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Juxtaposing social anxiety and introversion in children with ASD: A systematic review of the literature

 Retsene Karabo Mogoboya

University of South Africa.

(Email: mogobrk@unisa.ac.za)

Abstract

The DSM-5 classification of ASD symptoms overlaps with behaviours consistent with social anxiety and introversion. The indicated overlap has had various implications for the diagnosis of Social Anxiety. Children with ASD regularly experience social anxiety within various interactive scenarios. Subsequently, Introversion is an orientation towards one's inner experience. It involves considering all aspects related to oneself and a tendency toward introspective cognitive activity following socialisation. This study aims to juxtapose social anxiety and introversion by employing emergence, diagnostic differentiation, environmental effects, and psychosocial factors, despite the severity level of the condition. This review of literature utilised twenty-five identified articles from 2014 to 2024, with six on introversion, another six on social anxiety, six on environmental effects, two on treatments, and four on the psychosocial elements of both. The findings indicate that the current factorial structure of introversion shows how autistic traits interact to form the personality dimension. At the same time, social anxiety is a set of cognitive, behavioural, and physiological symptoms experienced by autistic children when interacting with other people. These symptoms are associated with their challenges in social communication and interaction. This literature survey will assist practitioners and researchers in understanding and analysing overlapping issues while offering solutions to mitigate problems. It is recommended in this study that social disengagement in ASD should not always be pathologized as there are actually caused by different internal processes and calls for different strategies. Making a precise distinction between the two promotes better respect for individual heterogeneity within the autism spectrum, increases the appropriateness of therapies, and improves diagnostic clarity.

Keywords: Autism spectrum disorder, Introversion, Social anxiety.

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1. Introduction

Autism Spectrum Disorder (ASD) is a complex neurodevelopmental condition characterised by challenges in social communication, restricted interests, and repetitive behaviours [1]. According to the American Psychiatric Association [2] the symptoms of ASD typically emerge in early childhood and can significantly affect an individual's daily functioning and quality of life. The spectrum nature of the disorder means that it presented with varying degrees of severity and a wide range of symptoms, from mild to severe, impacting social interaction, communication skills, and behaviour patterns [3]. Children with ASD often experience difficulties in understanding social cues, forming relationships, and engaging in typical peer interactions, which can contribute to additional issues such as social anxiety and introversion [3, 4].

Understanding social anxiety and introversion in children with Autism Spectrum Disorder (ASD) is crucial for several reasons [5]. First, children with ASD often face unique challenges in social situations, which can lead to heightened feelings of anxiety and withdrawal [6, 7]. Recognizing the nuances between social anxiety and introversion can help educators, parents, and clinicians tailor interventions that support each child's specific needs [8]. Furthermore, addressing these issues is vital for fostering social skills and emotional well-being, as children who are both anxious and introverted may miss out on meaningful social interactions and relationships [8, 9]. By exploring the interplay between these two constructs, we can gain insights into how to create supportive environments that enhance the social experiences of children with ASD, ultimately promoting their overall development and quality of life [10, 11].

The primary objective of this article is to explore the complex relationship between social anxiety and introversion in children with Autism Spectrum Disorder (ASD). Specifically, the article aims to delineate the distinct characteristics of social anxiety and introversion, highlighting how these two constructs can coexist and influence one another within this population. Additionally, the article seeks to examine the implications of these dynamics for social functioning and emotional well-being, providing insights into effective interventions and support strategies. By juxtaposing social anxiety and introversion, this article aspires to enhance understanding and inform practices that promote positive social interactions and developmental outcomes for children with ASD.

2. Methodology

The "traditional" method of examining the body of existing literature is the narrative review, which leans towards a qualitative interpretation of existing knowledge [12]. In other words, a narrative review does not look for generality or cumulative knowledge from the examined material; rather, it aims to summarise or synthesise the existing literature on a certain topic [12-14]. In order to find texts that highlight social anxiety and introversion in children with ASD, the literature was examined using computerised databases. Five electronic databases (PubMed, Scopus, Web of Science, Google Scholar, and DOAJ) were searched using a set of subject-related keywords (Introversion Traits in ASD, social anxiety disorder in ASD, and diagnosis processes) in order to extract potentially relevant articles and texts. The databases were chosen because they reflect the most widely used multisystemic journal indexing and biological and health-related research.

Google Scholar, Web of Science, PubMed, and Scopus, these databases offer access to disciplinary peer-reviewed research, which serves as the basis for a literature review. Researchers can access top-notch peer-reviewed journals through the Directory of Open Access Journals (DOAJ). More than two million articles from 17,193 publications have been stored, and you can search by keyword or browse by theme [15, 16]. Google Scholar provides a simple way to broadly search for scholarly literature. From one place, you can search across many disciplines and sources: articles, theses, books, abstracts and court opinions, from academic publishers, professional societies, online repositories, universities and other websites. Google Scholar helps to find relevant work across the world of scholarly research [17].

