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Sensory-Motor Domain-Specific Abilities in Cattell-Horn-Carroll Model

Phantasia, Aphantasia and the Spectrum Subtypes of Imagination

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CONTENT

Paper 1

Sensory Abilities/Disabilities: An Application of the Sensory Profile-Caregiver Questionnaire to better understand the Sensory-Motor Domain-Specific Abilities in the CHC Model Version 2.1

Wujing LIU
Associate Therapist & Representative (Chengdu)
Paediatric Therapy Centre, Singapore

Guo-Hui XIE EdD, BCET, BCSE
Principal Therapist
Paediatric Therapy Centre, Singapore

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Abstract
As practicing educational therapists, both authors have chosen to focus their paper more on pragmatic issues related to sensory abilities and/or disabilities along with the theory-to-practice theme relevant to current practice of educational therapy. In this paper, the authors explored both sensory abilities and disabilities through the administration of the Sensory Profile (Dunn, 1999) in their attempt to understand the Sensory-Motor Domain-Specific Abilities within the Cattell-Horn-Carroll (CHC) framework/theory of broad and narrow cognitive abilities. By operationalizing the definitions of the relevant broad and narrow cognitive abilities into broad goals and specific objectives respectively, the authors believe it will enable educational therapists to decide how to design and what to include in an appropriate sensory-based treatment plan for those who need it.

Key Words: CHC Theory/Model, Cognitive Abilities, Sensory Abilities/Disabilities, Sensory Profile-Caregiver Questionnaire, Treatment

Aristotle (b.384 BC-d.322 BC), a Greek philosopher, is known to be the first person who attempted to make a list of human senses in his classical work *De Anima* (cited in Hicks, 2015, & Shields, 2016). In fact, Aristotle was also the first person to name the five basic human senses (known as exteroceptors today), which include sight (visual), smell (olfactory), hearing (auditory), touch (haptic/tactile), and taste (gustatory). These exteroceptors take a variety of forms, e.g., the photoreceptors which comprised of retinal rods and cones, are for sight, and the cutaneous receptors, which consist of Pacinian corpuscles, Meissner's corpuscles and Merkel's tactile disks, are for touch. Much later, additional four more senses were included in Aristotle's list

(see Hicks, 2015, & Shields, 2016, for detail). These senses were further differentiated and soon the list expanded to include a total of 21 or more (sometimes 33) senses, but the number of senses also depends very much on the varied opinions of different neurologists. For instance, Cohen's (1995) definition of senses has gone beyond the physiological phenomenon or nerve sensor definition, and he put the number of senses at 53. Cohen (1995) classified the senses under the following four categories:
(1) Radiation senses: These are the senses of colour, of moods that are associated with colour, and also of temperature.
(2) Feeling senses: Cohen (1995) described these senses as sensitivity to gravity, air and wind pressure, as well as motion.
(3) Chemical senses: These are related to the hormonal sense, e.g., pheromones, hunger for food, quench for water or grasp for air.
(4) Mental senses: This fourth category include senses related to external and/or internal pain, mental or spiritual distress, sense of self that includes friendship, companionship and power, and psychic capacity.

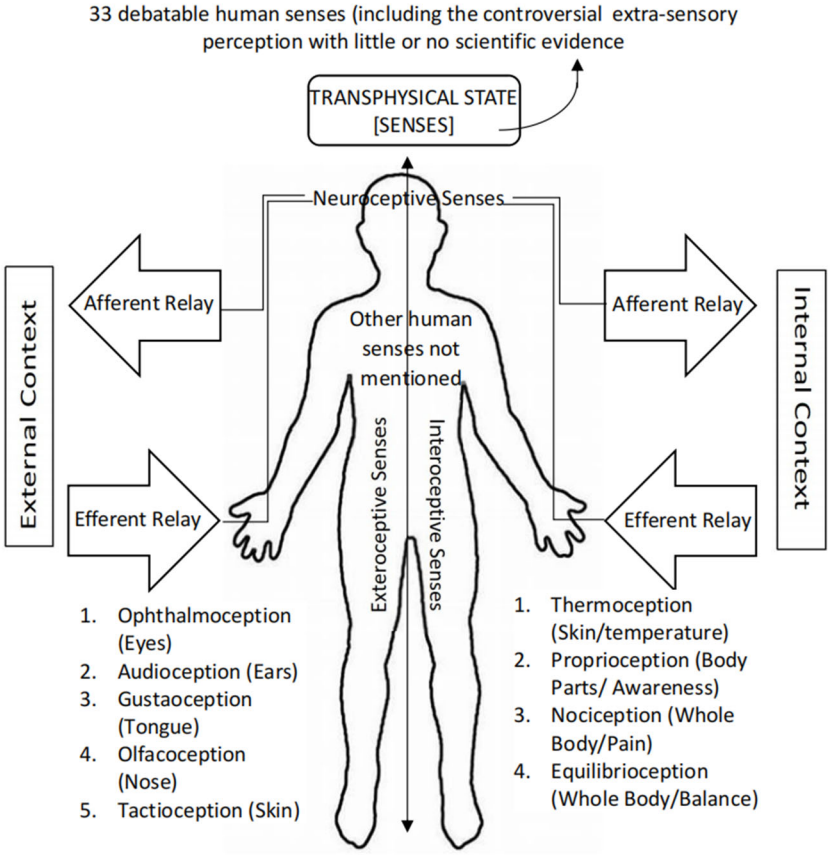

Figure 1. Sensory-Motor System
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A list of these generally accepted senses in human can be seen in Figure 1 (courtesy of Paediatric Therapy Centre, 2023) which shows the sensory-motor cycle. All the senses play an integrated important role to ensure the survival of a human being through neuroceptive senses - also known as neuroception, which "takes place in primitive parts of the brain, without our conscious awareness" (Porges, 2004, p. 19), is a term coined by Porges (2004) - which describes "how neural circuits distinguish whether a situation or an individual is safe, in danger, or something is threatening

his/her life" (Porges, 2004, p. 19). For instance, neuroception explains why a child is happy to have a parent's hug but perceives a stranger's hug as an assault. In another example, an infant coos when with its mother but cries at the sight of a stranger. Known as the Polyvagal Theory, it posits that the brain structures in mammals (particularly the primates) have evolved to manage both social and defensive behaviors (see Porges, 2004, for detail) through the senses, i.e., sensory abilities.

Sensory Abilities

When the term 'sensory abilities' (also known as sensory processing abilities) is mentioned, the usual response from a man-in-the-street is that there are the five senses: to see, to hear, to touch, to smell and to taste. These exteroceptive senses refer to the five sensory organs: eyes, ears, skin, nose and tongue. However, it is not exactly what the authors of this paper have in mind nor are they going to focus in this present discussion. They refer these sensory abilities (or sensory processing abilities) to the functions of five unique sensory organs that "receive, transmit, and interpret stimuli from the environment" (Nurse Key, 2017, para. 1; see Figure 2 below).

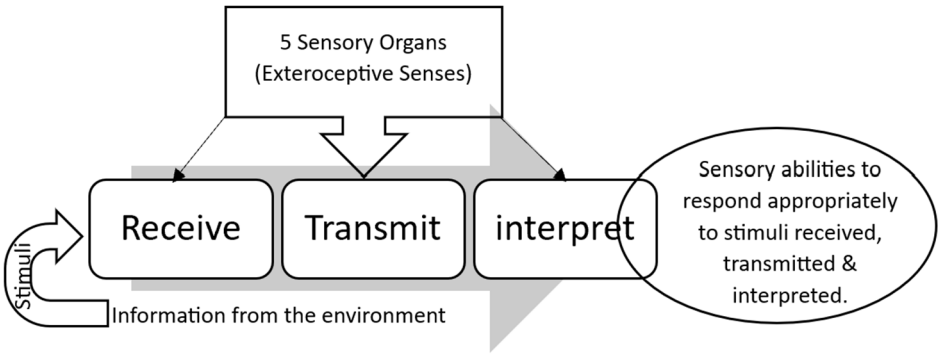

Figure 2. Sensory Abilities = Functions of the 5 Sensory Organs

However, currently, it is generally accepted that there are eight main types of sensory processing that are as follows:

(1) Exteroception, i.e., the five common senses: vision (ophthalmoception), auditory system (audioception), tactile or haptic system (tactioception), olfactory system (olfalcoception) and taste or gustatory (gustaoception) system;

(2) Proprioception, i.e., it refers to the internal awareness of body that helps to maintain posture and motor control as well as how one moves about and occupies space;

(3) Vestibular system, i.e., it refers to the inner ear spatial recognition, which keeps a person balanced and coordinated;

(4) Interoception, i.e., the sense of what happens in the body, e.g., the feeling of hot or cold as well as the feeling of emotions.

All these multiple sensory modality inputs are processed and managed by the brain into usable functional outputs (Stein & Rowland, 2011; Stein, Stanford, & Rowland, 2009).

The Sensory Nervous System (SNS) registers and processes explicit (from the immediate environment) and/or implicit sensory inputs (a.k.a. sensory stimulation) (from within an individual's psychological and/or emotional state of mind) by handling

the information from the sensory receptors, which will transmit the information through its efferent relay system to the SNS, which in turn, will respond to it through its afferent relay system to elicit a response (e.g., answering a question asked by the teacher) or reaction (e.g., shouting at a culprit who attempt to rob) to the stimuli (see Diagram 1 shown earlier, courtesy of Paediatric Therapy Centre, 2023) (also see The Star Institute, 2020, & Therapy Solutions for Kids, 2023, for detail and other examples).

As mentioned above, sensory stimulation (i.e., sensory inputs) is linked to three key domains of developmental milestones in children: emotional, cognitive and physical. Any delay or impairment in two or more of these three domains can lead to global developmental delay. Educational therapists working with such children often use repetitive activities to stimulate their senses so that infants and toddlers can learn and reach their developmental milestones.

The sensory processing can affect the way an individual (be s/he a child, adolescent or adult) learns, uses language, socializes with others, and problem-solves in the daily routine of his/her life (see The Star Institute, 2020, & Therapy Solutions for Kids, 2023, for detail). Sensory-motor (a.k.a. sensorimotor) functioning is the integration of the various senses and the musculoskeletal system to raise an awareness as well as adaptation to the world around the individual (Mcilroy, 2022). For instance, “by the end of the first year babies achieve sensory integration. They are then able to process information from multiple senses together – especially vision and hearing” (Mcilroy, 2022, para. 7). The development of sensory abilities is the sensational exploration of the world or, in other words, exploring through the senses (see Children’s Hospital of Richmond@Virginia Commonwealth University, 2023, for more detail). This sensational exploration requires a person to employ appropriate social skills when interacting with other people in a given social context (e.g., greeting a teacher in classroom or a colleague in office) and these skills require activation of various senses involved.

Sensory Disabilities

From the moment a stimulus (or event/episode) is picked up by a sensory receptor (e.g., someone saw a drunkard driving his car onto the sidewalk and knocking down several pedestrians), the sensory input is registered and being processed or transmitted by the efferent relay system to the brain (e.g., the occipital lobe makes sense of what was seen) which interprets the episode as ‘danger’, ‘urgent’ and ‘immediate help needed’, the person (agent) receiving the sensory input (sensory stimulation) via the efferent relay system to the SNS would respond via the afferent relay system from the SNS in the way s/he sees fit, e.g., flee from the danger zone, shout for help, rush to help the injured, etc.

The process that is described above is what the authors of this paper termed as the Sensory Relay Cycle. From the sensory stimulation through the sensory processing to sensory interpretation and sensory behavioral response, it shows how the sensory message elicits a response or reaction (within the split of second) from the receiver based on his/her interpretation of the event according to his/her perception, controlled attention (or attentional control; Astle & Scerif, 2009), prior knowledge and/or experience (e.g., binge drinking can make a driver drunk), and speed of response

(involving the equation where Latency + Processing Time = Response Time[1], i.e., L+PT=RT), before the receiver could respond (neuromotor) to the incident as witnessed. This description of the sensory relay cycle from the triggering event to the responding act can be simplified as follows: Stimulus → Sensory Stimulation → Sensory Processing → Sensory Interpretation → Sensory Behavioral Response. The entire Sensory Relay Cycle is also presented diagrammatically in Figure 3.

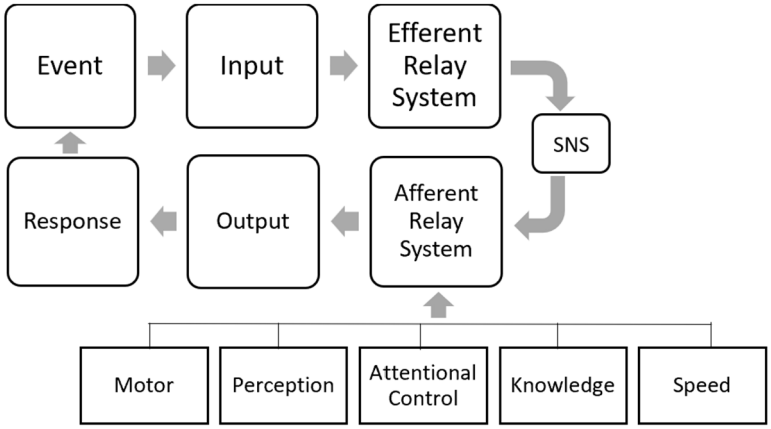

Figure 3. Sensory Relay Cycle

From the above description, sensory abilities (I.e., neuroceptive senses) certainly play a very important role in relaying explicit/implicit information accurately and fluently to the SNS in order to elicit an appropriate and swift response to the information received, transmitted and interpreted (see Figure 2). Neuroception will search for cues of safety and also watch for signs of danger to help an individual orientate and take action to safeguard his/her survival.

However, supposedly, things went haywire in the SNS (i.e., neuroceptive senses are not functioning properly), the person who witnessed the event as described above did not react appropriately, one can imagine the serious outcome(s) of the incident (e.g., the witness also got knocked down by the drunk driver, more innocent lives lost, damaged public property, and the list can go on). Slowness, lack of awareness, distortion in perception, misinterpretation and inappropriateness in sensory response can lead to all kinds of sensory disabilities, collectively known as sensory processing disorder (also used to be known as sensory integration disorder), which include sensory discrimination disorder, sensory modulation disorder and sensory-based motor disorder (Miller et al., 2007; Schoen, Miller, & Sullivan, 2014). Currently, the sensory processing disorder is still not officially recognized or included in the *Diagnostic and Statistical Manual of Mental Disorders-5th edition* (DSM-5) (American Psychiatric Association, 2013).

The symptoms of sensory processing disorder can include sudden mood swings and strange or anomalous behavior. There are reported cases of children and adults with challenging sensory issues who might avoid bright lights or loud noises as they find

[1] Latency (L)=the time the message is in transit between two points, i.e., initiator and receiver; Processing Time (PT)=the time the message takes to be processed; and Response Time (RT)=the sum of L and PT.

the lights/noises irritating, and such stimuli can agitate them into behaving abnormally (e.g., flapping their hands, hitting their ears, and vocal stimming noted in individuals with autism), walk around crashing into furniture or other things, throw into anger fits (temper tantrums), or seem to be clumsy in whatever tasks they have been assigned to do. “Faulty neuroception might lie at the root of several psychiatric disorders, including autism, schizophrenia, anxiety disorders, depression, and reactive attachment disorder” (Porges, 2004, p. 19).

Sensory Profile-Caregiver Questionnaire

As a result of a wide range of sensory challenges, educational therapists need screening or assessment tools to help them to identify these issues of concern experienced by their clients. There are many sensory profiles, inventories, questionnaires and/or checklists already available online for free, while others, especially the formal or standardized ones, can only be purchased by qalified professionals. To the educational therapists, these diagnostic tools are incredibly powerful and useful to help children, adolescents and adults to identify and recognize the sensations they are sensitive to, indifferent to (or totally unaware), seeking/carving for or avoiding (or not noticing), and, more importantly, what can be done about it. For parents and teachers working with children with sensory challenges, such an issue of concern can have a huge impact on associated behaviors.

Among the many sensory screening and assessment tools, the Sensory Profile-Caregiver Questionnaire (SP-CQ; Dunn, 1999) is the authors’ choice as it "provides a standard method for professionals to measure a child's sensory processing abilities and to profile the effect of sensory processing on functional performance in the daily life of a child" (p. 1). The SP-CQ consists of 125 items that are categorized under three sections (see Figure 4). Each section is briefly described below (Dunn, 2008, p. 2).

