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REVIEW ARTICLE

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

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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.

Keywords: *Autism Spectrum Disorder, Developmental Phase, Hyperlexia, Symptomatic Nosology, Theoretical Concept*

1. INTRODUCTION

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).

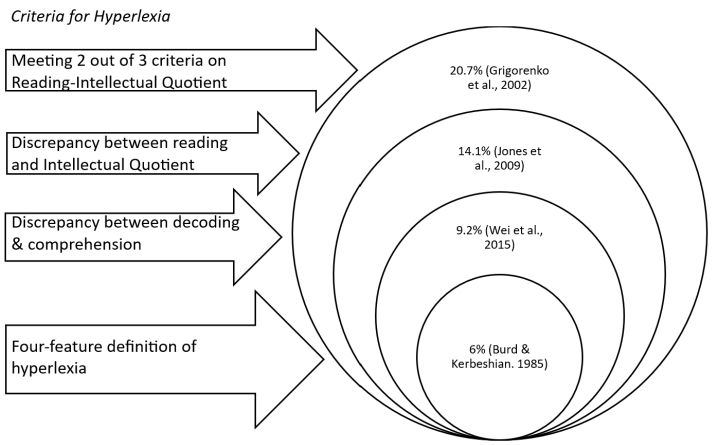

Figure 1. Criteria for identifying Hyperlexia and Its Varied Prevalence (%)

2. 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).

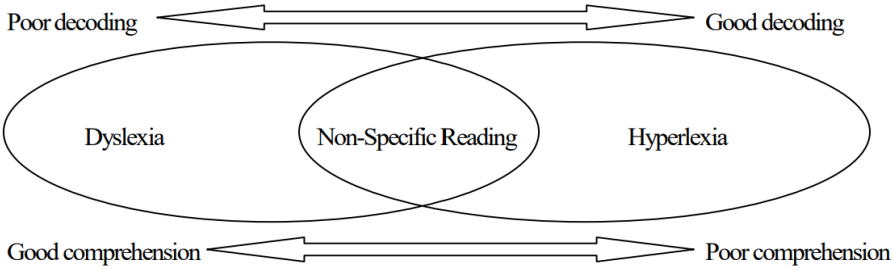

Figure 2: Model of Bipolarity of Reading Disabilities

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), whatever 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).

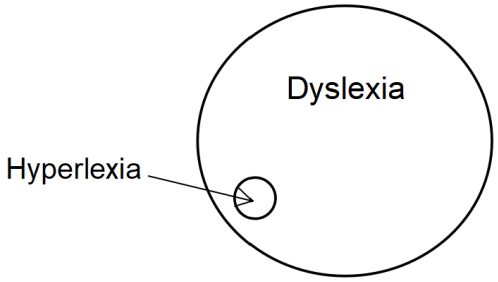

Figure 3: Model of Hyperlexia as a subtype of Dyslexia

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.

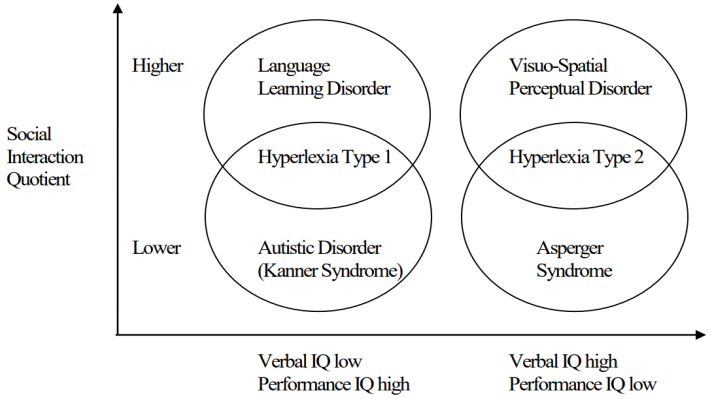

Figure 4. Richman's Model of Hyperlexia Types 1 & 2

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.