A preliminary evaluation of the titles found during the searches and an examination of the abstracts of the articles were part of the article selection process. An article is required to use one or more of the chosen keywords and phrases in order to be included [18]. Each citation's title and abstract were screened by the author, who removed any that did not fit the search parameters and method. Additionally, unrelated papers were not included. Before making a final choice, the author separately assessed the potentially relevant articles to ascertain their eligibility and settled any disagreements. For review, twenty-five studies were chosen. The author double-coded articles and fixed any discrepancies to create uniformity in the review and coding process. In order to represent the most often noted symptoms and diagnoses in children with ASD across all papers, the author created a classification system employing methods like to those employed in theme analysis. This classification procedure revealed the conditions' overlaps and misunderstandings. The purpose of contrasting the two ideas is to address potential ramifications and post-diagnosis therapeutic options.

Using standardised data from research studies and analysing publication bias, the author attempted to expose the overlaps and misconceptions of both situations in order to increase the study's credibility and dependability [19, 20]. Furthermore, to demonstrate reliability and credibility, the concepts were thoroughly discussed, and a comprehensive literature search was carried out in an effort to uncover, recover, and incorporate difficult-to-find study results or unpublished literature. In addition to electronic bibliographic databases, a comprehensive literature search would also involve a review of conference proceedings and reference lists of previous reviews and articles on the main topic, a cover-to-cover search of important journals, communication with other researchers and institutions, and searches of trial registers, online library catalogues, and the Internet. With everything taken into account, it can be said that publication bias poses a risk to all research fields, including narrative reviews, primary quantitative studies, qualitative research, systematic reviews, and meta-analyses [20, 21].

3. Conceptual Classifications

Examining social behaviour in children with autism spectrum disorder (ASD) requires an understanding of the difference between introversion and social anxiety. Both categories have essentially different psychological ramifications and underlying reasons, despite the fact that they may manifest as social disengagement or limited peer interaction [22, 23]. Inaccurate diagnoses, incorrect actions, and unmet support requirements might result from mistaking one for the other [24]. There are important ramifications for both research and practice from this conceptual uncertainty. These concepts are frequently confused in the research currently in publication, which makes it difficult to comprehend how social functioning occurs in ASD populations [25]. To shed light on how these ideas are defined, operationalised, and interpreted in relation to autism, a thorough literature review is therefore required. This review looks at how researchers have distinguished or not between social anxiety and introversion in children with ASD and what that means for future research, educational support, and clinical evaluation [26, 27].

3.1. Understanding Autism Spectrum Disorder

Autism Spectrum Disorder (ASD) encompasses a range of developmental conditions characterised by specific deficits in social communication and the presence of restricted or repetitive behaviours [2]. Social Communication Challenges in children with ASD often include struggles with various aspects of social communication, which can manifest in difficulties with verbal and nonverbal interactions [28]. This includes challenges in understanding and using gestures, facial expressions, and tone of voice, leading to misinterpretations in social contexts [29]. Additionally, these children may have trouble initiating and maintaining conversations, recognising social cues, and developing peer relationships. As a result, they may experience social isolation or difficulties in forming friendships, which can exacerbate feelings of anxiety in social situations [30].

Restricted and Repetitive Behaviours is another hallmark of ASD is the presence of restricted interests and repetitive behaviours [31]. This can include repetitive movements (such as hand-flapping or rocking), insistence on sameness, and intense focus on specific topics or objects [31, 32]. These behaviours may provide comfort and predictability for the child, but they can also hinder social interactions and participation in typical activities. Moreover, the rigidity associated with these behaviours can contribute to anxiety, especially when faced with changes in routine or unfamiliar environments [33].

Understanding these characteristics is essential for recognizing the unique experiences of children with ASD, particularly as they navigate social landscapes that may evoke anxiety or reinforce introverted tendencies.

3.1.1. Prevalence Rates and the Impact on Social Functioning

The prevalence of Autism Spectrum Disorder (ASD) has been increasing, with recent estimates suggesting that approximately 1 in 36 children are diagnosed with the condition in the United States [34]. This rise in prevalence underscores the importance of understanding the diverse experiences of children with ASD, particularly in relation to social functioning [34]. Children with ASD often face significant challenges in social interactions, which can hinder their ability to connect with peers and participate in everyday activities [30]. Research indicates that social communication deficits and restricted behaviours commonly associated with ASD contribute to difficulties in forming friendships and navigating social contexts [35]. According to Kuzminskaite, et al. [35] these challenges can lead to feelings of isolation and increased vulnerability to social anxiety, as children may become anxious about potential negative evaluations or misunderstandings in social situations.

Furthermore, the interplay between social anxiety and introversion in children with ASD can further complicate their social experiences [6]. While some children may withdraw from social interactions due to anxiety, others may be more inclined toward solitude due to their introverted nature [6, 36]. Understanding these dynamics is critical for developing effective interventions that promote social engagement and emotional well-being among children with ASD [5].