Section 1: Sensory Processing

There are six item categories in this first section. They represent the six types of sensory processing used in daily life: (I) auditory processing; (ii) visual processing; (iii) vestibular processing; (iv) touch processing; (v) multisensory processing; and (vi) oral sensory processing. The movement processing (proprioception) is not included in the SP-CQ, but it is listed in the Sensory Profile-Adolescent/Adult version (Brown & Dunn, 2002). Closer to the movement processing is the vestibular processing.

The vestibular processing as a sensory subsystem, according to Braley (2014), is concerned with balance and movement, and it is centered in the inner ears, where the vestibular organs are located deep inside. When a person moves his/her heads, the fluid in these vestibular organs also moves and shifts, constantly providing vital sensory information about the position of his/her head and body in space, i.e., the spatial awareness. Once, the person starts to move about and act as required by a certain task, proprioception (also known as kinesthesia) comes into play. Proprioception (i.e., movement processing in AA-SP) refers to the ability to sense movement, action, and location. It is present in a person’s every muscle movement. Without it, one would not be able to move without thinking about the next step Brennan, 2021).

Section 2: Modulation

There are five item categories in this second section. They represent the various combinations of sensory inputs used in daily life: (I) sensory processing related to endurance/tone; (ii) modulation related to body position and movement; (iii) modulation of movement affecting activity level; (iv) modulation of sensory input affecting emotional responses; and (v) modulation of visual input affecting emotional responses.

Section 3: Behavioral and Emotional Responses

There are three item categories in this third section. They represent emotional and behavioral responses that indicate sensory processing abilities: (I) emotional/social responses; (ii) behavioral outcomes of sensory processing; and (iii) thresholds for response.

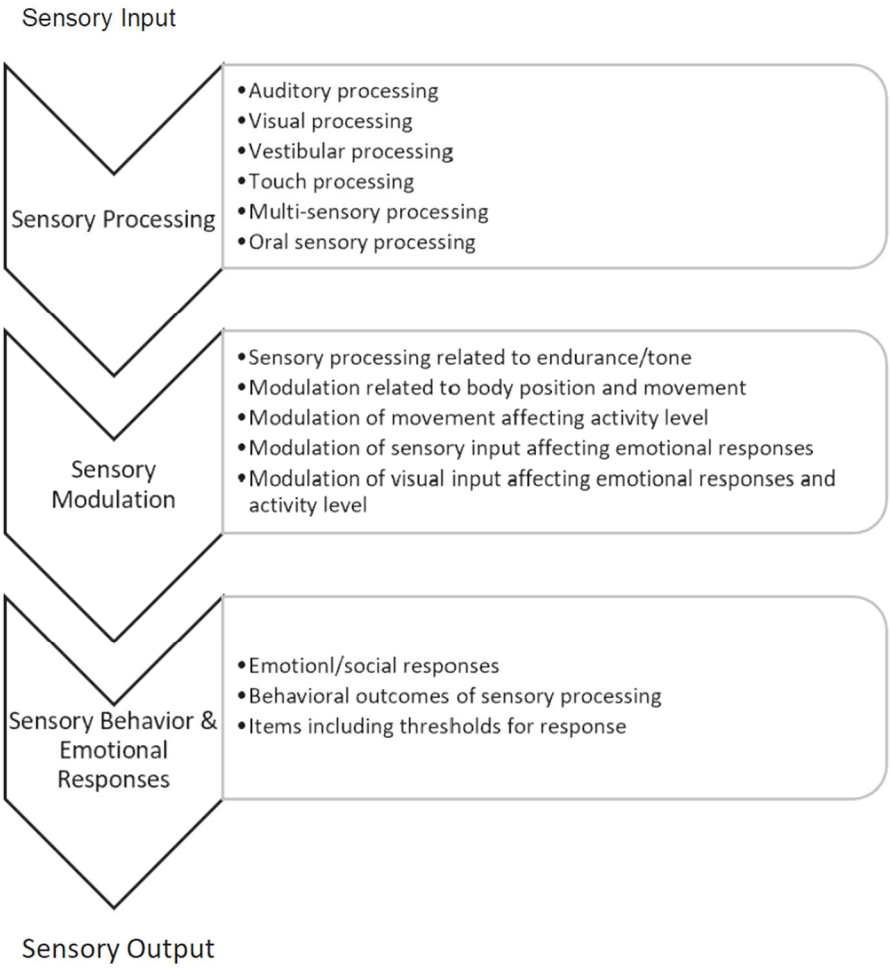

Figure 4. Three Main Sections of the SP-CQ

In addition, there are four quadrants or patterns of sensory processing in the SP-CQ as mentioned in Dunn's model of sensory processing (Dunn, 1997; also see PsychCorp, 2005, for detail): (I) Low Registration; (ii) Sensation Seeking; (iii) Sensory Sensitivity; and (iv) Sensation Avoiding (see Figure 5). Dunn's model consists of two axes comprising of the x-axis of the behavioral response (BR) and the y-axis of the neurological threshold (NT) (Dunn, 1997). These four quadrants resemble to some extent the characteristics as described in Eysenck's Introversion/Extraversion (I/E)

model of personality (Sato, 2005) and also the somatosensory event-related potentials (SERP) and their gating (Davies & Gavin, 2007).

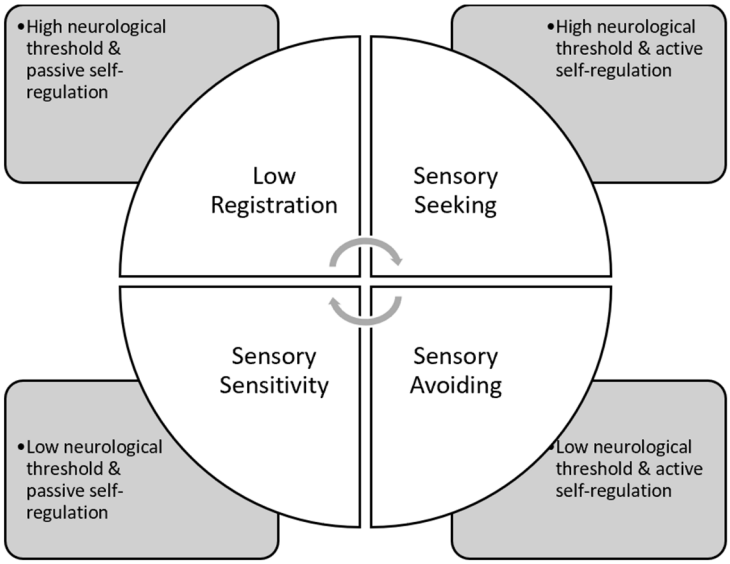

Figure 5. The 4 Quadrants in the SP-CQ

Quadrant 1: Low Registration (LR)

This first sensory quadrant measures an individual's awareness of all available types of sensation. A person with LR does not recognize or process all of the incoming sensory input, and s/he does not compensate by attempting to increase more sensory input to meet his/her needs. Hence, the person appears to be uninterested or inattentive to his/her immediate surrounding.

Quadrant 2: Sensation Seeking (SSk)

This second sensory quadrant measures an individual's interest in and pleasure with all sensory types. A person with SSk is identified as sensation seeking and s/he does not recognize or process all of the incoming sensory information. In contrary to LR, s/he carves for this sensory input to meet his/her needs. The person may be seen as hyperactive, frequently touches others or engages in unsafe activities without considering the risk or danger involved.

Quadrant 3: Sensory Sensitivity (SSt)

This third sensory quadrant measures an individual's ability to notice all sensory types. A person with SSt can be overwhelmed by sensory information, but s/he does not actively try to avoid the over-stimulation. Instead, the person may display frustration. S/He is distracted easily, feels irritable, stays cautious, and feels uncomfortable places with loud noises or bright lights.

Quadrant 4: Sensation Avoiding (SA)

This fourth and last sensory quadrant measures an individual's need for controlling the amount and sensory type available at any time. A person with SA feels overwhelmed by sensory information and will actively avoid the sensory stimulation. S/He may run

away from loud, busy environments, cover his/her ears when over-stimulated by noise, or wear boots to avoid the feet getting wet from the puddles after a heavy downpour.

Moreover, the results obtained from the SP-CQ administration, based on Dunn's (1997) sensory processing framework, can show an interplay between the neurological thresholds (y-axis[2]) and self-regulation (x-axis) of emotional- behavioral responses (see Figure 5) in order to explain how sensory information is processed. According to Dunn (2007), the y-axis of neurological threshold (low or high) is an individual's "personal range of threshold for noticing and responding to different sensory events in everyday life" (Cho, 2022, para. 1). Anyone with a low sensory threshold level would notice and/or respond to sensory stimuli more frequently than others because his/her "neurological system activates easier and more readily to sensory events" (Cho, 2022, para. 1). On the other hand, anyone with a high sensory threshold level would frequently "misses stimuli that others notice easily because their neurological system requires stronger stimuli to activate" (Cho, 2022, para. 1).

Cho (2022) described self-regulation of behavioral/emotional responses as "a continuum of behavioral construct" (para. 1) with one end that indicates passive self-regulation, i.e., an individual allows sensory experiences to happen and then reacts (see Dunn, 2007, for detail). For example, a child having to stay at one corner of the classroom, where s/he feels like being bombarded with many sensory inputs, that causes him/her feel uncomfortable. In no time, the child would feel so frustrated that s/he might react by hitting himself/herself or screaming at the top of his/her voice. The other end of the behavioral continuum indicates active self-regulation, which an individual engages in behaviors to manage or control sensory inputs. Cho (2022) provided an example: "adjusting one's position to get a manageable amount of sensory input" (para. 1).

From the intersection of the two axes of neurological threshold and self-regulation, the resulting four sensory quadrants or patterns are as follows:
(1) SSk has high threshold and active self-regulation strategy;
(2) SA has low thresholds and active self-regulation strategy;
(3) SSt has low threshold and passive self-regulation strategy; and
(4) LR has high threshold and passive self-regulation strategy.

Therefore, children, adolescents and/or adults, who display extreme reactions or adverse responses to sensory stimuli, are likely to experience uncalled disruption or interference with the activities of their daily living. High neurological threshold suggests an individual displays hyposensitivity (a condition known as sensory dormancy) that can result in a high probability of depression (Pfeiffer et al., 2005). In addition, sensory dormancy includes *la belle* indifference, lack of attention and concentration, lack of empathy, and craving for sensory stimuli. On the other hand, low neurological threshold indicates hypersensitivity (a condition known as sensory defensiveness) and is known to lead to anxiety (Pfeiffer et al., 2005). Dunn's model of sensory processing has indeed provided useful assessment and helpful intervention strategies for educational therapists to apply in their professional practice in promoting positive participation of their clients in sensory-based activities.

[2] The x- and y- axes are the authors' conceptual explanation for the interplay between self-regulation and neurological threshold.

A Brief Introduction to Cattell-Horn-Carroll Model of Cognitive Abilities

The Cattell-Horn-Carroll (CHC in short) framework of human cognitive abilities was originally conceived by McGrew and Woodcock (2001). It was later extended by Schneider and McGrew (2012) by amalgamating the Horn-Cattell Gf-Gc (based on the theory of fluid Gf and crystallized Gc intelligence) model (Cattell, 1941; Horn 1965) and Carroll's (1993, 1997) 3-stratum model due to substantial similarities between the two theories (Willis et al., 2011). The cognitive abilities are divided into three strata based on Carroll's 3-stratum theory (1993): Stratum 1 consists of narrow abilities; Stratum 2 consists of broad cognitive abilities; and Stratum 3 consists of general abilities.

Briefly described, the CHC model is a psychological theory on the structure of human cognitive abilities based on the work of three psychologists: Raymond B. Cattell (b.1905-d.1998), John L. Horn (b.1928-d.2006) and John B. Carroll (b.1916-d.2003). The CHC model or theory has been regarded as a monumental study in the development of human intelligence. With a large body of research that spans over 70 years, Carroll's 3-stratum theory was developed using the psychometric approach with an objective measurement of individual differences in cognitive abilities, and with the application of factor analysis (i.e., a statistical technique to uncover relationships between variables and the underlying structure of concepts, e.g., intelligence) (Keith & Reynolds, 2010). According to Neisser et al. (1996), this psychometric approach has consistently facilitated the development of reliable and valid measurement tools and it continues to dominate the field of intelligence research.

The Focus on the Sensory-Motor Domain-Specific Abilities

There are six different categories of broad cognitive abilities within the CHC framework provided by Schneider and McGrew (2012) namely, (1) Acquired Knowledge; (2) Domain-Independent General Capacities; (3) Sensory-Motor Domain-Specific Abilities which is further divided into Sensory Category and Motor Category; and (4) General Speed (see Table 1).

Table 1. CHC Model Version 2.1 (Schneider and McGrew, 2012)

Acquired Knowledge	**Domain-Independent General Capacities**	**Sensory-Motor Domain-Specific Abilities**		**General Speed**
		Sensory	**Motor**	
Quantitative Knowledge (Gq)	Short-Term Memory (Gsm)	Auditory Processing (Ga)	Kinesthetic Abilities (Gk)	Processing Sped (Gs)
Reading & Writing (Grw)	Long-Term Storage & Retrieval (Glr)	Visual Processing (Gv)	Psychomotor Abilities (Gp)	Reaction & Decision Speed (Gt)
(Comprehension-Knowledge (Gc)	Fluid Reasoning (Gf)	Olfactory Abilities (Go)		Psychomotor Speed (Gps)
Domain Specific Knowledge (Gkn)		Tactile Abilities (Gh)		

Key: Shaded boxes: Functional Grouping of Broad Cognitive Abilities
Unshaded boxes: Conceptual Grouping of Broad Cognitive Abilities

In this paper, the authors have chosen to focus on the comparison between the Sensory Processing items in the SP-CQ and the broad and narrow cognitive abilities in the Sensory-Motor Domain-Specific Abilities in the version 2.1 of the CHC model (Schneider and McGrew, 2012, 2013), which consists of two subdomains: (1) Sensory and (2) Motor.

Sensory Subdomain

Unlike the six item categories in the SP-CQ Section 1 Sensory processing, there are four broad cognitive abilities under the Sensory Subdomain of the Sensory-Motor Domain-Specific Abilities in the CHC model version 2.1. They are as follows:

(1) Auditory Processing (Ga): This refers to the ability to discriminate, remember, reason, and work creatively (on) auditory stimuli, i.e., tones, environmental sounds, and speech units.

(2) Visual Processing (Gv): This refers to the ability to make use of simulated mental imagery to solve problems. It includes perception, discrimination and manipulation of images in the "mind's eye" (see Zeman, 2021, for detail).

(3) Olfactory Abilities (Go): This refers to the ability to detect and process meaningful information in odors.

(4) Tactile Abilities (Gh): This refers to the ability to detect and process meaningful information in haptic (touch) sensations. It includes perception, discrimination and manipulation of touch stimuli.

Table 2 provides a summary of the comparison of the sensory processes under the Section 1 Sensory Processing in the SP-CQ and the broad and narrow cognitive abilities under the Sensory Subdomain in the Sensory-Motor Domain-Specific Abilities in the CHC model Version 2.1.

Table 2. Comparison of Sensory Abilities between the SP-CQ and the CHC Model

SP-CQ	**CHC Model Version 2.1**		
Section 1: Sensory Processing	**CHC Code**	**Broad Cognitive Abilities**	**Narrow Cognitive Abilities**
Auditory Processing	Ga	Auditory Processing	Ga-PC: Phonetic Coding Ga-US: Speech Sound Discrimination Ga-UR: Resistance to Auditory Stimulus Distortion Ga-UM: Memory for Sound Patterns Ga-U1/U9: Musical Discrimination & Judgment Ga-U8: Maintaining & Judging Rhythm Ga-UP: Absolute Pitch Ga-UL: Sound Localization
Visual Processing	Gv	Visual Processing	Gv-Vz: Visualization Gv-SR: Speeded Rotation Gv-CS: Closure Speed Gv-CF: Flexibility of Closure Gv-MV: Visual Memory Gv-SS: Spatial Scanning Gv-PI: Serial Perceptual Integration Gv-LE: Length Estimation Gv-IL: Perceptual Illusions Gv-PN: Perceptual Alterations Gv-IM: Imagery
Touch Processing	Gh	Tactile Abilities	The cognitive and perceptual aspects of this domain was not widely investigated.