3. 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.

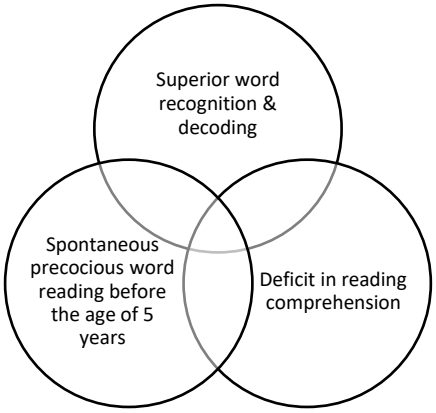

Figure 5. Primary/Core Symptomatic Nosography of Hyperlexia

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).

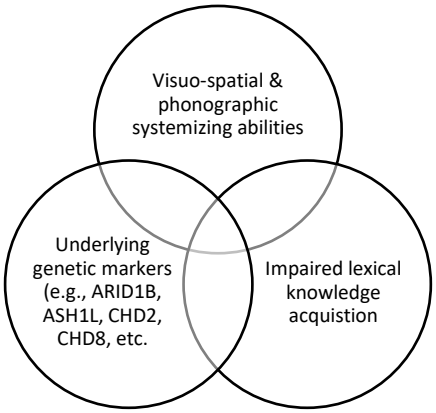

Figure 6. Correlated/Concomitant Symptomatic Nosography of Hyperlexia

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.

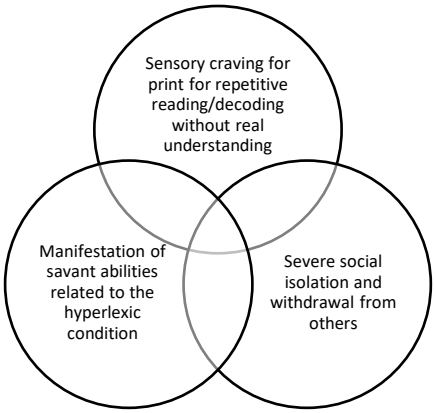

Figure 7. Secondary Symptomatic Nosography of Hyperlexia

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.

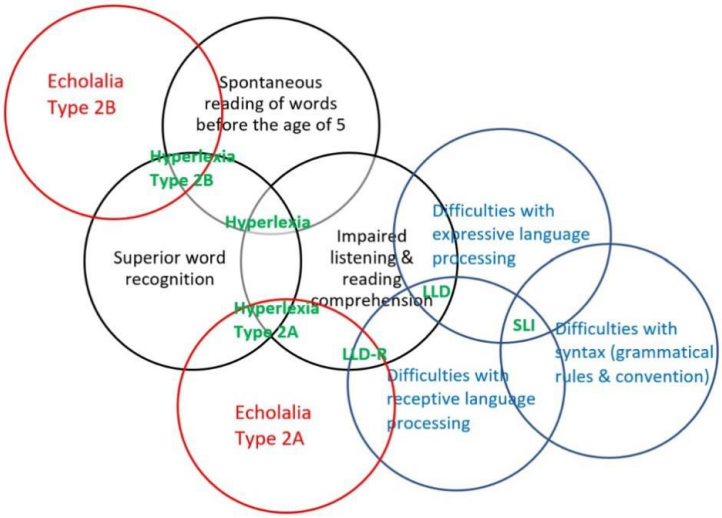

Figure 8. Example of Artifactual Symptomatic Nosography of Hyperlexia Type 2

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:

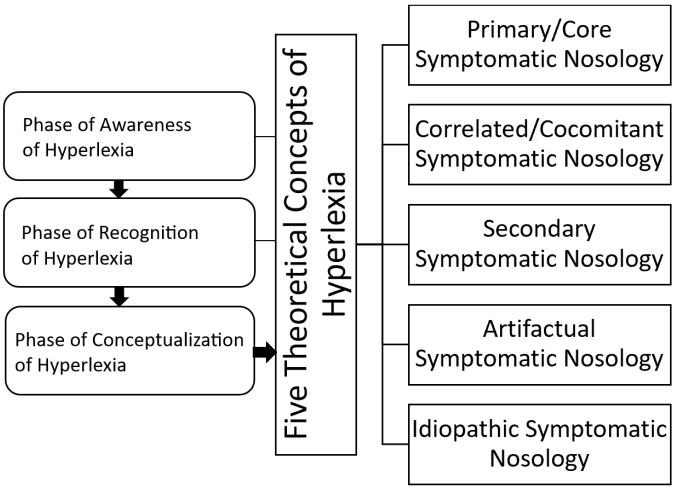

Figure 9. A Diagrammatic Summary

4. 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.

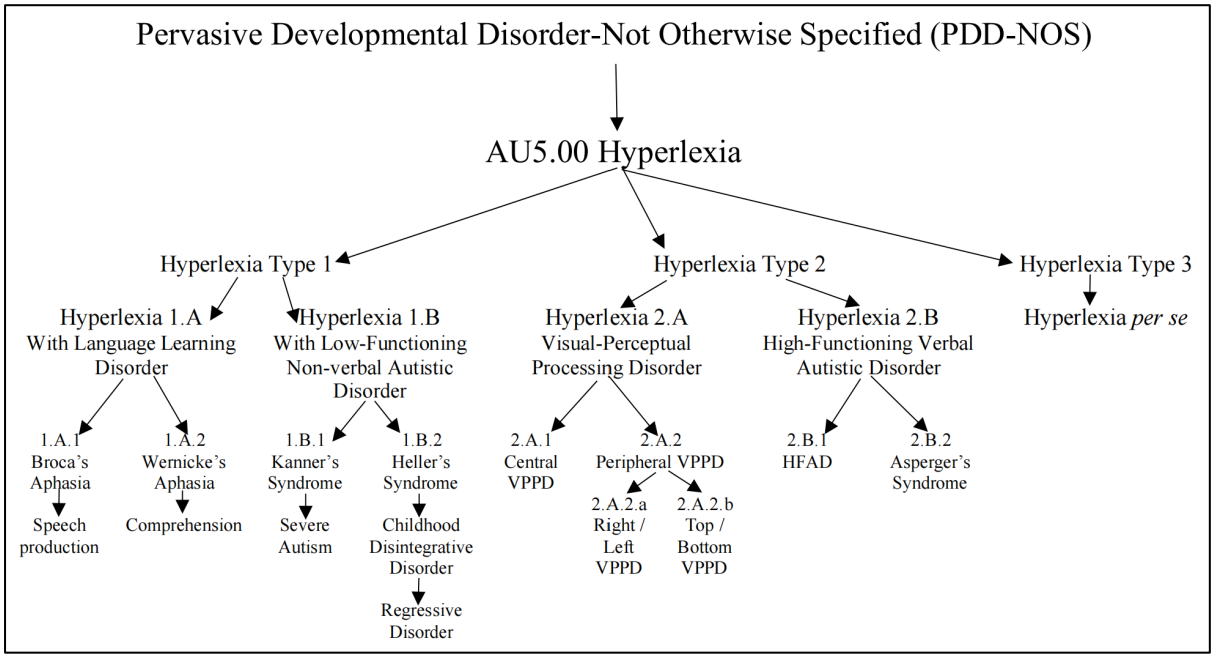

Figure 10. The Revised Classification of Hyperlexia & Its Subtypes (Xie, 2022)

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.

5. ACKNOWLEDGEMENT

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6. COMPETING INTERESTS

Authors have declared that no competing interests exist

7. ARTIFICIAL INTELLIGENCE DISCLOSURE

No generative AI or AI-assisted technologies were used in the preparation of this manuscript.

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