3.2. Social Anxiety in Children with ASD

Social Anxiety Disorder (SAD), also known as social phobia, is characterized by an intense fear of social situations where individuals may be exposed to scrutiny or judgment from others [37]. According to Avramchuk, et al. [38] this disorder involves excessive anxiety about being embarrassed, humiliated, or rejected in social interactions, leading to significant distress and avoidance behaviours. Children with SAD may exhibit symptoms such as excessive worry about upcoming social events, physical manifestations of anxiety (like sweating or trembling), and a tendency to avoid situations that provoke anxiety, such as school activities or peer gatherings [37].

Social anxiety can be especially noticeable in children with autism spectrum disorder (ASD). The challenges associated with social communication and understanding social cues inherent in ASD can exacerbate feelings of anxiety, making social interactions even more daunting [7]. As a result, children with ASD who experience social anxiety may find themselves increasingly withdrawn, further complicating their social development and well-being [39].

The symptoms specific to children with ASD include excessive worry about social situations and fear of negative evaluation [7]. Children with Autism Spectrum Disorder (ASD) often exhibit unique symptoms of Social Anxiety Disorder (SAD) that may differ from those seen in neurotypical peers [40]. One prominent symptom is excessive worry about social situations, which can manifest as intense apprehension regarding interactions with peers, performance in group settings, or participation in social activities. This worry can be particularly pronounced in children with ASD, as they may already struggle with understanding social cues and expectations, leading to heightened anxiety about potential misunderstandings or negative evaluations [22]. Additionally, fear of negative evaluation is a significant concern for these children. They may be overly sensitive to perceived criticism or judgment, which can deter them from engaging in social situations altogether.

This fear can result in behaviours such as avoidance of eye contact, reluctance to speak in group settings, or outright refusal to participate in social events [41]. The interplay of these symptoms can create a cycle where anxiety leads to social withdrawal, further isolating the child and hindering their social development [27].

Research indicates that this combination of excessive worry and fear of negative evaluation can significantly impact the overall well-being and quality of life for children with ASD, making it essential to address these issues through targeted interventions and support strategies. Studies indicate higher rates of social anxiety in children with ASD compared to neurotypical peers [22, 42]. Research consistently demonstrates that children with Autism Spectrum Disorder (ASD) experience higher rates of social anxiety compared to their neurotypical peers. For instance, a study by Briot, et al. [42] found that approximately 37% of children with ASD also met criteria for social anxiety disorder, significantly higher than the prevalence in the general population. This elevated rate highlights the compounded challenges that children with ASD face in social settings, where their inherent difficulties in social communication can exacerbate feelings of anxiety. Eussen, et al. [22] also identified that children with ASD exhibited greater levels of social anxiety symptoms than those without the disorder. Their findings suggest that the interplay of social communication deficits and heightened social sensitivity in children with ASD contributes to an increased likelihood of experiencing anxiety in social situations. Furthermore, research by Lievore, et al. [43] indicated that social anxiety can significantly interfere with social functioning and peer relationships among children with ASD, leading to increased isolation and withdrawal.

These studies underscore the critical need for targeted interventions that address both the social communication challenges and the anxiety experienced by children with ASD. By understanding the higher prevalence of social anxiety within this population, practitioners and caregivers can better support their emotional and social development.

3.3. Introversion in Children with ASD

Introversion is a personality trait characterised by a preference for solitary activities and a greater comfort level in low-stimulation environments [44]. Introverts typically recharge their energy through solitary pursuits rather than social interactions [45]. He describes introversion as a disposition toward introspection and a focus on internal thoughts and feelings, which can lead to a rich inner life. Moreover, recent studies have explored the intersection of introversion and Autism Spectrum Disorder (ASD), suggesting that many children with ASD may exhibit introverted traits alongside their social communication challenges [46].

A preference for Solitary Activities is one characteristic of introversion. They often engage in activities that allow for self-reflection and creativity, such as reading, writing, or engaging in hobbies that do not require social interaction [23]. These activities provide fulfilment and a sense of tranquillity, enabling introverts to thrive in their own company [45]. While introverts can enjoy socializing, they typically prefer smaller, more intimate gatherings over large crowds. They may feel drained by prolonged social interaction and require time alone to recharge. This can manifest as a preference for one-on-one conversations or small group settings where deeper connections can be formed [23, 47].

Understanding introversion is particularly relevant when considering children with Autism Spectrum Disorder (ASD), as many may exhibit introverted traits alongside their social communication challenges. Recognizing the distinction between introversion and social anxiety is vital for ensuring that the unique needs of introverted children with ASD are acknowledged and supported in social contexts [23, 47].

4. Overlap and Distinction between Social Anxiety and Introversion in ASD

Children with autism spectrum disorder (ASD) frequently display behaviours that may be similar to introversion and social anxiety, such as diminished verbal communication, social disengagement, and limited peer contact. In both clinical and educational settings, this seeming similarity has caused serious conceptual and diagnostic misunderstandings [42, 48]. The psychological processes behind social anxiety and introversion differ significantly, despite the fact that their apparent behaviours may overlap. Proper interpretation, diagnosis, and intervention depend on being able to differentiate between the two [27, 49].