Oral Sensory Processing (includes both smell and taste)	Go	Olfactory Abilities	Go-OM: Olfactory Memory

Motor Subdomain

Under the Motor Subdomain of the Sensory-Motor Domain-Specific Abilities in the CHC model version 2.1, the two broad cognitive abilities are as follows:
(1) Kinesthetic Abilities (Gk): This refers to the ability to detect and process meaningful information in proprioceptive sensations. At the time of the release of the CHC model version 2.1 in 2012, there were no well-supported narrow cognitive ability factors within Gk (Schneider & McGrew, 2012).
(2) Psychomotor Abilities (Gp): This refers to the ability to perform skilled physical body motor movements (e.g., moving fingers, hands, legs) with precision, coordination, or strength. Schneider and McGrew (2012) believed there were likely more narrow abilities in Gp than were listed in the CHC model version 2.1.

In sensory processing system, the two interoceptive senses that control body awareness, and balance and spatial orientation are proprioceptive senses and vestibular sense, respectively. Only Vestibular Processing (movement) is available in the 125-item SP-CQ, while the Movement Processing (proprioceptive sense) is found in the Sensory Profile-Adolescent/Adult (Brown & Dunn, 2002). According to Vasković (2023), the vestibular processing system is a somatosensory aspect of the sensory nervous system, which raises the awareness of the spatial position of the head and body (known as proprioception) as well as self-motion (known as kinesthesia). ”It is composed of central and peripheral portions” (Vasković, 2023, para. 1).

Table 3 below provides a summary of the comparison of the sensory processes under the Section 1 Sensory Processing in the SP-CQ and the broad and narrow cognitive abilities under the Motor Subdomain in the Sensory-Motor Domain-Specific Abilities in the CHC model version 2.1.

Table 3. Comparison of Sensory Abilities between the SP-CQ and the CHC Model

SP-CQ	**CHC Model Version 2.1**		
Section 1: Sensory Processing	**CHC Code**	**Broad Cognitive Abilities**	**Narrow Cognitive Abilities**
No equivalent of proprioception; Closer to it is Vestibular Processing in the SP-CQ (Dunn, 1999)	Gk	Kinesthetic Abilities (Proprioception)	The cognitive and perceptual aspects of this domain was not widely investigated.
Not in the SP-CQ; The term Movement Processing is only found in the Sensory Profile-Adolescent/Adult (Brown & Dunn, 2002)	Gp	Psychomotor Abilities (Physical body motor movement)	Gp-P3: Static Strength Gp-P6: Multi-limb Coordination Gp-P2: Finger Dexterity Gp-P1: Manual Dexterity Gp-P7: Arm-Hand Steadiness Gp-P8: Control Precision Gp-A1: Aiming Gp-P4: Gross Body Equilibrium

Extending from the SP-CQ to the CHC Model in the Sensory-Motor Domain

It is not sufficient to depend on the SP-CQ administration only to understand about sensory abilities/disabilities. The CHC model provides the much needed extension of

the current knowledge about sensory processing, modulation and emotional-behavioral responses from the Sensory Profile (Dunn, 1999) to a deeper exploration of broad and narrow cognitive abilities relevant to the Sensory-Motor Domain-Specific Abilities. In this way, with this understanding, educational therapists will know better how to apply the principles of sensorimotor learning (Wolpert, Diedrichsen, & Flanagan, 2011) when working with their clients with sensory disabilities.

Below is an elaboration of the broad and narrow cognitive abilities in the Sensory-Motor Domain-Specific Abilities in relation to the relevant item categories under the Section 1 Sensory Processing in the Sensory Profile (Dunn, 1999):

Auditory Processing (Ga)

This is first of the six item categories in the Sensory Profile (Dunn, 1999) Section 1 Sensory Processing on Auditory Processing, but it is not broken down further into its sub-processes. In the CHC framework, the Auditory Processing is represented by the CHC code Ga, which is defined as "[T]he ability to detect and process meaningful nonverbal information in sound" (Schneider & McGrew, 2013, p. 9). Moreover, the cognitive abilities in Ga depend on sound input and the functioning of the hearing apparatus to register, process and interpret these auditory stimuli. A key characteristic is the extent an individual can cognitively manage the competition between signal and noise in the perception of auditory information.

A sensory-motor based treatment plan (SMbTP) for Ga can be done by operationalizing (i.e., express or define aim, goal or objective in terms of the operations used to determine or prove it) its broad goals for Ga and specific objectives for the narrow cognitive abilities of Ga. The following broad goals for Ga are provided below:
Ga Goal-1: To interpret sounds or phonemes heard;
Ga Goal-2: To organize sounds under noisy background or distorting conditions in discriminating patterns in (a) sounds, (b) phonemes, and (c) musical structure;
Ga Goal-3: To analyze sound entities in terms of (a) sound elements, (b) groups of sounds, or (c) sound patterns;
Ga Goal-4: To manipulate sound entities in terms of (a) sound elements, (b) groups of sounds, or (c) sound patterns;
Ga Goal-5: To understand sound entities in terms of (a) sound elements, (b) groups of sounds, or (c) sound patterns; and/or
Ga Goal-6: To synthesize sound entities in terms of (a) sound elements, (b) groups of sounds, or (c) sound patterns.

Unlike the SP-CQ, the CHC framework shows a further breakdown in the broad cognitive ability of Auditory Processing (Ga) into the following narrow cognitive abilities with their respective specific objectives. Below are the narrow cognitive abilities of Ga:

- **Phonetic Coding (Ga-PC)**
  Ga-PC Objective 1: To (a) code, (b) process, and (c) be sensitive to nuances in phonemes or speech sounds in short-term memory; and or
  Ga-PC Objective 2: To (a) distinguish, (b) isolate, (c) blend, and/or (d) transform speech sounds.
- **Speech Sound Discrimination (Ga-US)**
  Ga-US Objective 1: To detect differences in speech sounds/phonemes under conditions of either (a) little or (b) no distraction or distortion; and/or

Ga-US Objective 2: To discriminate differences in speech sounds/phonemes under conditions of either (a) little or (b) no distraction or distortion.

- **Resistance to Auditory Stimulus Distortion (Ga-UR)**
  Ga-UR Objective: To (a) listen to and (b) understand speech or spoken language by overcoming the effects of either distortion or distraction.
- **Memory for Sound Patterns (Ga-UM)**
  Ga-Um Objective: To retain (a) tones, (b) tonal patterns, and/or (c) voices on a short-term basis.
- **Musical Discrimination and Judgment (Ga-U1/U9)**
  Ga-U1/U9 Objective: To (a) differentiate as well as (b) judge tonal patterns in music with respect to (i) melodic, (ii) harmonic, and (iii) expressive aspects based on the following criteria: (1) phrasing, (2) tempo, (3) harmonic-complexity, and (4) intensity variations.
- **Maintaining and Judging Rhythm (Ga-U8)**
  Ga-U8 Objective: To (a) recognize and (b) maintain a musical beat.
- **Absolute Pitch (Ga-UP)**
  Ga-UP Objective: To perfectly distinguish the pitch of tones.
- **Sound Localization (Ga-UL)**
  Ga-UL Objective: To localize heard sounds in a given space.

Visual Processing (Gv)

This is second of the six item categories in the Sensory Profile (Dunn, 1999) Section 1 Sensory Processing on Visual Processing, but it is not broken down further into its sub-processes. In the CHC framework, the Visual Processing is represented by the CHC code Gv, which is referred to "[T]he ability to make use of simulated mental imagery (often in conjunction with currently perceived images) to solve problems" (Schneider & McGrew, 2013, p. 9). Perception, discrimination and manipulation of visual images take place in what is known as the "mind's eye" (Schneider & McGrew, 2012). According to the online APA Dictionary of Psychology (American Psychological Association, 2023), the mind's eye is defined as "the mind's capacity to recall or create images based on visual experience" (para. 1). An impaired mind's eyes can result in aphantasia (see Zeman, 2021, for detail) and this condition is also evident in the spectrum of imagination in autism (see Xie & Deng, 2023, for detail). The narrow cognitive abilities in Gv are generally measured by tasks (viz., figural or geometric stimuli) that require perception and transformation of visual forms, images, shapes and/or, tasks. These, in turn, require an individual to maintain spatial orientation of visual items that may change or move through space.

A SMbTP for Gv can be done by operationalizing its broad goals for Gv and specific objectives for the narrow cognitive abilities of Gv. The broad goals for Gv are provided below:

Gv-Goal 1: To generate (a) visual images and/or (b) sensations;
Gv-Goal 2: To store (a) visual images and/or (b) sensations;
Gv-Goal 3: To retrieve (a) visual images and/or (b) sensations; and
Gv-Goal 4: To transform (a) visual images and/or (b) sensations.

Unlike the SP-CQ, the CHC framework shows a further breakdown in the broad cognitive ability of Visual Processing (Gv) into the following narrow cognitive abilities with their respective specific objectives. Below are the narrow cognitive abilities of Gv:

- **Visualization (Gv-Vz)**

Gv-Vz Objective 1: To apprehend a (a) spatial form, (b) item, or (c) scene;
Gv-Vz Objective 2: To match a (a) spatial form, (b) item or **(c)** scene with another (i) spatial item, (ii) form, or (iii) scene with the requirement to rotate it (one or more times) in either two or three dimensions.
Gv-Vz Objective 3: To mentally (a) imagine, (b) manipulate or (c) transform either items or visual patterns (without having to concern about the response speed); and/or
Gv-Vz Objective 4: To "see" (predict) how these (a) items or (b) visual patterns would appear under altered conditions (e.g., parts are rearranged, replaced or moved).

- **Spatial Relations (Gv-SR)**
  Gv-SR Objective 1: To rapidly (a) perceive and (b) manipulate (mental rotation, transformations, reflection, etc.) visual patterns;
  Gv-SR Objective 2: To maintain orientation with respect to items in space; and/or
  Gv-SR Objective 3: To distinguish an item when viewed from different (a) angles and/or (b) positions.
- **Closure Speed (Gv-CS)**
  Gv-CS Objective 1: To take a short time to distinguish a familiar meaningful visual item from incomplete (i.e., it can be disconnected, partially obscured or vague) visual stimuli, without knowing in advance what the item is.
  Gv-CS Objective 2: To assume a target item to be represented in an individual's long-term memory (LTM) storage.
  Gv-CS Objective 3: To (a) "fill in" unseen/omitted parts in a disparate perceptual field and (b) form a single criterion/rule.
- **Flexibility of Closure (Gv-CF)**
  Gv-CF Objective 1: To distinguish a (a) visual figure and/or (b) pattern embedded in a complex (i) distracting and/or (ii) disguised visual pattern/array with prior knowledge of what the pattern is.
  Gv-CF Objective 2: To either (a) recognize or (b) ignore distracting background stimuli as part of the visual closure ability.
- **Visual Memory (Gv-MV)**
  Gv-MV Objective 1: To (a) form as well as (b) store a mental representation or image of a (i) visual shape and/or (ii) configuration (especially, during a short study period), over at least a few seconds; and/or
  Gv-MV Objective 2: To recognize or recall the mental representation/image of a (a) visual shape and/or (b) configuration later (during the test phase).
- **Spatial Scanning (Gv-SS)**
  Gv-SS Objective 1: To survey (visually explore) a wide or complicated spatial field or pattern promptly and accurately;
  Gv-SS Objective 2: To distinguish a particular configuration/pathway through the visual field; and/or
  Gv-SS Objective 3: To visually follow an indicated route/path through the visual field.
- **Serial Perceptual Integration (Gv-PI)**
  Gv-PP Objective: To distinguish (and also especially to name) a pictorial and/or visual pattern when parts of the pattern are presented quickly in serial order (e.g., portions of a line drawing of an animal are passed in sequence through a small 'window').
- **Length Estimation (Gv-LE)**

Gv-LE Objective 1: To make an accurate estimation of visual lengths or distances without the help of measurement or measuring tools; and/or
Gv-LE Objective 2: To make an accurate comparison of visual lengths or distances without the help of measurement or measuring tools.

- **Perceptual Illusions (Gv-IL)**
  Gv-IL Objective 1: To resist being affected by mistaken perception or illusory perceptual aspects of geometric figures in response to some characteristic of the stimuli); and/or
  Gv-IL Objective 2: To resist perceptual illusions (also known as an individual's 'response tendency').
- **Perceptual Alternations (Gv-PN)**
  Gv-PN Objective: To keep a consistent rate of alternating between different visual perceptions.
- **Imagery (Gv-IM)**
  Gv-IM Objective 1: To mentally encode/depict an absent (a) item, (b) idea, (c) event or (d) impression in the form of an abstract spatial form; and/or
  Gv-IM Objective 2: To mentally manipulate an absent (a) item, (b) idea, (c) event or (d) impression in the form of an abstract spatial form.

Olfactory Abilities (Go)

In the SP-CQ, this is known as Oral Sensory Processing, which covers both smell and taste. It is the last of the six item categories in the Sensory Profile (Dunn, 1999) Section 1 Sensory Processing, but it is not broken down further into its sub-processes. In the CHC framework, the Olfactory Abilities is represented by the CHC code Go, which strictly focuses on smell alone with no taste (Gustatory Abilities or Gg? as its CHC code) being taken into consideration. The olfactory abilities depend on odorant receptors of the olfactory system (nasal chambers). According to Schneider and McGrew (2013), "Go refers not to sensitivity of the olfactory system but to the cognition one does with whatever information the nose is able to send" (p. 10). The cognitive and perceptual aspects of this domain had not yet been thoroughly researched when the CHC model version 2.1 was released (Schneider & McGrew, 2012).

A SMbTP for Go can be done by operationalizing its broad goals for Go and only one specific objective for the narrow cognitive ability of Go. The following broad goals for Go are provided below:
Go-Goal 1: To detect smell/odor through the nose;
Go-Goal 2: To sense the direction where the smell/odor is coming from;
Go-Goal 3: To discriminate between pleasant and unpleasant smells/odors;
Go-Goal 4: To use smell/odor to make a choice of preferred food; and/or
Go-Goal 5: To use smell/odor to sense danger in the environment (e.g., fire).

Like the SP-CQ, the CHC framework shows no further breakdown in the broad cognitive ability of Olfactory Abilities (Go). As mentioned earlier, at the moment, only one narrow cognitive ability with its specific objective has been listed in the CHC model version 2.1 for Go as follows:

- **Olfactory Memory (Go-OM)**
  Go-OM Objective: To establish memory for smells/odors.

Schneider and McGrew (2013) believed there should be more probable narrow cognitive abilities in Go such as "olfactory memory, episodic odor memory, olfactory

sensitivity, odor specific abilities, odor identification and detection, odor naming, olfactory imagery" (p. 10).

Tactile Abilities (Gh)

This is generally known as Touch Processing (also known as Haptic Processing in literature) in the SP-CQ. It is the fourth of the six item categories in the Sensory Profile (Dunn, 1999) Section 1 Sensory Processing, but it is not broken down further into its sub-processes. In the CHC framework, the Tactile Abilities (also known as Haptic Abilities) is represented by the CHC code Gh, which are involved in the perception and judging of sensations that are received through tactile (touch) sensory receptors. That is to say Gh does not refer to sensitivity of touch but to the cognition an individual does with tactile sensations (Schneider & McGrew, 2013). According to Schneider and McGrew (2013), "[B]ecasue this ability is not yet well-defined and understood, it is hard to describe it authoritatively" (p. 10). The sense of touch or tactioceptive sense involves the skin which contains general receptors to detect touch, pain, pressure and temperature.

A SMbTP for Gh can be done by operationalizing its broad goals for Gh and specific objectives for the narrow cognitive abilities of Gh. The following broad goals for Gh are provided below:
Gh-Goal 1: To (a) perceive and (b) judge thermal stimulation,
Gh-Goal 2: To (a) perceive and (b) judge spatial stimulation, or
Gh-Goal 3: To (a) perceive and (b) judge patterns imposed on the skin.

At the time of the release of the CHC model version 2.1 in 2012, the cognitive and perceptual aspects of this domain was not widely investigated (Schneider & McGrew, 2012). However, Schneider and McGrew (2013) did highlight that the domain might include such probable narrow cognitive abilities as Tactile Memory, Texture Knowledge and Tactile Sensitivity. At the moment, there are still no confirmed narrow cognitive abilities of Gh.

