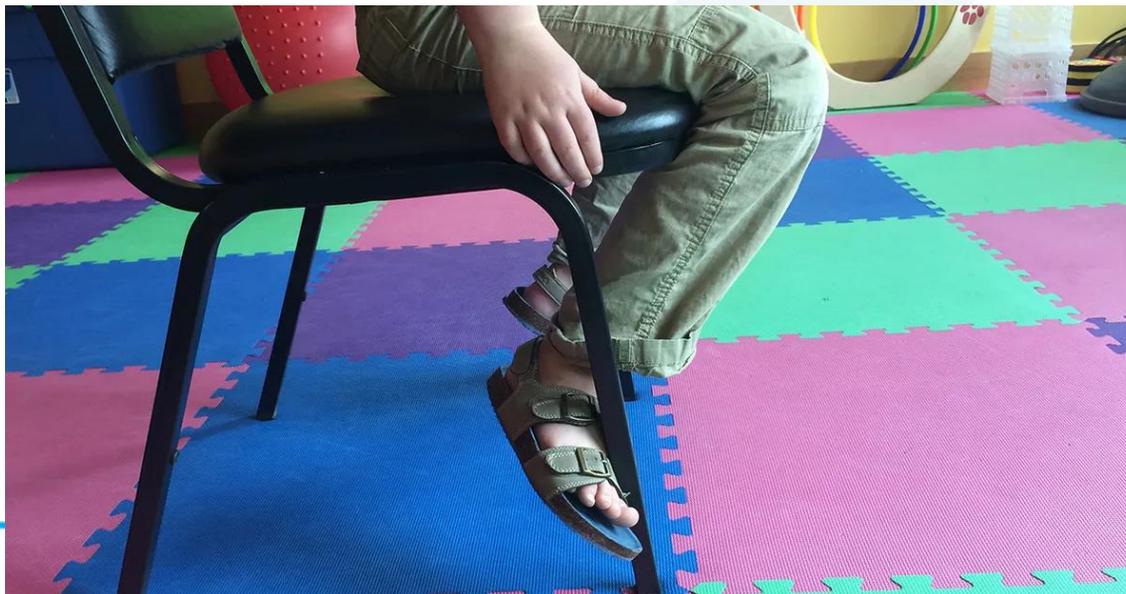
- Difficulties with postural-related demands like righting and equilibrium reactions, flexion and extension postures, postural stability and lateral flexion and rotation are experienced by these children. Poor ocular control impacts on activities where a stable visual field is needed.
- When following an object with the eyes, visual fixation is needed with dissociation of the eyes from the head movements. Poor ocular control will also delay the development of form and space perception and eye–hand coordination.

- In the literature, it is assumed that posture is the observable manifestations of vestibular and proprioceptive processing. There are also schools of thought that postural dysfunctions reflect the basis for deficits in BIS and sometimes for somato-dyspraxia (Bundy et al. 2002).
- Observable postural indicators include extensor muscle tone (observed in a standing position), prone extension, proximal stability, ability to move the neck into flexion against gravity (part of supine flexion), equilibrium and post-rotary nystagmus. This cluster of indicators is referred to in some cases as ‘postural–ocular’ components.

- Postural control and stability are usually problematic for these children described by Bundy et al. and they experience problems such as maintaining their posture and relying on their environment to support them with the postural demands. These children will lean against a wall when in the upright position, curl their legs and feet around chair legs or assume a 'lying' position in a chair.