4.1. Co-Occurrence of Social Anxiety and Introversion in Children with ASD

Children with Autism Spectrum Disorder (ASD) often display a complex interplay of traits associated with both social anxiety and introversion. This co-occurrence can significantly affect their social experiences and overall well-being [5, 23]. The exhibition of Social Anxiety Traits is common in children with ASD, with many experiencing heightened anxiety in social situations due to their challenges in social communication and understanding social cues. This anxiety can manifest as excessive worry about potential negative evaluation, leading to avoidance of social interactions [5, 46]. For instance, a child with ASD may be apprehensive about participating in a group activity at school, fearing they might be misunderstood or criticised by peers. Such anxiety can exacerbate feelings of isolation, as the child may withdraw from opportunities to engage socially [5]. While exhibiting Introverted Traits is simultaneously visible in children with ASD, who may also display introverted tendencies [50]. They may prefer solitary activities, such as reading or engaging in focused hobbies, over socialising in larger groups. These preferences do not stem from a lack of interest in social interactions, but rather from a desire for environments that feel more manageable and less overwhelming [46]. Introverted children with ASD might enjoy socialising but choose to do so in smaller, more intimate settings where they feel comfortable and can connect more deeply [46, 50].

4.2. Interplay between Anxiety and Introversion

The interplay between social anxiety and introversion can create a cycle that further complicates social interactions [51]. For instance, a child who is both anxious and introverted may avoid social situations altogether, leading to missed opportunities for socialization and the development of social skills. Conversely, if they are pushed into larger social settings, their anxiety may spike, reinforcing their preference for solitude. Recognizing that children with ASD can experience both social anxiety and introversion is crucial for developing effective interventions. Tailored support can help these children navigate their social environments, respecting their introverted nature while addressing the underlying anxiety that may hinder their social engagement [52, 53].

Research suggests that some children with Autism Spectrum Disorder (ASD) may develop social anxiety as a consequence of their introverted tendencies [6, 7]. While introversion itself is not a disorder, the social preferences and behaviours associated with it can sometimes lead to increased anxiety in social contexts [54]. Studies indicate that children who identify as introverted may be more susceptible to social anxiety due to their limited social interactions and the perceived pressures of engaging in social situations. For example, a study by Kirsch, et al. [55] found that children with ASD who exhibited introverted traits often reported higher levels of anxiety related to social interactions. The combination of a preference for solitary activities and a fear of negative evaluation can create a perfect storm for heightened anxiety, particularly in unfamiliar or high-stakes social environments [6, 55].

Additionally, research by Özerk, et al. [11] suggests that children with ASD who are introverted may find it challenging to develop social skills, leading to feelings of inadequacy and increasing their anxiety when faced with social situations. The lack of practice in socialising can exacerbate worries about how they will be perceived by peers, reinforcing a cycle where introversion and anxiety feed into one another.

Understanding this relationship is critical for caregivers and educators, as it highlights the importance of creating supportive environments that respect a child's introverted nature while also providing opportunities for gradual social engagement [56]. Tailoring interventions to address both the introverted preferences and the associated anxiety can help mitigate the social challenges faced by children with ASD.

4.3. Differences in Social Motivation Among Children with ASD

Children with Autism Spectrum Disorder (ASD) exhibit a range of social motivations, which can significantly influence their experiences of social anxiety and introversion [43]. Understanding these differences is crucial for providing appropriate support.

Seeking Social Interaction Despite Anxiety in some children with ASD may enhance the need for a strong desire for social connection, but they struggle to engage due to heightened anxiety [7]. These children often feel an intrinsic motivation to form friendships and participate in social activities; however, their fear of negative evaluation or misunderstanding in social situations can inhibit their ability to initiate or maintain interactions. For instance, a child may want to join a group game but feel overwhelmed by the prospect of interacting with peers, leading to avoidance behaviours. This internal conflict can create a cycle where the desire for connection is overshadowed by anxiety, further complicating their social experiences [5, 26]. Secondly, Contentment with Limited Social Contact is also visible in these children [57]. Conversely, other children with ASD may be more content with limited social interaction, exhibiting introverted tendencies. These children might prefer solitary activities or small, familiar gatherings and may not feel a strong need for extensive social engagement [5, 57]. Their satisfaction with fewer social interactions often means they do not experience the same level of anxiety as their more socially motivated peers. While they may enjoy occasional socialisation, their preference for solitude allows them to feel comfortable without the pressures of social expectations [58].

In order to properly help children with ASD, it is imperative to acknowledge these disparities in social motivation. Balanced possibilities for social engagement can be achieved by designing interventions that take into consideration both the need for social connection and the comfort that comes from being alone [59]. This method can lessen anxiety, encourage healthy social interactions, and enhance general well-being.

5. Neurobiological and Psychological Underpinning

Understanding the nuanced relationship between social anxiety and introversion in children with ASD is essential for developing effective interventions that address both the neurobiological and psychological aspects of these conditions [5].