Kinesthetic Abilities (Gk)

In the SP-CQ, only the Vestibular Processing is explicitly mentioned. It is the third of the six item categories in the Sensory Profile (Dunn, 1999) Section 1 Sensory Processing on Oral Sensory Processing, but it is not broken down further into its sub-processes. A close equivalent of Vestibular Processing in the SP-CQ is the Movement Processing in the Adolescent/Adult-Sensory Profile (AA-SP; Brown & Dunn, 2002). As mentioned earlier, Vestibular Processing, which receives sensory information from head movement and gravity to maintain balance, equilibrium, and movement through space, also includes both proprioceptive senses and kinesthetic senses (see Vasković, 2023, for detail). In the CHC framework, the Kinesthetic Abilities, which is represented by the CHC code Gk, depend on sensory receptors that detect bodily (a) position, (b) weight, and/or (c) movement of three musculoskeletal aspects: muscles, tendons, and joints. It refers to "[T[he ability to detect and process meaningful information in proprioceptive sensations" (Schneider & McGrew, 2013, p. 10). Schneider and McGrew (2013) elaborated further on proprioception as "the ability to detect limb position and movement via proprioreceptors … Gk refers not to the sensitivity of proprioception but to the cognition one does with proprioceptive sensations" (p. 10). At the time of the release of CHC model version 2.1, "[T]here were no well-supported narrow cognitive ability factors within Gk yet" (Schneider & McGrew, 2013, p. 10).

Although Vestibular Processing (movement modality) covers proprioception and kinesthesia, there is no exact equivalent of Gk in the SP-CQ. However, it has been identified as Movement Processing in the AA-SP form (Brown & Dunn, 2002).

A SMbTP for Gk can be done according to the following broad goals for Gk as there were no specific objectives for the narrow cognitive abilities of Gk back in 2012. According to Schneider and McGrew (2012), the cognitive and perceptual aspects of Gk have yet to be widely studies. The following broad goals are provided below:
Gk-Goal 1: To control body movements
Gk-Goal 2: To coordinate body movements

Perhaps the Kinesthetic Sensitivity being a sensory acuity ability should be considered as a probable narrow cognitive ability in Gk. Schneider and McGrew (2013) defined it as "the ability to make fine discrimination in proprioceptive sensations (e.g., if and how much a limb moves)" (p. 10).

Psychomotor Abilities (Gp)
In the SP-CQ, there is no exact equivalent sensory processing (closest being the Vestibular Processing or Movement Processing in the AA-SP) for Psychomotor (Gp) mentioned in the CHC model version 2.1. Schneider and McGrew (2013) described it as "[T]he ability to perform physical body motor movements (e.g., movement of fingers, hands, legs) with precision, coordination, or strength" (p. 11). These movement or motor behaviors are typically the result of mental activity.

A SMbTP for Gp can be done by operationalizing its broad goals for Gp and specific objectives for the narrow cognitive abilities of Gp. The following broad goals for Gp are provided below (see Schneider & McGrew, 2013, p. 11):
Gp-Goal 1: To perform physical body motor movements with precision;
Gp-Goal 2: To perform physical body motor movements with coordination; and
Gp-Goal 3: To perform physical body motor movements with strength.

The CHC framework shows a further breakdown in the broad cognitive ability of Psychomotor Abilities (Gp) into the following narrow cognitive abilities with their respective specific objectives. Below are the narrow cognitive abilities of Gp (see Schneider & McGrew, 2013, p. 11, for detail):

- **Static Strength (Gp-P)**
  Gp-P3 Objective: To exert muscular force to move, i.e., (a) push, (b) lift, and/or (c) pull) a relatively (i) heavy or (ii) immobile object.
- **Multi-limb Coordination (Gp-P6)**
  Gp-P6 Objective: To make quick (a) specific or (b) discrete motor movements of the arms or legs (measured after the movement is initiated). Accuracy is not relevant here.
- **Finger Dexterity (Gp-P2)**
  Gp-P2 Objective: To make precisely coordinated movements of the fingers (with or without the manipulation of items).
- **Manual Dexterity (Gp-P1)**
  Gp-P1 Objective: To make precisely coordinated movements of (a) a hand, or (b) a hand and the attached arm together.
- **Arm-hand Steadiness (Gp-P7)**

Gp-P7 Objective: To precisely and skillfully coordinate arm-hand positioning in space.

- **Control Precision (Gp-P8)**
  Gp-P8 Objective: To exert precise control over muscle movements, particularly when responding to environmental feedback (e.g., speed change or position of a manipulated item).
- **Aiming (Gp-Al)**
  Gp-Al Objective: To execute (a) precisely and (b) fluently a sequence of eye-hand coordination movements for positioning purposes.
- **Gross Body Equilibrium (Gp-P4)**
  Gp-P4 Objective 1: To maintain the body in an upright position in space; and/or
  Gp-P4 Objective 2: To regain balance after a disturbance to balance.

Conclusion

Figure 6 below provides a diagrammatic summary of what has been discussed in this paper.

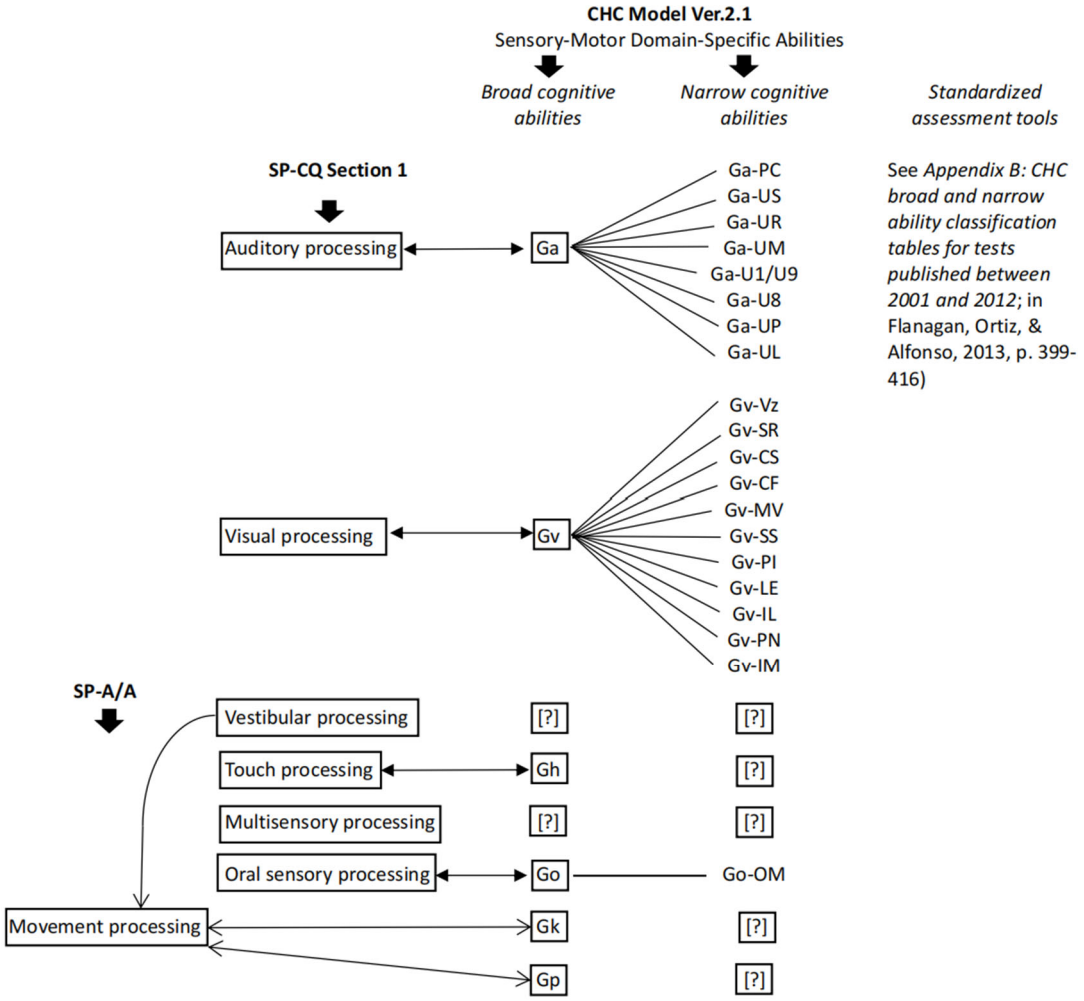

Figure 6. A Diagrammatic Summary

Educational therapists will find it most helpful as well as useful to them if they go beyond the SP-CQ results by taking an addition step to consider the various relevant broad and narrow cognitive abilities listed in the Sensory-Motor Domain-Specific

Abilities provided in the CHC model version 2.1. When operationalizing the broad goals and specific objectives based on the CHC-based broad and narrow cognitive abilities respectively, educational therapists with their professional content knowledge and creativity can utilize them in deciding the kind of standardized assessment tool to use in their administration to determine the problem suspected and also in designing an appropriate treatment plan that can best meet their client's unique learning and behavioral needs (see Figure 6 above).

In the best practice of educational therapy, there remains much for everyone in the field to learn about the CHC model and understand how to apply it in their professional work. However, there is still a need to ensure a smooth process of transition from obtaining the screener subtest results (e.g., the different item categories in the SP-CQ) and match them with the CHC broad cognitive abilities. Next, under each CHC broad cognitive ability, there are several CHC narrow cognitive abilities. Each of them lists several age-appropriate specific standardized tests to be administered in order to identify the root causes of the problem concerned. With this detailed set of specific test results based on the CHC narrow cognitive abilities via interpretation of the results, a more targeted treatment plan with a higher level of effectiveness can be designed by an educational therapist to meet a client's learning and/or behavioral needs.

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Paper 2

Is Hikkomori Syndrome a 'Modern-day Depression'? A Nosological Perspective

Gideon Qinxian Guo, PhD
Clinical Director, Hope Therapy Centre, Singapore
President, Lions Club of Singapore Hope

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Abstract
This short paper is the author's attempt to provide an investigative examination of a severe disorder of socially avoidant behavior observed over a period of at least six months or more. Known as Hikikomori Syndrome, the condition can cause serious distress and dysfunction to the sufferer and the explicit behavioral traits include the refusal to leave home or go outside, to go to school (if the sufferer is still studying) or to work (if s/he is a working adult), and withdrawal from peers as well as close family members leading to social isolation and limited social communication with others. However, Hikikomori Syndrome appears to be a biosocio-psychological disorder that overlaps and is co-morbid with other psychiatric disorders, particularly depression and generalized anxiety disorder. It is vital to examine the underlying conceptualization and consider if Hikikomori Syndrome is indeed a form of modern-day depression.

Key Words: Hikikomori, Social Withdrawal, Depression, Anxiety, and Nosology

Hikkomori syndrome (or simply called *Hikikomori* throughout this paper, except for sub-headings) is a complex, heterogeneous, and prevalent disorder. Research revealed a diversity in the conceptualization of this disorder, which poses a challenge in establishing a clear psychological nosology that is crucial in diagnostic agreement and communication among clinicians for evaluating psychiatric morbidity, treatment plan, and therapeutic outcomes (Jablensky & Kendell, 2002). Studies (e.g., Kato, Kanba, & Teo, 2019; Malagón-Amor et al., 2015; Tamaki & Angles, 2013) mostly examined the psychiatric profile of individuals with Hikikomori, and comorbidity with psychiatric diagnosis varies depending on study methodology and sampling. The most common comorbid diagnoses include psychotic disorders, as well as mood and anxiety disorders, such as major depression and social phobia, and pervasive developmental disorders. As a result, Hikikomori is perceived as 'modern-day depression'. This short paper aims to examine the nosological concept of Hikikomori.

Hikikomori Syndrome: Symptomatic Level of Nosology

Hikikomori is considered a socio-psychological condition marked by a triad of traits: (1) spending most of the time at home; (2) persistent social withdrawal for more than 6 months; and (3) lack of interest or motivation in employment or going to school to the exclusion of psychiatric conditions such as schizophrenia, intellectual disability, and

bipolar disorder as well as those who maintain personal relationships (e.g., friendships).

The main symptoms for the Social Withdrawal Syndrome (SWS) are associated with (1) feelings of shame, (2) low self-esteem, and (3) fear of rejection. Such social withdrawal is a major symptomatology of Hikikomori. Another condition similar to SWS is Anthropophobia, i.e., a strong fear of other people, which is aggravated by a state of withdrawal. However, it should not be construed or misdiagnosed as severe social withdrawal. There is yet another related syndrome is Social Phobia (SP) or Social Anxiety Disorder (SAD) which entails the following traits: (1) extreme shyness, (2) low self-esteem; and (3) self-isolation (Sottosanti, 2023). Then there is that condition of Avoidant Personality Disorder (APD) which has been postulated to that avoidant personality underpinning Hikikomori and its symptoms include the following: (1) avoiding work, social, or school activities for fear of criticism or disapproval, or feeling awkward in social situations, which may not so; (2) low self-esteem; and (3) self-isolation (Sottosanti, 2023).

Figure 1 shows an example of a symptomatic nosography of a case of an adolescent aged 13 years old with Hikikomori Syndrome. Every Hikikomori case has its own individual nosography due to differences in its five-level symptomatic nosology of the condition for each person (see Xie, 2023, for detail on nosology and nosography).

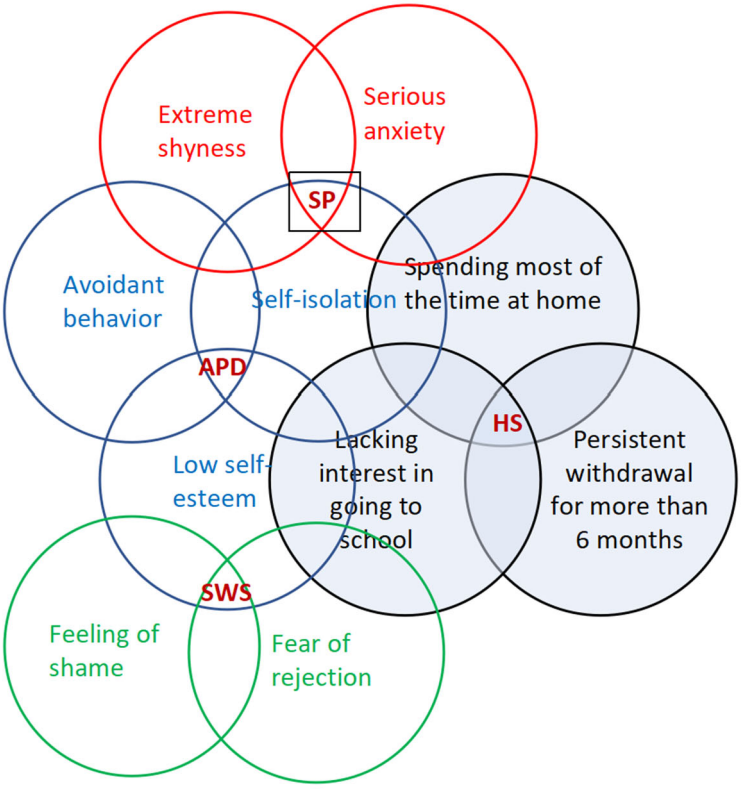

Figure 1. A Symptomatic Nosography of a Case with Hikikomori Syndrome

Typology of Hikikomori Syndrome

Suwa and Suziuki (2013), Li and Wong (2015), and Frankova (2019) have proposed a typology to advance the understanding of Hikikomori, mainly, the primary type versus secondary type of Hikikomori. The primary Hikikomori Syndrome has no clear

psychiatric disorder, on the other hand, secondary Hikikomori Syndrome has social withdrawal traced to psychiatric disorders (Frankova, 2019). However, such classification is hypothetical and lacks empirical evidence for such delineation (Stip et al., 2016). Presently research showed that the majority of Hikikomori are classified under secondary Hikikomori, which means they are also comorbid with other psychological disorders. However, such a classification is not well-defined and may differ across cultures. For instance, all issues of social concern or problems encompass those with or without psychiatric comorbidities. Borovoy (2008) postulated that Hikikomori results from a combination of social, medical and emotional issues.