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- **Motor skills level 3:**
- Although postural–ocular abilities are seen as discriminative abilities, it is difficult to draw a line where the abilities end and motor skills start. More advanced postural–ocular abilities such as those used when riding a bicycle can also be viewed as skill.
- There is currently a debate on whether or not BIS are motor skill functions or functions supported by praxis abilities. The latest research indicates that a BIS dysfunction is a separate type of dysfunction to the visuo- and somato-praxis factors that are identified in current research

There is however consensus on what these functions entail and what it allows for:

- The effective use of the two sides of the body whether on a level of navigating the body through space or on a more skilled level
- Similar use of the two hands, skilled in each, for example, skilled hand function and good hand function relative to hand skill
- Cooperative use of hands together
- Symmetrical rhythmic movements of arms, hands and feet
- Coordinated bilateral asymmetric movements of limbs
- Ability to coordinate rhythmic sequences of movements

- Children experiencing problems with BIS will have difficulties in **using the two sides** of the body in a coordinated manner, **crossing of their midline** and adequate establishment of dominance.
- Difficulties with the **sequencing** of motor actions, and specifically **anticipatory projected movements**, can be experienced. Anticipatory projected actions are very much feed forward dependent, meaning that they depend on past experiences and the ability to anticipate what is coming.

- Vestibular and proprioceptive system functions are the basis for adequate BIS actions, and the visual system also plays an important role in directing motor actions.
- Children with BIS dysfunctions also suffer emotionally because of their inability to experience success. They usually have a low self-esteem and their motivation is low.
- The important question is whether a child can perform skilled motor actions related to his/her age norm and to what extent it influences their function and engagement in occupations.

- **Praxis level 4:**

- Ayres defined developmental dyspraxia as a ‘motor planning disorder’ and as a ‘disorder of sensory integration interfering with ability to plan and execute skilled or non-habitual motor tasks’.
- Praxis was also described by Ayres (1989) as the process that includes conceptualisation or ideation, motor planning and execution of a novel or new motor action.
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- They also state that ‘ideation underlies planning, sequencing and organization of actions and ideational abilities may influence how a child engages in activities and occupations’. Difficulties with ideation will present itself in a child’s inability to know or make use of the affordances of objects in 3D space.

- Visuo-praxis is mainly dependent on the visual system but also relies on the vestibular system in terms of providing a stable visual field. Somatopraxis is dependent on the support of the proprioceptive and tactile systems.
- Visuo- and somato-dyspraxia have been described in Ayres' original work on the Sensory Integration and Praxis Test (SIPT). This is also one of the 'clusters' of dysfunctions that are described in the SIPT Manual. These two types of dyspraxia are still seen as factors evolving from current research.
- A child affected by poor SI abilities will experience difficulties with engaging in daily occupations during play, school, personal independence, recreation, sleep and interpersonal relations.

- The degree of difficulties can and will depend on the level/levels of difficulties or dysfunction.
- A generalised SI dysfunction is also described in research as a combination of dysfunction where a child obtains below-average scores on tests involved in BIS, visuo-dyspraxia and somato-dyspraxia.
- Children with praxis dysfunction can experience difficulties with body scheme, gross and fine motor skills and oral-motor control. They appear clumsy in performing motor actions, are accident-prone, mouth objects or drool and depend on using their vision for successful completion of tasks. Their behaviour varies from controlling and demanding to apathetic. Emotions that they frequently have to deal with include frustration, aggression or apathy. Academic problems such as perceptual and visual-motor difficulties (inclusive of reading and writing) can also be a direct result of these disorders.

- Visuo-dyspraxia is a deficit in visual perception abilities that affects constructional skills. The visual as well as the proprioceptive systems are involved in this dysfunction. Children with visuo-dyspraxia experience difficulties with visually planning space on 3D and two-dimensional (2D) levels, which impacts on mapping space and organising their own personal space (Lane 2012). Drawing and writing are usually problematic and can be observed in their management of their working space.

- Somato-dyspraxia causes children to have difficulty with motor tasks in terms of creating ideas of the how or what is possible, the planning of the actions and the execution of it. They do not receive feedback from their body and the environment after the action is completed, namely, its success or lack of success. The quality of their feedforward mechanisms is also poor (before an action is carried out, information is needed from the nervous system on the 'how' of the actions, e.g. in an action like catching a ball, the individual needs to get his/her limbs to a particular place in time to catch it). Any activity that depends on intact somatosensory feedback, for example, identifying shapes by touch without seeing them, will pose problems for a child with dyspraxia. Fine motor abilities are often also affected.