5.1. Neurobiological Underpinnings

A limbic structure in the medial temporal lobe, the amygdala plays a crucial role in emotion and social interaction. Numerous neurological conditions that are associated with atypical social behaviour have been shown to have structural and functional abnormalities of the amygdala by neuroimaging studies [60]. One such disorder is the ASD amygdala. The connection between conduct and the amygdala's structure and function is still unclear, though. Based on histological criteria, the many nuclei that make up the amygdala can be identified from one another. The anatomical variability of these nuclei appears to correlate with functional variations, according to tracer and lesion investigations in animal models [60]. Particularly, two separate but overlapping processing loops are strongly associated with four nuclei: the lateral, basal, auxiliary basal, and central nuclei. Because of the strong bidirectional connection to association regions in the frontal and temporal lobes, it is believed that the lateral, basal, and auxiliary basal nuclei are important in cognitive processing [61]. As the primary output nucleus of the amygdala to the brain stem and hypothalamic regulatory centres, the central nucleus, on the other hand, is essential to the autonomic loop of processing in the amygdala. It does not have connectivity to the association cortex, but it gets a lot of intra-amygdala projections [60].

According to postmortem studies of the amygdala in ASD, the lateral nucleus was found to be preferentially vulnerable in the disease, resulting in a considerable decrease in the number of neurons in the lateral nucleus compared to neurotypicals [62]. These targeted changes in opposing directions of development may help explain the differential abnormal processing of social cues in ASD [63]. The lateral nucleus is a key area for cognitive processing of external stimuli and the principal location of cortical input into the amygdala. Neurotransmitter systems commonly affect neuronal activity, although variations in amygdala function are probably influenced by variations in neuron quantity [64]. One monoamine that has been linked to a wide range of brain processes is serotonin [65]. As a neurotransmitter, serotonin contributes to a number of brain development and plasticity processes, including synapse creation and remodelling, neurogenesis, neuronal differentiation, and axon myelination. Additionally, serotonin has a crucial role as a neuromodulator in a number of emotional and cognitive processes, such as social behaviour and anxiety [65]. The substantial comorbidity between anxiety disorders and ASD diagnoses suggests that the serotonergic system is involved in both conditions, as evidenced by the successful use of selective serotonin uptake inhibitors (SSRIs) to reduce severe anxiety symptoms in ASD patients [60, 65, 66].

Additionally, research using animal models has revealed indications of abnormal serotonergic production and metabolism in ASD, which is linked to distinctive neuroanatomical and behavioural characteristics [67]. Serotonergic axons significantly influence the amygdala's neuronal activity, and disturbances in the amygdala's serotonergic chemoarchitecture may be a factor in neuropathology that underlie atypical social behaviour, including the dichotomous behavioural phenotypes of ASD [62].

The serotonin transporter (SERT), which is involved in serotonin reuptake back into the presynaptic terminal, is a crucial part of the brain's serotonergic function [68]. Histological techniques that identify SERT expression in preserved brain tissue can provide information about the anatomy and chemoarchitecture of the serotonin system in humans. In postmortem brains, atypical SERT axon density has been found in the cortex of other neurological illnesses with affective behavioural characteristics, such as schizophrenia and suicide victims [69]. However, SERT axon density has not yet been measured in any illness or disease, including ASD, across the major subdivisions of the postmortem human amygdala [70]. The serotonergic innervation of the primary amygdala subdivisions in neurodevelopmental disorders with dichotomous socio-affective behavioural traits was examined for the first time in a quantitative stereological investigation by Lew et al. In particular, they discovered that, in comparison to neurotypicals, people with ASD tended to have slightly higher mean SERT-IR axon densities [70]. Perhaps the dichotomous amygdala pathologies seen in ASD in these two domains, neurone number and SERT axon density, could be related to the effect of various manifestations of serotonergic disruption to amygdala cellular development and seemingly opposing behavioural phenotypes, given the role of serotonin in the regulation of several neurodevelopmental processes, including neurogenesis, neuronal differentiation, neuropil formation, axon myelination, and synaptogenesis [71]. It is unknown how serotonergic innervation of the amygdala and behaviour are related, despite the intriguing comparable pattern of changes in behavioural phenotype and SERT-IR axon density in ASD [62].

Last but not least, it has been shown that oxytocin efficiently enhances social cognitive function and greatly enhances ASD patients' capacity for social information processing, empathy, and social communication. Mammalian uterine contraction and breastfeeding are facilitated by the hormone oxytocin, which is released from neurons in the hypothalamus, paraventricular nucleus, and supraoptic nucleus. The human central nervous system is regulated in large part by oxytocin. According to Huang, et al. [72] children with autism had lower plasma oxytocin levels than healthy children of the same age, and there was no positive correlation between the two variables. Additionally, a meta-analysis reveals that children with ASD have reduced endogenous oxytocin levels, although adolescents and adults do not [73]. In any case, it is widely believed that oxytocin and ASD, particularly its social deficits, are intimately associated [74, 75]. Accordingly, scientists hypothesise that oxytocin deficiency could be a contributing factor to social disorders in children with autism [74].