Similarly, Kato et al. (2018) also proposed two subtypes of Hikkomorri Syndrome: The first, subtype concerns those with the 'hardcore' type who demonstrated extreme social reclusion by not leaving their home nor interacting with parents or family members. The second subtype has to do with the 'soft' type and those with this subtype do go out and have some social interactions with others. A more recent third subtype of Hikikomori has to do with those stay separately from their family, and they comprise the majority of the cases (see Tajan, 2015, for detail).

Etiology of Hikikomori Syndrome

Research (e.g., Chong & Chan, 2012; Kato, Shinfuku, & Tateno, 2020; Yong, R., & Nomura, 2019) have also indicated that stressful events such as academic pressure, illness, and interpersonal difficulties could trigger socially avoidant behaviors that lead to Hikikomori. Other studies noted that Hikikomori is correlated with internet addiction (Kato, Shinfuku, & Tateno, 2020), dysfunctional family settings (Hattori, 2006), or experienced trauma (Silić et al., 2019).

Another pertinent factor in the Hikikomori research is school dropout (see Young & Nomura, 2019, for detail). Particularly, school refusal or dropout and mental health issues are more common among early adolescents. School refusal is also identified as a possible trigger for Hikikomori, and there is an increase in the number of Hikikomori cases and school drop-out (Jones, 2006). Hence, it is common to come across Hikikomori young adults who have been socially withdrawn for over a decade (Sakai et al., 2011). The longer youth remains socially withdrawn, the harder for them to reintegrate back into society. Possible triggers of Hikikomori might include school absenteeism (termed as *futoukou*) or job insecurity. Both the numbers of Hikikomori and school refusals have been increasing as it becomes increasingly difficult to reintegrate into society the longer one remains socially withdrawn (Jones, 2006). As a result, it has become quite common to find a Hikikomori who has been withdrawn for over a decade (Sakai et al., 2011).

Moreover, Hikikomori is notable as a mental disorder in the early adulthood and it is associated with a range of long-term adverse outcomes in later adulthood, including emotional and physical health problems (Scott et al., 2016), relationship dysfunction (Kerr & Capaldi, 2011), and labor market marginalization (Niederkrotenthaler et al., 2014; Goldman-Mellor et al., 2014). The age of onset can range from 20 to 27 years, but prodromal symptoms often emerge during early adolescence (Kondo et al., 2013). Also, it appears that Hikikomori is more prone among adolescents (Kato, Kanba, & Teo, 2016) and more common among males than females (Yong, Fujita, Chau, & Sasaki, 2020).

Japanese Research on Hikikomori Syndrome

Japanese research (e.g., Guo, 2022; Tarumi & Kanba, 2005; Wong et al., 2019) had outlined how rapid socioeconomic changes would affect the lifestyle and psychosocial well-being of individuals. Typical melancholy has been referred to as common depression, which appears to have evolved with socio-cultural changes following economic growth (1960s-1980s), economic crisis and depression (1990s), and the complexity and challenges of modern society in 21st century (Tarumi, 2005; Tarumi & Kanba, 2005). In some instances, some Hikikomori may not experience a decline in quality of life, and negative behavioral and social consequences may come about from the implications of a reclusive lifestyle.

In Asian societies that value individual industrialism and structured routines, an erratic and conventional lifestyle is not socially acceptable, and may adversely impact youth's health (Wong et al., 2019). Beyond an individual's distress, such a lifestyle has adverse social impacts on families like family and marital conflicts, emotional distancing between family members, and loss of youth's income and family savings. At the social level, it encompasses reduced human capital and a negative impact on population growth. Hence, Hikikmori is theorized to be triggered or aggravated by stressful life events (see Nonaka & Sakai, 2021, for detail).

Hikikomori was initially thought to be a localized or culture-bound syndrome but research found it across cultures (Hamasaki et al., 2022). In the Japanese context, Hikikomori who have a fear of interpersonal relationships, particularly in face-to-face interactions are included in culture-bound syndrome. For example, *taijin kyofusho* is fear of offending others through awkward social interaction including eye-to-eye contact and blushing (Nakagami et al., 2017). Notably, there are variations in terms used to describe this phenomenon. For instance, in China, Hong Kong and Singapore, Hikikomoris are referred to as ‘hidden youth’, and in South Korea, ‘socially withdrawn youth’ (see Wong et al., 2019, for detail). The term 'NEET' (Not in Education, Employment, or Training) was first used in the United Kingdom to label young people not in employment, education, or training (Bynner & Parsons, 2002). Likewise, 'slacker', 'twixter', and 'adultolescent' describe young people in the United States who stay with their parents and do not develop independence (Staff, 2013). 'NEY' (Non-Engaged Youth) in Hong Kong refers to the non-engaged youth, and who are not gainfully employed and not pursuing education (Wong, 2012). In particular, this is salient in collectivistic Asian cultures that strongly emphasize communal and family ties. Hence, societal expectations and demands could be a potential risk factor for Hikikomori tendencies.

Literature in East Asian regions outlined similar findings and identified risk factors such as male gender, insecure attachment style, and psychiatric conditions (Clauss & Blackford, 2012; Krieg & Dickie, 2013; Saito, 2013). Conversely, other risk factors achieve less consensus. According to Wong et al. (2019), clinical studies of Hikikomori in Japan likewise demonstrated that the high educational status of families (i.e., fathers), is related to an increase in the risk of Hikikomori. A recent research study (see Hamasaki et al., 2022, for detail) indicated that lack of communication between parents and heavy internet usage were found to be significant predictors of Hikikomori severity. Hikikomori is thus referred to as ‘modern-day depression’ as young people could not adapt to the high-pressure work demand or school work as a result of economic impetus, leading to social withdrawal usually in the form of engrossment in

video games, social media, and devices (Kato et al., 2011). Therefore, it would be appropriate to deem ‘modern-day depression’ as more of a socio-cultural concept than a clinical diagnostic categorization or label (Orsolini et al., 2022).

Major depression is commonly comorbid with Hikikomori (Teo et al., 2018). Similarly, in depression, these social withdrawal-like behaviors manifest with a depressed mood, lowered motivation, and lethargy. Indeed, depression and Hikikomori share many similar psychological symptoms, and in some instances, comorbid. While some literature outlines distinctions between Hikikomori and depression, others imply that it is a form of "modern-day depression."

In a nosological sense, depression is diagnosed when a specific combination of symptoms persists over a certain period and with a particular intensity (American Psychiatric Association/APA, 2013). According to the DSM-5 (APA, 2013), the DSM-5 has defined major depression as having five or more symptoms in two weeks (APA, 2013). These include irritability, lack of interest or pleasure, sleep issues, psychomotor agitation or retardation, sluggishness or low energy, a sense of inadequacy or inappropriate guilt, poor concentration, persistent thoughts of death, and suicidal ideation. The term *dysthymia* refers to a milder, persistent form of depressive disorder when depressive symptoms manifest for most days over at least one year (American Psychiatric Association, 2013). Such a blurred delineation could be traced to the co-morbidity with mood and anxiety disorders (Pozza et al., 2019).

Indeed, research (e.g., Coluccia et al., 2015; Teo, 2013; Teo et al., 2020) had noted that individuals with depression tend to exhibit Hikikomori such as social reclusion and social anxiety. Other research has shown that youths with Hikikomori tend to develop gaming or internet addiction as a coping mechanism (Saito, 2013). Another research established that the Hikikomori population tends to be comorbid with psychological disorders, such as depression, which result in social withdrawal (Lin, Koh, & Liew, 2022). Other Hikikomori populations had psychosis and anxiety as their common comorbid disorders (Malagón-Amor, Córcoles-Martínez, Martín-López, & Pérez-Solà, 2015). Some studies in Japan also showed that older Hikikomori individuals had anger and depression issues (NHK World–Japan, 2019). Hence, in some instances, Hikikomori-like behavior or responses seem to serve as a coping strategy to manage stress, which could be dysfunctional and then develop into a disorder or syndrome.

Developmentally, according to Krieg and Dickie (2013), some theories attempt to explain the Hikikomori. Insecure attachments (i.e., avoidant and ambivalent attachments) have been proposed to be associated with social withdrawal. In other words, inconsistent or lack of parental support and affection would influence youth to seclude themselves as they are unable to manage social expectations and peer pressure. Erikson's (195)) stages of psychosocial development propose that youth withdrawal behavior results from the youth's inability to meet the psychosocial developmental task. The intimacy vs isolation conflict is significant at the young adulthood stage between the ages of 20 and 39 years (Erikson, 1950). Hypothetically, a young adult who fails to achieve intimacy at the young adulthood stage would suffer from isolation and hence from youth social withdrawal (Teo et al., 2013). Research has also established support for the role of parental support in youth's psychological well-being and psychosocial development (see Krieg & Dickie, 2013, for detail). Besides poor interpersonal social support and social reclusion, it appears that socioeconomic

factor contributes to this Hikikomori (Nonaka & Sakai, 2021). Other review studies (e.g., Kato et al., 2019; Krieg & Dickie, 2013; Muris & Ollendick, 2023) showed that Hikikomori may be an outcome of developmental difficulties such as insecure attachment. Particularly for families in middle to high socioeconomic status with high academic expectations from families, this over-protective parenting style tends to co-dependent behaviors, and attachment issues, which would influence them to be reclusive. Along the same vein, by creating strong social pressures, youth may appear to be coping with social expectations and duties but are already withdrawing psychologically and emotionally (Wong et al., 2019).

It is of significance to examine the nosology and co-morbidity of Hikikomori and other psychological conditions, particularly social anxiety disorders. Since youth social withdrawal behavior is a central feature of Hikikomori, so many mental health professionals tend to consider such acute social withdrawal as a manifestation of a range of psychological disorders included in the DSM-5 (APA, 2013): e.g., schizophrenia, post-traumatic stress disorder, social anxiety disorder, major depressive disorder, schizoid personality disorder, and avoidant personality disorder (Kato, et al., 2019). Similarly, severe social withdrawal appears to be a consistent and prominent factor for psychotic disorders, social anxiety disorder, depressive disorders, obsessive-compulsive disorder, and internet addiction. Instead, it has been suggested that social withdrawal is a consequence of the disorder(s). However, Teo and Gaw (2010) suggested that a substantial subset of the clinical cases had substantial psychopathology that did not meet the criteria for any of the existing psychiatric disorders listed in the DSM-5.

Of importance, recent research (Kondo et al., 2013; Tateno et al., 2012) recognizes the comorbidity of Hikikomori with neurodevelopmental disorders, which also include intellectual developmental disorder . For instance, Hikikomori shows comorbidity with autism spectrum disorder (ASD), whose tendencies like lack of empathy can lead to social maladjustment and prone to bullying. Thus, it is suggested that severe social withdrawal behavior could be included as a new psychiatric disorder in a future edition of DSM despite its clinical overlap with other psychiatric disorders. While it is unclear whether it is Hikikomori that arises from other psychiatric disorders or if it is the cause of co-occurring psychiatric disorders, as observed that some disorders share Hikikomori-like characteristics including psychosis, social anxiety disorder, avoidant personality disorder, depressive disorders, internet addiction, and post-traumatic stress disorder (Kato et al., 2012). Indeed, prominent risk factors for Hikikomori include psychiatric disorders, developmental disorders, substance-related or behavioral addictive disorders (e.g., Internet and gaming misuse), and poor psychosocial contexts (Lee et al., 2013). The strong interpersonal nuances of Hikikomori warrant the consideration of social anxiety. This is especially so since anxiety in social interactions may lead to Hikikomori and social anxiety disorder is found to be highly comorbid among Hikikomori youth (Teo et al., 2015). Such Hikikomori-like behaviors are also common manifestations during the depressive episode of bipolar disorder (Kato et al., 2019). Thus, Hikikomori-like symptoms are perceived as co-existing with perceived Hikikomori-like major psychiatric disorders listed in DSM-IV and the current DSM-5. Other Hikikomori cases fall in the gray zone as there is a lack of clear diagnostic criteria.

Concluding Remark

It appears that Hikikomori is a social and ‘modern-day depression’ as it is a product of an economic shift and technological advent. Against such a backdrop, youth experience distress in response to challenges imposed by school and work, and exhibit psychological symptoms which overlap or form a subset of depression and social anxiety disorders. Thus, Hikikomori appears to be a "modern-day" disorder that seems to onset during adolescence and exhibits significant depressive symptoms and social anxiety, leading to social withdrawals often coupled with increased gaming and internet addiction as a coping response. Yet, these symptoms do not fall under the clear clinical categorization of the international classification of disease or DSM-5 (APA, 2022) to qualify as a disorder partly due to the amalgamation of syndromes and often these symptoms are not severe enough to be categorized as a clinical concern. While a series of revisions have been made to the diagnostic criteria, Hikikomori may not meet the criteria of any psychiatric disorders but demonstrate adjustment and social withdrawal issues. In these cases, these youth would be classified as adjustment disorder based on the DSM-5 (APA, 2013), and the Hikikomori state was named as 'idiopathic [ichijisei] Hikikomori' by a Japanese (see Teo, 2010, for detail). Nosologically, it draws affiliation from panic disorder and appears to have similarities with major depressive disorder (MDD). Indeed, the high comorbidity, shared profile, and putative genetic risk among major depressive disorder with generalized anxiety disorder would warrant a question about Hikikomori's place in future psychiatric nosology.

Perhaps, with extensive research in the future on the interrelationship among these syndromes, the Diagnostic and Statistical Manual-5 (DSM-5) and International Classification of Diseases-11 (ICD-11) would finally establish the nosological validity of Hikikomori Syndrome and establish its position in psychiatric nosology. Understanding the nuances and psychopathological characterization of this intriguing syndrome would further contribute to the advancement of clinical categorization in diagnosis as well as shedding important insights which would be instrumental in formulating preventive and intervention programs.

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Paper 3

The Five Underlying Theoretical Concepts and the Five-Level Symptomatic Nosology of Hyperlexia

Harjit Singh s/o Harnam Singh, SNCP
Special Needs Community Service Worker
Lecturer, Merlion Academy, Singapore

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Abstract
Hyperlexia has often, though not always, been associated with the autism spectrum disorder (ASD). While the disorder is regarded as a 'splinter skill' - a unique skill but without much practical application - with precocious reading ability (more like barking at print) but no real understanding of what is read. It becomes a enigma in itself between superior word recognition and/or decoding and deficient reading and/or listening comprehension. In this short paper, the author has chosen to cover briefly on the three developmental phases of hyperlexia research from the awareness through recognition to conceptualization, but paid more attention on five underlying theoretical concepts of hyperlexia and the five-level symptomatic nosology of the condition of hyperlexia.

Key Words: Autism Spectrum Disorder, Developmental Phase, Hyperlexia, Symptomatic Nosology, Theoretical Concept

Hyperlexia is a unique syndrome characterized by an individual's precocious capability to read accurately and fluently albeit mechanically without expression. Initially identified by Norman E. Silberberg and Margaret C. Silberberg (1967, 1968), the disorder was once thought to be a splinter skill of savantism (i.e., talented or gifted autistics) (Grigorenko, Klin, & Volkmar, 2003) closely associated with the autism spectrum disorder (ASD) and was defined it as the precocious ability to read words without prior training in learning to read, typically before the age of five. It is an enigmatic condition between being superior in word recognition and/or decoding and deficient in understanding and, hence, poor social interaction with others (see Healy, 1982, for detail).

The original understanding of hyperlexia was that the condition was never meant to denote a kind of disorder or a form of reading disability. However, some kind of savant ability has been frequently observed in that condition (Aaron, 1989). However, today, hyperlexia has been taken to be a form of reading disorder manifested by an unexpected superior ability to read fluently, but also with an equally unexpected deficit in reading or listening comprehension (Chia, 1995). Moreover, Tyre and Young (1994) categorized it as a subtype of dyslexia, known as direct dyslexia. Wong (2010) argued that "[I]n order to differentiate between the two conditions, i.e., dyslexia and hyperlexia,

it is important … to look at the profile of a reader, and second, the process of reading/listening comprehension" (p. 80; also see Wong, 2010, for detail).

To understand how the term hyperlexia has come to be what it is known and has been defined today, Aaron (1989) argued that the historical development of research on hyperlexia has undergone three major phases of change as described briefly below (however, not within the scope of this paper to delve further on this topic):

- Phase 1: The Awareness of Hyperlexia - According to Chia, Poh, and Ng (2009), "began in the early part of the twentieth century when sporadic reports (e.g., Cobrinik, 1974; Philips, 1930; Snowling & Frith, 1986) in educational literature described children with amazing reading ability but failed to understand what they had read" (p. 72).
- Phase 2: The Recognition of Hyperlexia - This took place "in the late 1960's and early 1970's, saw the term *hyperlexia* being coined and used by Silberberg and Silberberg (1967) to describe the word decoding ability that is out of proportion to comprehension ability" (Chia, Poh, & Ng, 2009, p. 73). Hence, it signaled the beginning of formal recognition of hyperlexia in the disability studies.
- Phase 3: The Conceptualization of Hyperlexia - Since 1971, more hyperlexia studies (e.g., Chia, 1996; Healy, 1982; Richman, 1997) became interested in re-defining the condition "by determining the causes of comprehension deficits among hyperlexic children, i.e., what had caused the breakdown in comprehension despite good decoding process" (Chia, Poh, & Ng, 2009, p. 73). It is also during this phase that several theoretical concepts of hyperlexia were derived from research (Chia, 2000). The aspect of this issue will be discussed in more detail in the later part of this paper.

As already mentioned in the first paragraph above, hyperlexia most commonly affects children diagnosed with ASD. While it is challenging to know the prevalence of the hyperlexia in the general population or even to determine exact statistics, Zhang and Joshi (2019) reported that it is believed hyperlexia affects roughly 6% to 20% of individuals with autism in the United States (see Figure 1).

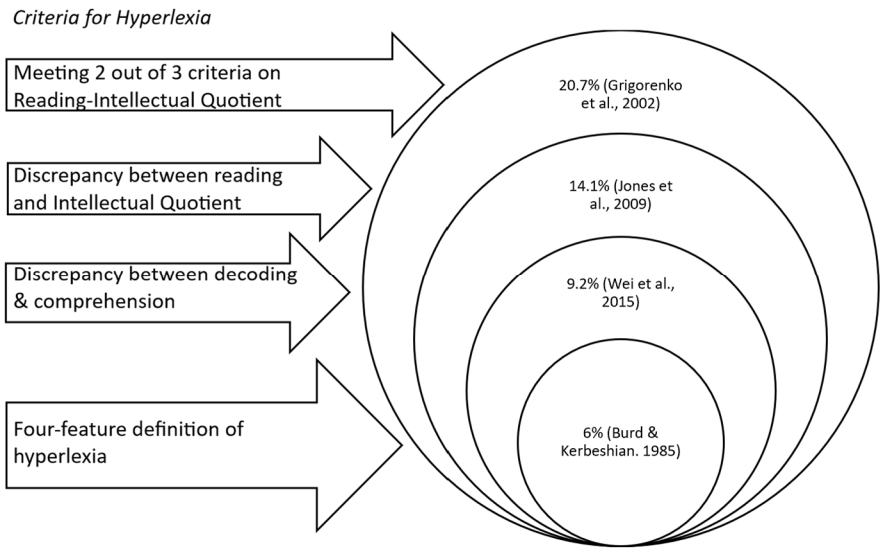

Figure 1. Criteria for identifying Hyperlexia and Its Varied Prevalence (%)

The Underlying Theoretical Concepts for Hyperlexia

Since 1971, research studies (e.g., Chia, 1996; Healy, 1982; Richman, 1997) paid more attention to the issue of interest, i.e., to re-define the condition of hyperlexia by determining the causes of reading/listening comprehension deficits among hyperlexic children. In other words, the research question that was asked here: What caused the breakdown in comprehension despite good decoding process? Basing on the information collected from other studies and accumulated over several decades, Chia (2000) put forth four different theoretical concepts of hyperlexia that have been derived from research. A fifth theoretical concept of hyperlexia is added by Xie (2023). They are briefly described as follows:

The First Theoretical Concept of an Accelerated Cognitive Ability

Early research studies (e.g., Elliott & Needleman, 1976; Niensted, 1968) suggested that hyperlexia is not a disorder per se, but should be described as a syndrome, i.e., a manifestation of a unique and accelerated cognitive ability. Niensted's (1968) definition of hyperlexia includes all children with a one-year discrepancy between word recognition and comprehension scores. This amazing skill was then regarded as a precocity of reading - a special talent than a cognitive deficit.

The Second Theoretical Concept of Bipolarity of Reading Disabilities

Proposed in several research studies (e.g., Aaron, 1989, 1997; Gough & Tunmer, 1986), this theoretical concept describes dyslexia and hyperlexia as two different reading disabilities that occur at the opposite poles of the reading/comprehension continuum with a mixture of both in the middle range of the continuum, resulting in a wide range of non-specific reading disabilities (NSRDs) (see Figure 2).

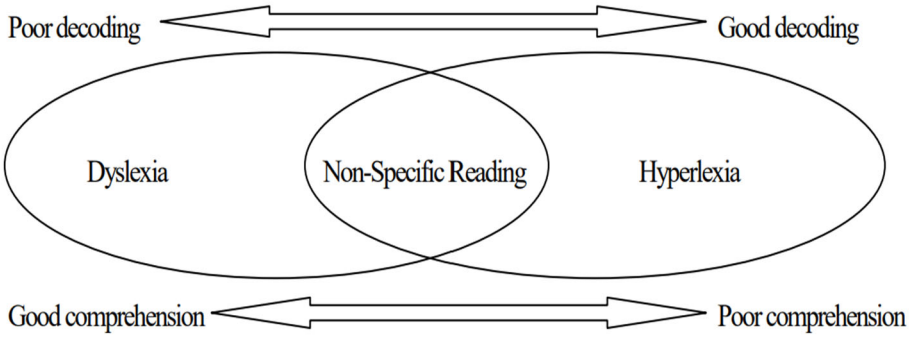

Figure 2: Model of Bipolarity of Reading Disabilities

The Third Theoretical Concept of Hyperlexia as a Subtype of a Disorder

Another concept of hyperlexia can be found in research literature that has described the condition as a subtype of a disorder, which can be either dyslexia (Chia, 1996; Tyre & Young, 1994) or autism (American Hyperlexia Association, 2005; Richman, 1997), and maybe both in co-existence. In other words, hyperlexia can be a disorder of language development or a disability of social imperception or even both. To understand this concept, there is a need to understand that hyperlexia is a syndrome with an inevitable breakdown in inter-textuality as well as inter-subjectivity.

What is inter-textuality? According to Wong (2003), **w**hatever an individual reads and how he/she interprets the text depends very much on the degree of inter-textuality he/she can achieve between the text type (also known as genre) and his/her mental

text. This can be attained by establishing the association between a given text and other relevant texts a reader has encountered previously and is retrieved from his/her long-term memory (de Beaugrande, 1980; Kristeva, 1980). Chi (1995) has defined reading as a complex inter-textual processing that provides one of the key links for readers to make meaning of the texts for the purpose of achieving reading comprehension. In other words, reading is more than just decoding words as observed in individuals with hyperlexia, and that is why hyperlexia is also known as direct dyslexia (Tyre & Young, 1994), which is an ability to read print easily and surprisingly well beyond the vocabulary usage but without real or proper reading comprehension. This means the condition of hyperlexia is taken as a facility in word calling with inferior reading comprehension, which represents a special instance within the larger category of what should be rightly termed as dyslexia syndrome (see Figure 3; Chia, Poh, & Ng, 2009).

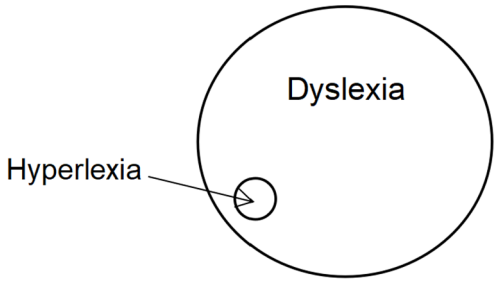

Figure 3: Model of Hyperlexia as a subtype of Dyslexia

What is inter-subjectivity? Trevarthen (1980) referred it to “both recognition and control of cooperative intentions and joint patterns of awareness” (p. 530). Inter-subjectivity constitutes a vital part of social imperception, i.e., an individual’s ability or lack of ability to understand his/her social environment, especially in terms of his/her own behaviour (Myklebust, 1975). Inter-subjectivity can be attained through both verbal as well as non-verbal process of communication through which participants are required to recognize and coordinate their understanding of the connections between others’ theories of mind and their respective actions, and to consequently regulate their own role responses to sustain a communicative act (e.g., conversation, role-play, interview, etc.). In this sense, Tan-Niam (2003) pointed out that inter-subjectivity involves an understanding of other minds through the understanding of a partnering individual who intentionally perceives a situation as same or different from one’s own. Hence, should there be a breakdown in inter-subjectivity, it will lead to an inefficiency of social imperception that “ultimately contributes to immaturity and difficulty making routine judgments necessary to succeed in everyday life” (Leavell, 1998, p.4). This, in turn, may cause the theory of mind to become defective resulting in what is also known as mind-blindness, leading to the condition of autism (Baron-Cohen, 1999; Chia & Chua, 2014). Hence, the condition of hyperlexia also carries autistic traits and it may represent a subtype within the autism spectrum disorder (ASD) (Newman et al., 2007; Whitehouse & Harris, 1984).

The Fourth Theoretical Concept of Hyperlexia as a Syndrome or Generic Class of Comprehension Disability

Research studies (e.g., Aaron, 1989; Chia, 1996; Healy, Aram, Horwitz, & Kessler, 1982) have also suggested hyperlexia should be taken as an independent generic class of listening and/or reading comprehension deficit disorder and be separated from

dyslexia. Hyperlexia should be rightly termed as *hyperlexia syndrome* because it consists collectively signs and symptoms that characterize it as a form of psychologically abnormal condition different from dyslexia and other types of literacy disorders (Manzo & Manzo, 1994).

According to Turkeltaub et al. (2004), hyperlexia is a rare disorder that is essentially the opposite of dyslexia – instead of having a difficult time reading, children will read early, often and with extreme skill. Hyperlexia is conceptualized as a specific and identifiable syndrome with the following three key symptoms: (1) a spontaneous reading of words before the age of five; (2) an impaired comprehension of both listening and reading tasks; and (3) the word recognition of decoding skill is superior (Healy et al, 1982).

The Fifth Theoretical Concept of Hyperlexia as an Autistic Subtype
Past studies (e.g., Burd, Kerbeshian, & Fisher, 1985; Snowling & Frith, 1986; Whitehouse & Harris, 1984) and most current studies (e.g., Macdonald, Luk, & Quintin, 2022; Mammarella et al., 2022; Wong, 2010) have suggested hyperlexia is a syndromic condition associated with ASD. According to the Autism Support Network (2002), its three main characteristics are: (1) early precocious or intense fascination with letters or numbers; (2) delays in verbal language; and (3) social skills deficits, which are also found in *The Educator's Diagnostic Manual of Disabilities and Disorders* (Pierangelo & Giuliani, 2007, p. 258).

According to the American Hyperlexia Association (2005), whether hyperlexia is or is not part of the ASD is a matter of much debate. It is a common trait found in autism and such individuals "have a unique learning style and a better prognosis than those without this reading skill" (p.1). Although a large number of hyperlexic children manifest symptoms of ASD, not all of them do (Aaron, 1997). About two in every 10,000 children with ASD have hyperlexia (Chia, Poh, & Ng, 2009), and the author of this paper believes that studying autistic children's development may help explain why some of them naturally pick up reading the same way that others pick up spoken speech. The results, he hopes, may also improve the current understanding of disorders such as dyslexia and autism, and also help children with hyperlexia. Therefore, hyperlexia should not be dismissed as a meaningless or useless splinter skill, because "it is much more than that even if comprehension lags because reading can be a very useful tool for learning other skills and can be the doorway to language in general" (American Hyperlexia Association, 2005, p.1).

According to Chia, Poh, and Ng (2009) and Wong (2010), hyperlexia has an overlap between autistic disorder (also known as Kanner Syndrome) and language learning disorder constituting what is known as Hyperlexia Type 1, and between visual-spatial perceptual disorder and Asperger Syndrome forming what is known as Hyperlexia Type 2 (Richman, 1997) (see Figure 4). This is also what Brown (2016) proposed with only two types of hyperlexia as follows:
Type 1: Hyperlexia marked by an accompanying language disorder; and
Type 2: Hyperlexia marked by an accompanying visual-spatial learning disorder.

However, Treffert (2011) argued that there are three types of hyperlexia, specifically as follows:
Type 1: A neurotypical child who is observed to be a very early reader.

Type 2: An autistic child who manifest very early reading ability as a splinter skill.
Type 3: A very early reader who displays some autistic-like traits and behaviors (but not on the autism spectrum), which fade away as s/he matures.

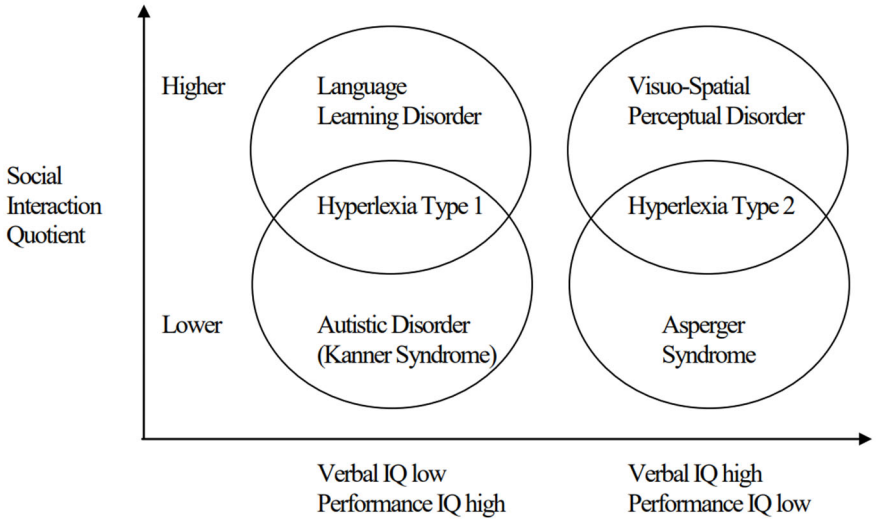

Figure 4. Richman's Model of Hyperlexia Types 1 & 2

Brennan (2021) has elaborated further on the three types of hyperlexia as identified by Treffert (2011):
Type 1: This hyperlexia type occurs when a child without any disabilities learns to read early and far above his/her expected level. Since other children will also learn to read and catch up eventually, this condition does not last long but a temporary phenomenon.
Type 2: This hyperlexia type occurs in a child with ASD. Generally, for such a child, s/he is obsessed with letters and numbers, often preferring to read books and manipulate with magnetic letters over other types of toys. Moreover, the child displays an excellent memory remembering important numbers, e.g., public bus service numbers, car license plates and birth dates. S/He usually displays more classical symptoms of ASD, e.g., poor or fleeting eye contact, stereotyped behaviors and sedentary disposition.
Type 3: The symptoms of this hyperlexia type decrease over time and soon disappear. A child with this hyperlexia type shows remarkable reading comprehension, but is lagging in his/her verbal language development when compared with his/her peers. S/He may also possess an excellent memory. When comparing with children with ASD autism, the child with this hyperlexia type can easily socialize with others besides being outgoing and affectionate. There is no defective theory of mind noted.

The 5-Level Symptomatic Nosology/Nosography of Hyperlexia

The author of this paper proposed to include the five levels in establishing the symptomatic nosology and nosography of hyperlexia based on Xie's (2023) diagnostic format for hyperlexia subtypes. In order to have a full understanding of what is meant by the two terms *nosology* and *nosography*, the author decided to cite from Xie (2023) to define them here. The first term *nosology* comes from the ancient Greek words - νόσος (nosos) which means 'disease', and -λογία (-logia) which means 'study of' - is the branch of medical science that deals with the classification of diseases. In the field of educational therapy, within the educological context, nosology is to classify a psychoeducational condition requires knowing its cause or a set of causes, the effects

it has on the patient/client, the symptoms that are produced, and other issues or factors of concern.

Unlike nosology, the second term *nosography* refers to a description whose primary purpose is to enable a diagnostic label to be put on the targeted condition. As such, a nosographical entity need not have a single cause. For example, an inability to understand what is spoken or read due to hyperlexia and a difficulty someone would have with perspective-taking could be nosologically different but nosographically the same for that condition of hyperlexia.