5.1.1. Arousal and Sensory Processing

The vestibular, somatosensory, visual, auditory, olfactory, and gustatory systems are among the many domains where over 96% of children with ASD express hyper and hyposensitivity, according to the literature [76]. One of the main characteristics of ASD is thought to be atypical sensory processing, which can disrupt development and have an impact on how people interact with their surroundings [77]. Less attention has been paid in the literature to the neurological bases of sensory impairments in ASD [78].

Atypical sensory processing, such as increased sensory sensitivity (sensory over-reactivity) and trouble regulating emotions, is frequently seen in children with ASD. Anxiety symptoms may be exacerbated by these sensory sensitivity issues, which can raise physiological arousal in reaction to environmental stimuli [79]. For example, research has indicated that anxiety in people with ASD is linked to sensory over-reactivity. This is closely related to anxiety, which is defined as a persistent sense of tension or dread over present or possible future occurrences [79]. Although we still don't fully understand how these two constructs interact, prior research has demonstrated their association [79-81]. It is well recognised that a significant percentage of people have sensory processing sensitivity (SPS), which is sensitivity resulting from improved processing of internal and external stimuli. However, there is currently a lack of a clear localisation of SPS and its subdomains in relation to other pertinent features [82]. In order to portray sensory processing sensitivity as measured by the Highly Sensitive Person Scale (HSPS) in relation to the Big-Five Inventory (neuroticism, extraversion, openness, agreeableness, and conscientiousness), as well as to shyness, alexithymia, autism quotient, anxiety, and depression, Attary and Ghazizadeh [82] used a data-driven approach that included hierarchical clustering, t-distributed stochastic neighbour embedding (t-SNE), and graph learning. The results of the analysis showed that the SPS subdomains

were separated into two trait clusters. Questions about aesthetic sensitivity (AES) were found to be primarily associated with positive traits and were surrounded by openness, whereas questions about ease of excitation (EOE) and low sensory threshold (LST) were found to be primarily associated with negative traits and were surrounded by neuroticism. Questions about autism that were consistent with it being a spectrum disorder showed a comparable distribution across clusters; in contrast, subdomains related to alexithymia fell well within the negative cluster. The findings lend credence to the idea that sensory processing sensitivity is a unique but non-uniform characteristic and offer suggestions for improving the notion and measures of sensory processing sensitivity as they stand.

5.1.2. Amygdala and Prefrontal Cortex Activity

People with ASD may receive social information differently, according to neuroimaging research [83]. The prefrontal cortex, which is involved in higher-order cognitive processes, may be more aroused in people with ASD, even if the amygdala, the brain's emotion centre, is normally stimulated in response to social inputs. This implies a compensating mechanism in which people with ASD process social cues more purposefully and laboriously, which can be exhausting and exacerbate social anxiety [84]. In addition to affecting registration, impairments in the limbic system and other emotion-related brain regions also affect sensory modulation. The limbic system includes the insula, hypothalamus, hippocampus, para-hippocampal gyrus, amygdala, fornix, mammillary body, septal nuclei, and thalamus, among other subcortical nuclei and cortical structures. It has been hypothesised that structural anomalies in the limbic system of the forebrain cause malfunction in sensory modulation, which may result in emotional issues. Research indicates that adults with ASD have smaller hippocampal and amygdala volumes than people without the disorder. Variations in the pathways that link motor, auditory, and cognitive functions to brain regions connected to emotions have been documented in a few white matter investigations [85, 86].

Another study by Dinatolo, et al. [87] reported that the changes in blood oxygenation level-dependent (BOLD) signal of ASD participants exhibited diminished responses in the posterior cingulate cortex and the insula, particularly for pleasant and neutral tactile stimuli, compared to the typical developing group. For the unpleasant tactile stimuli, ASD participants exhibited greater BOLD signal than the control group in affective somatosensory processing areas, including the posterior cingulate cortex and the insula. There is evidence to show that dysfunction in touch and tactile perception is closely tied to social dysfunction and core symptoms of ASD. For instance, it has been discovered that children with ASD who are hyper-reactive to tactile stimuli (also known as tactile defensiveness) have social impairment (i.e., avoid unintentional touch and move away from crowds), while tactile hypo-responsivity has been linked to worse social functioning and nonverbal communication skills. Early infancy is when abnormal tactile behaviours and differences in touch processing are seen in ASD. A stable attachment to carers is one of the major social deficiencies that might result from atypical contact during infancy [87, 88].

5.2. Psychological and Behavioural Factors

Distinguishing the concepts of social anxiety and introversion requires an understanding of the behavioural and psychological aspects of social functioning in children with autism spectrum disorder (ASD). Although they may show up as comparable social behaviours, including withdrawal, little engagement with peers, or a hesitancy to approach others, the underlying psychological states that underlie these behaviours are very different. The emotional, cognitive, and behavioural mechanisms that distinguish social anxiety from introversion in the context of ASD are examined in this section, along with how these mechanisms affect observable behaviours.

5.2.1. Social Motivation and Communication Challenges

Social communication and motivation are frequently impaired in children with ASD [42]. These issues may result in trouble establishing and sustaining social connections, which could be mistaken for introversion. But rather than a desire for isolation, these acts are frequently the result of a failure to read social cues. According to research, social anxiety in children with ASD is linked to problems with social motivation and communication [42, 89].

The focus of autism research has shifted in recent years to motivational variables. Social orienting (i.e., social signals are prioritised during processing), social seeking (i.e., one seeks out social interactions because they are intrinsically rewarding), and social maintaining (people have a desire to maintain social engagement) are the three behavioural manifestations that [90] defined in a review to reify the construction of social motivation. According to this theoretical paradigm, a child's social development is negatively impacted by low social motivation since it prevents them from participating in important social interactions in their learning environment at a young age. This account is supported by a substantial amount of literature. According to Congiu, et al. [91]; De Angelis [92] and Hinz, et al. [93] children and adults with ASD frequently show less attention to social stimuli than to non-social ones. It has also been discovered that a diminished focus on social cues is linked to subsequent deficiencies in social cognition comprehension and social skills, such as joint attention social reciprocity and Theory of Mind comprehension [94].

Surprisingly little study has been done on the effects of low social motivation on language development in children with ASD, despite the large body of research on the subject's effects on social outcomes. Children with ASD may also have a harder time acquiring language if they have less social drive [95-97]. There are conflicting results from the few studies that have looked at the relationship between differences in linguistic proficiency in children with ASD and differences in some facet of social drive. In a head-turn preferring paradigm, Kuhl, et al. [98] found that a higher preference for non-social stimuli was linked to a lower level of expressive language as assessed by the Vineland Adaptive Behaviour Scales (VABS) Sparrow, et al. [99]. Watson [100] discovered a substantial correlation between concurrent and longitudinal

receptive and expressive language abilities and prolonged exposure to social stimuli. Orienting to social stimuli did not, however, significantly correlate with communication or language skills when measured using other language measures [100]. It is crucial to remember that, according to Chevallier, et al. [101] each of the aforementioned research only assessed one component of social motivation, namely social orienting. However, the other two components of social motivation social seeking and social maintaining are also theoretically essential to good language development, given the dynamic and interactive character of language learning.

5.2.2. The Double Empathy Problem

According to the "double empathy problem" theory, social challenges in ASD result from a lack of understanding between people with and without autism. This reciprocal misinterpretation might intensify social anxiety symptoms and lead to behaviours that might be interpreted as introverted [102]. Because of their distinctive social communication style, which neurotypical people often misunderstand, people with autism are often seen negatively by neurotypical people. As a result, neurotypical people appear to be incapable of empathising with those with autism, while they are said to be incapable of empathising with neurotypical people [103]. Accordingly, the twofold empathy problem, a bidirectional loss of empathy, should be seen as the condition of autism [102]. According to this idea, people with autism communicate more effectively with other people living with autism than with neurotypical people, which is in contrast to the medical model's predictions. It was previously suggested that neurotypical people's negative perceptions of autistic people's behaviour influence how they treat them (unwelcoming), which in turn affects how autistic people behave (perhaps wariness, mistrust, low self-esteem, and lack of social ability due to a lack of positive and rewarding social experience). This will therefore harm how neurotypical people view autistic persons, and so forth. However, it's possible that neurotypical people tend to view autistic people negatively because they find it difficult to decipher the signals in their behaviour, or that when they do, they lack empathy and make little attempt to decipher the signals. In any case, when neurotypical individuals are intolerant of and socially exclude autistic people, they do not learn to grasp their unique social interaction style, which may contribute to their continued misinterpretation and misperception.

Additional concepts that might be pertinent to comprehending the relationship between autistic people's poor mental health and denied belonging include that, in recent research, many autistic people attempt to "fit in" with neurotypical people and the general public by hiding or compensating for their autistic traits in social settings [104-107]. According to Bradley, et al. [108] camouflaging is unpleasant and draining for autistic people. People with autism described in co-designed research how they tried to hide their autism traits in social settings, but their "true self" was rejected as a result. This led to a greater sense of thwarted belonging, which in turn led to high rates of poor mental health, suicidal thoughts, and behaviours. Accordingly, even after adjusting for several other risk variables, the co-produced study demonstrated that camouflaging autistic features strongly predicted suicide thoughts and behaviours Bradley, et al. [108]. Moseley, et al. [109] also discovered evidence in favour of a serial mediation effect, in which high levels of thwarted belonging, suicidal thoughts and acts in neurotypical individuals, and a greater propensity to conceal these qualities were all linked to high levels of autistic traits.

6. Empirical Evidence in Behavioural Expressions

Teenagers with autism are believed to experience social anxiety frequently [46]. Although there is growing evidence that a number of mechanisms, such as alexithymia, sensory processing, and intolerance of uncertainty (IU), are important for sustaining anxiety, little is known about how these characteristics relate to social anxiety in adolescents with autism. A study by Larkin, et al. [110] shows similar strong correlations between social anxiety and IU, alexithymia, maladaptive emotion regulation, sensory hypersensitivity, and interoceptive responsiveness were found in teenagers with autism and neurotypical personalities who were matched for social anxiety. Using a dimensional approach, they discovered that the association between social anxiety symptoms and autistic features in the combined sample of adolescents was mediated by sensory hypersensitivity, alexithymia, and IU as reported by both parents and children.