Regardless of which theoretical concept that provides the best etiological explanation about hyperlexia, the 5-level symptomatic nosology can offer another perspective of the condition based on its different categories of symptoms. Below is a brief description for each of the five levels of symptomatic nosology of hyperlexia with its respective nosographical representation (see Xie, 2023, for detail), which is based on the four symptoms categories (i.e., primary/core, correlated/concomitant, secondary, and artifactual symptoms) proposed by Pennington (1991) to define a disorder, whose subtypes differ in the primary symptoms. The author of this paper has also added the fifth level of idiopathic symptomatic nosology of hyperlexia taken from Xie's (2023) recent diagnostic format.

Level #1 - Primary/Core Symptomatic Nosology of Hyperlexia
At this level, the focus is on the primary or core symptoms, which are "the observable behavioral characteristic that is most directly caused by the underlying neuropsychological deficit" (Pennington, 1991, p. 27). These "are universal, specific, and persistent in the disorder" (Pennington, 1991, p. 27), i.e., hyperlexia, in this case.

The primary/core symptoms of hyperlexia are as follows (see Figure 5):
(1) Superior word decoding and recognition;
(2) Deficit in reading (also listening) comprehension; and
(3) Spontaneous precocious word reading before the age of five years old.

These three key symptoms have become the classical traits of hyperlexia from the time when Silberberg and Silberberg (1967, 1968) first identified the enigmatic condition.

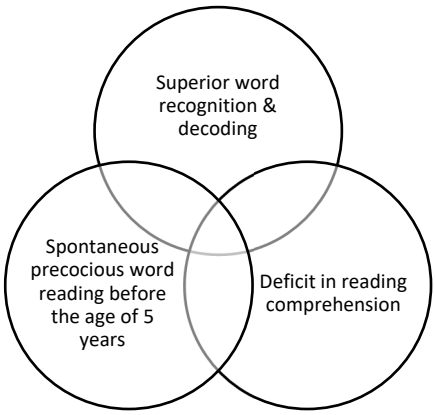

Figure 5. Primary/Core Symptomatic Nosography of Hyperlexia

Level #2 - Correlated/Concomitant Symptomatic Nosology of Hyperlexia

At this second level, the symptoms are considered correlated or concomitant because they "have the same etiology as primary symptoms, but arise from the involvement of different brain or other organ systems" (Pennington, 1991, p. 28).

The correlated/concomitant symptoms of hyperlexia are as follows (see Figure 6):
(1) Visuo-spatial and phonographic systemizing abilities;
(2) Impaired lexical knowledge acquisition; and
(3) Underlying genetic markers (e.g., ARID18, ASH1L, CHC2 and CHD8, just to list a few here).

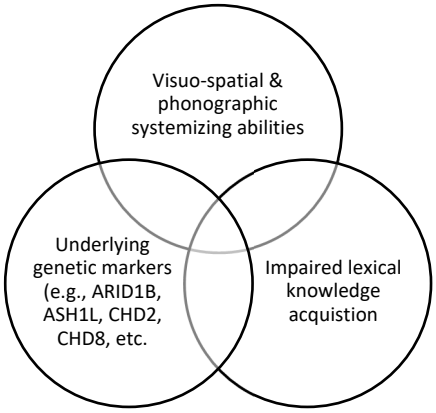

Figure 6. Correlated/Concomitant Symptomatic Nosography of Hyperlexia

Level #3-Secondary Symptomatic Nosology of Hyperlexia
At this third level, the symptoms are considered as secondary, i.e., they "are consequences of either core or concomitant symptoms" (Pennington, 1991, P. 28).

The secondary symptoms of hyperlexia are as follows (see Figure 7):
(1) Sensory craving for print for repetitive reading/decoding without real understanding;
(2) Severe social isolation and withdrawal from others; and
(3) Manifestation of savant abilities related to the hyperlexic condition.

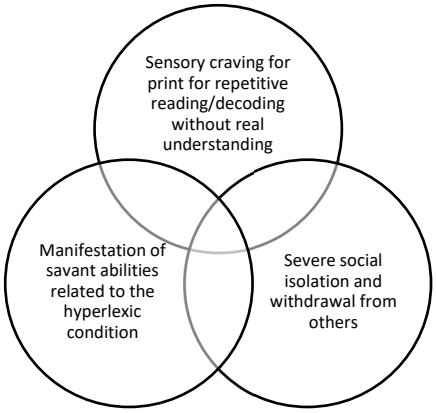

Figure 7. Secondary Symptomatic Nosography of Hyperlexia

Level #4-Artifactual Symptomatic Nosology of Hyperlexia

At the fourth level, Pennington (1991) defined artifactual symptoms as “those that appear to be associated with the disorder, but are not causally related” (p. 29). For example, hyperlexia has been found to coexist with autism spectrum disorder (ASD) (Nation et al., 2006; Newman et al., 2007) and because of the close association with ASD, attention-deficit/hyperactivity disorder (ADHD) (Åsberg, Gillberg, & Kopp, 2019) is also linked to hyperlexia, more so with the subtypes 1 and 2 that are comorbid conditions of ASD (Treffert, 2011).

The artifactual symptoms of hyperlexia subtype 2A are as follows (see Figure 8; also see Xie, 2023, for detail):
(1) Echolalia;
(2) Impaired listening and reading comprehension; and
(3) Superior word recognition.

The artifactual symptoms of hyperlexia below constitute the subtype 2B, which shares two similar features (except echolalia) of hyperlexia subtype 2A (Xie, 2023):
(1) Echolalia;
(2) Spontaneous reading of words before the age of five; and
(3) Superior word recognition.

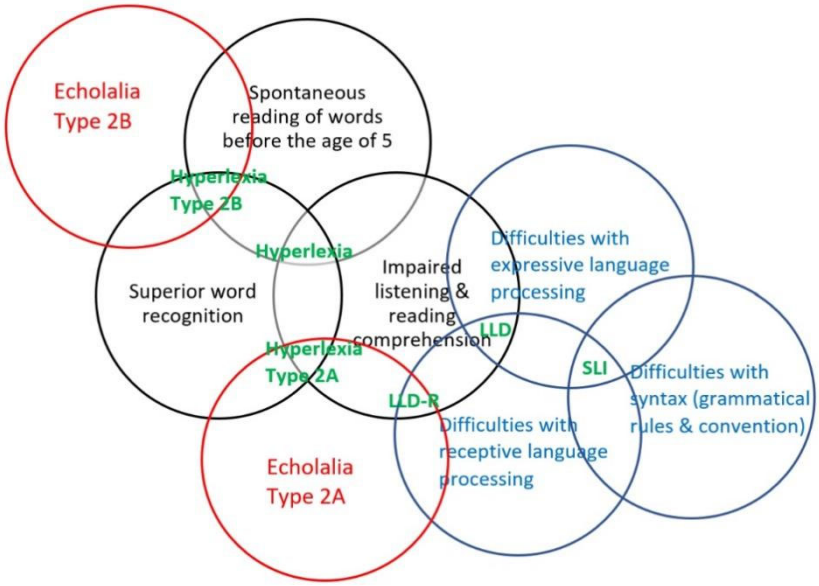

Figure 8. Example of Artifactual Symptomatic Nosography of Hyperlexia Type 2

Likewise, the hyperlexia subtypes 1A and 1B have another symptomatic nosography different from subtypes 2A and 2B but is not shown here.

Level #5-Idiopathic Nosology of Hyperlexia
In addition to the above four symptom categories, the author of this paper has added a fifth category, which Xie (2023) has termed as *idiopathic symptoms*, and, in turn creates a fifth level of idiopathic nosology of hyperlexia. The medical term i*diopathic* has its Greek roots, which mean ‘one’s own’ and ‘disease’, and literally (in its lexical meaning) refers to ’occurring without known or certain cause’. Generally, the term is applied when a connection between a disorder and any particular cause cannot be found or determined. Moreover, the term *idiopathic* (taken from a common dictionary) can also mean ‘arising spontaneously’ or ‘from an obscure or unknown cause’.

At the moment, the author has not managed to find a good example to illustrate this fifth level of symptomatic nosography of hyperlexia.

A summary of the association between the five theoretical concepts and the five-level symptomatic nosology of hyperlexia is provided in Figure 9 below:

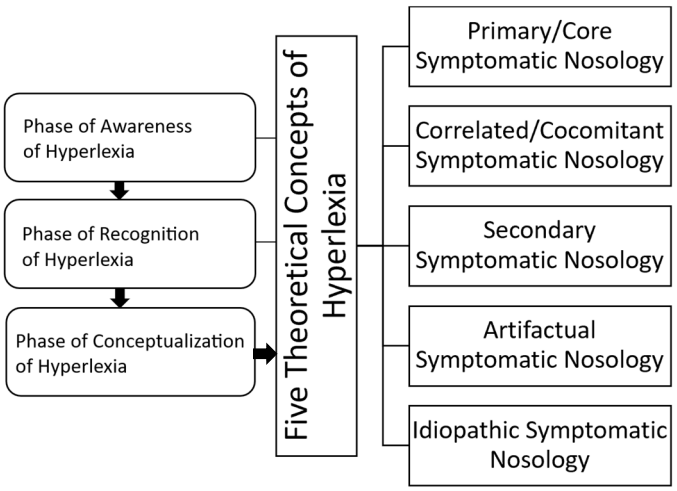

Figure 9. A Diagrammatic Summary

Concluding Remark

The Figure 10 shows a diagrammatic summary of what this author has discussed about hyperlexia in this paper. It can be taken as an updated version of a similar diagrammatic summary presented by Chia, Poh and Ng (2009) fourteen years ago.

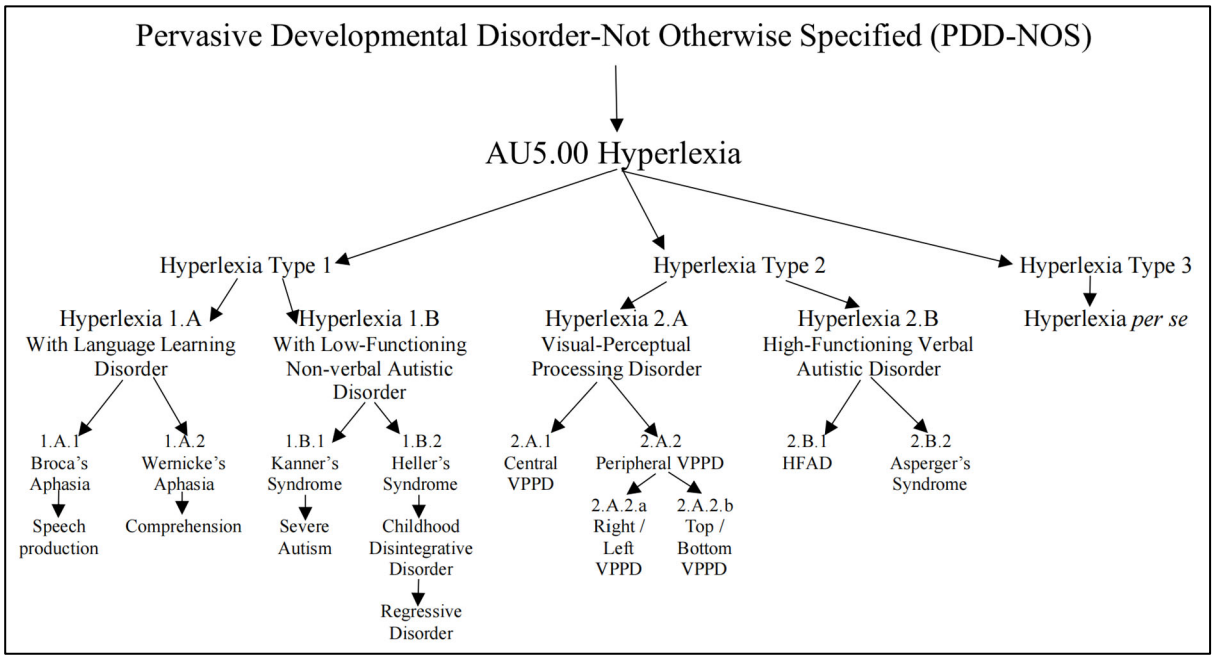

Figure 10. The Revised Classification of Hyperlexia & Its Subtypes (Xie, 2022)

The condition of hyperlexia as an entity is subdivided into its three specific types denoted with respective numerical symbols: 1, 2 and 3. These three hyperlexic types are further categorized under their respective subtypes denoted with respective

alphanumeric symbols in terms of 1.A, 1.B, 2.A, and 2.B. Each of these hyperlexic subtypes are again further sub-categorized into their respective specific subtypes denoted by alphanumeric symbols as follows: 1.A.1, 1.A.2, 1.B.1, 1.B.2, 2.A.1, 2.A.2, 2.B.1 and 2.B.2.

With more recent hyperlexia research being publicized through journals, books, public talks and workshops, webinars and social media platforms, this author hopes that with a better understanding of hyperlexia, a more efficient screening procedure for the condition can be developed so that the earlier it is identified, the earlier a child with hyperlexia can be treated with appropriate intervention strategies, the more positive the prognosis would be. This will certainly benefit all parties who are involved, especially the parents, teachers and, of course, the clients themselves.

Acknowledgement
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Paper 4

Phantasia, Aphantasia and the Spectrum Subtypes of Imagination

Guo-Hui XIE EdD, BCET, BCSE
Principal Therapist
Paediatric Therapy Centre, Singapore

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Abstract
Imagination remains one of the few uncharted complex terrains of the human mind. The original word for imagination comes from the Greek word *phantasia*. When the prefix *a-* (which means 'without') is added to the Greek word, the term *aphantasia* comes into existence. In fact, *aphantasia* was first coined by one of the world's few foremost experts on imagery extremes, Adam Zeman, who is currently a professor of cognitive and behavioral neurology at the University of Exeter, UK. Aphantasia is described as a handicapping condition in which an individual is unable to visualize. The opposite of aphantasia is hyperphantasia (known as image-free thinking), which is the condition of having extremely vivid mental imagery. Between them, there is a spectrum of imagination-related types or subtypes. This short paper is loosely extracted from the author's recently published monograph *The Spectrum of Imagination in Autism* (Lambert Academic Publishing, 2023), which he has coauthored with Ming-Jie Deng, a postgraduate neuroscience candidature at the King's College, London, UK.

Key Words: Aphantasia, Imagination, Mental imagery, Phantasia, Spectrum subtypes

There is still no consensus among those working on the topic of *imagination* or *imagining* which is too broad to allow simple taxonomy or definition. In this short paper, the author's focus is on *imagination* as a cognitive ability and/or *imagining* as a cognitive process.

Before moving ahead to delve on the topic of imagination, there is something more to it that needs to be addressed: i.e., the thoughts and ideas involved in imagination. According to Byrne (2007), "[I]maginative thoughts are guided by the same principles that underlie rational thoughts" (p. xi). Byrne (2007) went on to add that "[R]ationality and imagination have been viewed as complete opposites. At best, logic and creativity have been thought to have little in common. At worst, they have been considered to be each other's nemesis. But they may share more than has been suspected" (p. xi). This is indeed an interesting proposition, and to use Byrne's own words: "Rational thought has turned out to be more imaginative than cognitive scientists previously supposed" (Byrne, 2007, p. xi).

There are three subdomains of imaginative thoughts: (1) factual; (ii) non-factual; and (iii) counterfactual (see Figure 1). The word *factual*, in its dictionary meaning, refers to 'being restricted to or based on fact' (e.g., kangaroos can jump 10 feet high and 30 feet far), while the other word *non-factual* represents the total opposite of *factual*, of course, its dictionary meaning is 'not using or consisting of facts' (e.g., a kangaroo's tail used to be its additional leg, but after millions of years, evolved into a tail to make the hop - a classic and unique kangaroo maneuver - more efficient). The third word *counterfactual*, by its dictionary meaning, is 'relating to or expressing what has not happened or is not the case' (e.g., if a kangaroo had no tail, it would topple over) (see Lewis, 1973, for detail).

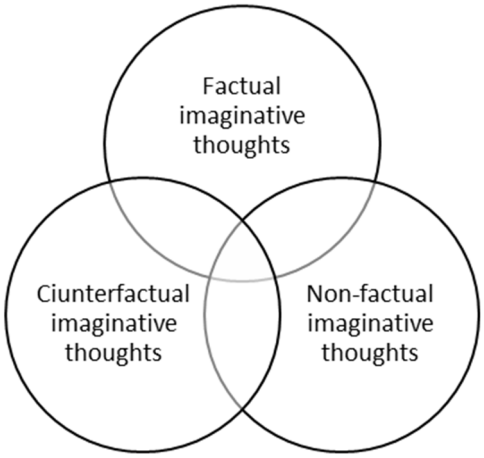

Figure 1. Three Subdomains of Imaginative Thoughts

One important point to take note is about the manifestation of imagination (be it factual, non-factual or counterfactual) and it is found in the emotions that individuals experience, "or that they judge other people to experience" (Byrne, 2007, p. 9). According to Kahneman and Miller (1986) as well as Roese (1997), thoughts about what might have been seem to amplify emotions (e.g., anticipation, guilt, hope, relief and shame) and they could also be counterfactual emotions (Landman, 1993; Niedenthal, Tangney, & Gavanski, 1994). By thinking about counterfactual or even non-factual possibilities, emotions are elicited, but these emotions themselves are real. "The emotions elicited seem to depend on a comparison between how the event actually turned out and how it could have or should have turned out differently" (Byrne, 2007, p. 9). Interestingly, the same can be expected for social attributions of culpability (e.g., blame, fault and responsibility) as in the case of "if you had pulled your brakes on time, the car would not have knocked down the old pedestrian crossing the road" (see Branscombe et al., 1996, and Mandel, 2003, for detail).

Imagination that involves alternatives to reality is often counterfactual: only if …, if only … and even if …, as if …, and as it is … These phrases are counterfactual. It is quite natural for people to "imagine how events might have turned out differently, 'if only …'. Often, such imaginative thoughts about what might been can seem irresistible" (Byrne, 2007, p. 1). According to Byrne (2007), imaginative thoughts or alternative thoughts "emerge at a very young age … exist in most cultures ,,, existence demonstrates that thoughts are not tied to facts" (p. 1). In fact, thoughts go beyond facts to include all other possibilities and probabilities: the former having to do with fantasy (i.e., suspension of disbelief); the latter, phantasy (i.e., immersion of disbelief).

Once an individual has gone too deeply into his/her imagination to the point that s/he could not differentiate between what is real and what is not, the person is described to be in the state of phantasmagoria (Chia, 1996).

The Greek Understanding of Phantasia

The word *imagination* is translated from the Greek word *phantasia*, which retains its connection with the verb form *phainomai* that means 'I appear'. It is applied both to the psychological capacity to receive, interpret, and even produce appearances and also to those appearances themselves.

Plato (b.428/427-348/347 BCE), a Greek philosopher, did not have much to offer or say about *phantasia*, but in *Sophist* 264a he described it as "a blend of perception and judgement (*doxa*)." According to the Encyclopedia.com (2021), in its updated online article on *phantasia*, it mentions that "[E]lsewhere, in *Timaeus* 70eff., in a strange passage that locates parts of the soul in particular parts of the body, he describes the liver as functioning like a mirror that reflects images coming from the rational part of the soul, suggesting a link between imagination, dreams, and inspired prophecy" (para. 2).

Aristotle (b.384 BC-d.322 BC), another Greek philosopher, gave *phantasia* a specific place between perception and thought. In *De anima* 3.3 he offers an account of *phantasia* that includes mental images, dreams, and hallucinations. For Aristotle, *phantasia* is based on sense-perception and plays a crucial role in animal movement and desire, as he explains in *De anima* 3.9 and in the *De motu animalium* (see Encyclopedia.com, 2021, para. 3).

It was not until 2015, when Zeman, Dewar and Della Sala (2015) coined the term *aphantasia* to describe the absence of visual imagery. The essential role of visual imagery in memory, day-dreaming and creativity typically enables an individual to see absent items in the mind's eye[3]. Zeman et al. (2015) also coined the other condition known as *hyperphantasia* (a total opposite of aphantasia) to describe the abundance of visual imagery. More recently, Zeman et al. (2020) reported in their study the psychological significance of lifelong visual imagery vividness extremes of phantasia: "Participants with aphantasia report an elevated rate of difficulty with face recognition and autobiographical memory, whereas participants with hyperphantasia report an elevated rate of synaesthesia. Around half those with aphantasia describe an absence of wakeful imagery in all sense modalities, while a majority dream visually. Aphantasia appears to run within families more often than would be expected by chance. Aphantasia and hyperphantasia appear to be widespread but neglected features of human experience with informative psychological associations" (p. 426).

With the introduction of the Cattell-Horn-Carroll theory[4] (abbreviated to CHC) of cognitive abilities based on the contributing efforts of three psychologists - Raymond Cattell (b.1905-d.1998), John Horn (b.1928-d.2006) and John Carroll (b.1916-d.2003) - in the 1990s, and also the later expansion of the CHC model by McGrew (2011) and Schneider and McGrew (2012), imagination or imagination quotient (ImQ) can be

[3] *Mind's eye* refers to that mental faculty that can conceive imaginary or recollected scenes; the mental picture so conceived.
[4] The Cattell–Horn–Carroll theory is an integration of two previously established theoretical models of intelligence: the theory of fluid and crystallized intelligence (Gf-Gc) (Cattell, 1941; Horn 1965), and Carroll's three-stratum theory (1993), a hierarchical, three-stratum model of intelligence.

treated as a probable broad cognitive ability within the CHC theory. The imaginative ideas, which are generated from within the mind and often unconsciously influenced by memories and feelings, can go hand-in-hand with creativity. In other words, this author proposed that imaginative ideas could come under the CHC broad cognitive ability of Gr (Retrieved Fluency), which, in turn, can be further subcategorized into several narrow cognitive abilities placed under the following two subheadings (see Figure 2): (1) *Ideas* that include three narrow cognitive abilities, i.e., (i) Ideational Fluency (Gr-FI), (ii) Associational Fluency (Gr-FA), and (iii) Expressional Fluency (Gr-FE); and (2) *Creativity* that include two narrow cognitive abilities, i.e., (i) Solution Fluency (Gr-FS) and (ii) Originality/Creativity (Gr-FO) (see Schneider & McGrew, 2018, for detail).

Briefly, extracted from the CHC list provided by Schneider and McGrew (2017), Retrieval fluency (Gr) refers to "the rate and fluency at which a person can access information stored in his/her long-term memory" (p. 3). At the time of pre-publication, Schneider and McGrew (2017) listed the following narrow cognitive abilities: Gr-FI is "the ability to rapidly produce a series of ideas, words, or phrases related to a specific condition or object" (p. 3); Gr-FE is "the ability to rapidly think of different ways of expressing an idea" (p. 3); and Gr-FA is "the ability to rapidly produce a series of original or useful ideas related to a particular concept" (p. 3). Gr-FS was not yet included in the CHC table then. Gr-FO is "the ability to rapidly produce original, clever, and insightful responses (expressions, interpretations) to a given topic, situation, or task" (Schneider & McGrew, 2017, p. 3). It is not within the scope of this paper to delve further into this specific topic of discussion.

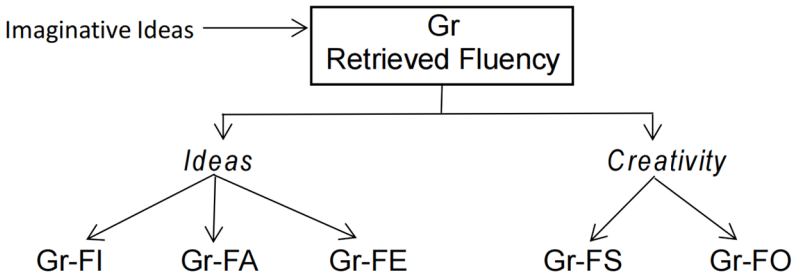

Figure 2. Imaginative Ideas under Gr Retrieval Fluency

Phantasia: The Spectrum of Imagination

For simplicity of discussion in this paper, the author has chosen to consider *phantasia* as typical or normal imagination that can be best understood as a spectrum or continuum (used interchangeably to mean the same thing in this paper) of imagination ranging from *phantasia* through *hypophantasia* to *aphantasia* on one end of the spectrum, and from *phantasia* to *hyperphantasia* or *metphantasia*, which is "*phainomai* about *phantasia*", on the other opposite end of the spectrum. There are also two other offshoots above or below the continuum from *phantasia* to *allo-phantasia*, and *para-phantasia*, which can lead to some kind of a phantasmagoric encounter with a phantasm, which can be a doppelgänger or an illusion, apparition, or ghost. The term *para-* as used in *para-phantasia* is the same as it is used in *para-normal* describing a supernatural phenomenon, suggesting some kind of a figment of imagination (e.g., ghost or demon) that mediums and psychics believe are real coming from the spiritual dimension (Nickell, 2012; Rhode, 1984; Smajic, 2003). The Figure 3 below illustrates the spectrum of imagination types or subtypes (these two terms *types* and *subtypes*

are used interchangeably throughout this paper) in what the author has described as within the context of the *mindspace*[5] (see Ng, Gou, & Xie, 2023, for detail).

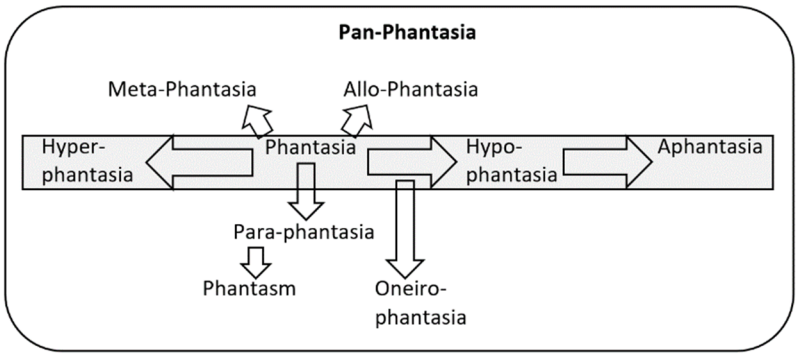

Figure 3. The Spectrum of Imagination Types

According to Xie and Deng (2023), the first one on the spectrum of imagination types or subtypes is *aphantasia*, which comes from two Greek words, *a-* which means without, and *phantasia* which means imagination. The term means that 'without any imagination' and cannot form mental images. According to Larner (2016), it refers to "the inability to visualize mental images" (p. 29) or "not being able to picture something in one's mind" (p. 30). Cherry (2020) called it "a phenomenon in which someone is unable to visualize imagery" (para. 1). A person with *aphantasia* finds it impossible to conjure an image of a scene or face in his/her mind. It seems to be quite impossible not see anything that comes so naturally to us, but those individuals with *aphantasia* describe what they see as nothing or totally black. Some of them even use the word "blank" or "void." In other words, "[B]asically, when people without it picture what they ate, they can see it, but people with *aphantasia* cannot" (Paige, 2020, para. 3).

In fact, *aphantasia* was first described by Sir Francis Galton (b.1822-d.1911), an English polymath in the Victorian era, in 1880. With the publication of a study on congenital *aphantasia* conducted by Zeman, Dewar, and Della Sala (2015) in the journal of *Cortex*, interest in the phenomenon has been rekindled. As a result, it has led several more research studies (e.g., Blazhenkova & Pechenkova, 2019; Dawes et al., 2020; Jacobs, Schwarzkopf, & Silvanto, 2018) have been conducted and published. A study done by Keogh and Pearson (2018) using binocular rivalry technique found that it is not because those with *aphantasia* have poor recall of their imaginings. Instead, they do not even possess such visual imaginings to start with. However, research on the condition remains scare and *aphantasia* is still not recognized with other learning disabilities.

Next is *hypophantasia*, which is the condition of impaired imagination of individuals with low or poor mental imagery. It can also be termed as partial *aphantasia* or borderline *aphantasia*, but certainly not a full *aphantasia*. Again, very little literature has been written or published about it.

[5] *Mindspace* is defined by Ng, Gao, and Xie (2023) "as a psychological space (or mental space) where the idea that a person's perception of the world affects his/her internal thoughts and beliefs, and how s/he rationalizes and organizes his/her thoughts and beliefs that can, in turn, affect his/her feelings and/or mood or in the other way round, emotions can impact on the person's thoughts and beliefs" (p. 33).

On the opposite end of the spectrum of imagination types or subtypes is *hyperphantasia*, which is described as "a condition where an individual can see extremely detailed and clear images in the mind with little effort" (Paige, 2020, para. 9). These images can be manipulated by the individual as if he/she is actually there. For example, a person with *hyperphantasia* is flown in a helicopter over New York City to get an aerial view of the city's skyline. Back on ground in an art studio or any open space, he starts to draw or sketch the details of the cityscape from memory. This was what a British artist, Stephen Wiltshire, did when he was invited to Singapore to do just that. He drew the beautiful cityscape on the 4-meters by 1-meter blank canvas mounted on a wooden structure at Paragon's main atrium in full view of the public. Stephen Wiltshire, "[D]iagnosed with autism (autistic savant) when he was three years old, … is acclaimed for his astounding ability to draw detailed cityscapes from memory after viewing them once" (Lim, 2014, para. 8). The completed artwork was eventually presented as a gift to Singapore for the nation's 50th year of independence in 2015. Interestingly, a question was asked during that time if autistic savant artists like Stephen Wiltshire also has *hyperphantasia*? Or could it possibly be his systemizing ability and superior eidetic memory that has enabled him to perform such a feat? There is no direct answer to it, but, hopefully, future research might be able to explain what actually goes in the mind of such an autistic savant artist.

The Offshoots of Phantasia

Other than the different imagination types or subtypes that are on the spectrum, Xie and Deng (2023) have also identified several offshoots from *phantasia*: They are *meta-phantasia*, *allo-phantasia*, *para-phantasia* and *oneiro-phantasia*. Each of them is briefly described below:

(i) *Meta-phantasia*: The prefix *meta-* is a loanword from Greek meaning "after" or "beyond." *Meta-phantasia* indicates imagining after or beyond imagination, or "*phainomai* about *phantasia*." One good example can be found in the eighth chapter of the book of Daniel in the Old Testament of the Holy Bible. It narrates Prophet Daniel's vision of a two-horned ram destroyed by a one-horned goat, followed by the history of the little horn, which is Daniel's code-word for the Antiochus IV Epiphanes, a Greek Hellenistic king who ruled the Seleucid Empire from 175 BC until his death in 164 BC.

(ii) *Allo-phantasia*: The prefix *allo-* means other or different. *Allo-phantasia* refers to other forms of imagination not found on the spectrum of imagination types (Xie & Deng, 2023). An example of *allo-phantasia* is autistic imagination (see Xie & Deng, 2023, for detail) which can be divided into sympathetic imagination and perceptual imagination that can happen propositionally or objectually (Nagel, 1974).

(iii) *Para-phantasia*: The prefix *para-* means close, beside or beyond. *Para-phantasia* refers to a subconscious form of imagination that is also known as a Third Man Factor (also known as the Third Man Syndrome), which has been reported in situations where an unseen presence (e.g., a spirit) provides comfort or support during traumatic experiences (Geiger, 2009).

(iv) *Oneiro-phantasia*: This refers to an unconscious form of imagination consisting of images, ideas, emotions and sensations all jumbled up to form *interobjects*[6] (Blechner, 2001) during certain stages of sleep. Hunter (2013) called it *dreams* and listed it as one of the eight types of imagination.

Conclusion

Imagination is a powerful psychological tool which many, if not all, people can deliberately use mental imagery to visualize desired outcomes (e.g., like winning a contest or solving a problem) or mentalize in order to understand the mental state of oneself or others that underlies overt behaviour (e.g., beliefs, desires, feelings, goals, needs, purposes, and reasons) (see Fonagy et al., 2002, for detail). In addition, imagination can be harnessed by counselors and therapists to access and process prior experiences, manage complex emotions, or relax the mind and body through meditation. While still not fully understood, there is a strong association between the mind (*noos*) and the body (*soma*) known as *noosoma* (see Xie, 2023, for detail) that can be tapped on to raise the awareness of mindfulness and bodyfulness, respectively. Professionals trained in cognitive health or wellness may employ imagination in the form of facilitated therapeutic imagery to help their clients address a number of challenging issues related to social emotional concerns (e.g., anxiety, depression, grief, shame and stress), social relationship problems (including boy-girl relations, family dynamics and parenting concerns), trauma and substance abuse.

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[6] The term *interobject* (first coined by Dr Mark J. Blechner in 2001 in his book *The Dream Frontier*) refers to a dream phenomenon of an object intermediate or in-between two other known objects.

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