Anxiety in social situations is frequently seen in people with ASD. According to the results of the systematic review conducted by Black, et al. [111] social anxiety in people with ASD is very different from the normal SAD experienced by those without ASD in terms of social awkwardness, experiences, and behaviours. The investigations by Jenkinson, et al. [112] generally emphasised that a high prevalence of intolerance to uncertainty (IU) among people with ASD frequently puts them at risk of social anxiety, which relates to the research topic. According to earlier research, IU is a personality trait in which people struggle to perceive ambiguity and show discomfort with uncertainty.

Many autistic people may exhibit intolerance to uncertainty because they have heightened sensory sensitivity, which can make uncertain or unpredictable sensory stimulation overpowering, even though this is not the main characteristic of ASD [112, 113]. As a result, they frequently favour predictable, routine circumstances where they can adhere to norms. When their surroundings shift or anything unexpected happens in their everyday lives, people with ASD feel uneasy and become more nervous around strangers and in socially challenging circumstances [113]. Because they are unable to comprehend social signs and standards in many contexts, people with ASD may find social interactions difficult. Uncertain social circumstances, such as strange social settings or unclear social cues, can therefore heighten anxiety and make it more difficult for people with ASD to navigate social situations [112].

According to Jung [114] introverts focus their energy inside, leading to more contemplative and solitary pursuits, while extroverts focus their energy outward. Additionally, according to Jung, introverted people think subjectively, developing and pursuing their thoughts inwardly. He observed that introverts frequently struggled to relate to others, making them feel unwelcome or irrelevant. According [114] "just because he is less related to the object than the subject, his judgement

appears cold, obstinate, arbitrary, and inconsiderate". Jung [114] also observed that other people may avoid introverts because they feel neglected by them. Because of this, he believed that introverts were frequently misinterpreted and that they would put up a wall to hide their true selves. His depiction of introverts seems to be subjective and internalised because of these factors. Jung [114] also believed that introverts may become angry when others did not value their subjective opinions. Regarding the introverted feeling type, according to Jung, introverts can also come off as aloof, and others may perceive a lack of concern for the well-being and comfort of others. According to him, an introvert is primarily self-centred and incapable of empathising with or appreciating the significance of others. These traits mimic those of autism spectrum disorder when they are exacerbated to the point of malfunction. Crucially, Jung [114] was attempting to understand the behavioural patterns of introverts rather than pathologising them.

Certain personality traits that are indicators of human well-being may be displayed by people with ASD [115]. In order to support diagnosis and guide treatment, recent studies have sought to compare the personality qualities of people with ASD to those without the disorder [116, 117]. Furthermore, personality profiles could account for the wide range of ASD symptoms [117]. Few studies, nevertheless, have been conducted to establish a clear link between ASD and a particular personality trait. Research has not yet confirmed the use of personality profiles to guide treatment, even if certain patterns on personality tests may suggest a person has ASD. Nonetheless, there is proof that personality assessments can help therapists identify treatment areas [118].

Seventy percent of the variance in the ASD trait scores was found to be explained by the five domains of the Five Factor model, comprising agreeableness, conscientiousness, extraversion, openness to experience, and neuroticism [119]. Neuroticism showed a positive correlation with the intensity of ASD symptoms, while extraversion, openness to new experiences, agreeableness, and conscientiousness showed a negative correlation. Based on these findings, researchers hypothesised that certain personality traits could help therapists better treat autism spectrum disorder [118, 119].

7. Implications for Diagnosis and Treatment

Adults with autism spectrum disorder (ASD) frequently have differential diagnoses, comorbidities, and overlaps with other psychiatric disorders [120, 121]. However, personality disorder (PD) screening is frequently overlooked in clinical assessments, despite the fact that PD is particularly prevalent in high-functioning ASD individuals who require less support [121]. It can occasionally be difficult to differentiate between social anxiety disorder (SAD) and the social avoidance that is commonly associated with autism spectrum disorder (ASD) due to their comparable behavioural presentations [122]. Furthermore, an increasing amount of research indicates that a sizable fraction of individuals with ASD also fit the criteria for SAD, and that individuals with SAD typically have a greater frequency of autistic features [121, 122].

Personality tests are rarely utilised to guide treatment planning, despite psychologists' extensive training in using evidence-based treatments with their clients [118]. According to Anestis, et al. [118] this phenomenon might be the result of a dearth of studies on the potential effects of personality tests on treatment planning and results. Four ways that personality profiling tools may help with treatment planning were put forth by Harkness and Lilienfeld [123]. Their findings suggested that personality tests could help clinicians identify areas that require change, create realistic expectations for therapeutic benefits, promote treatment matching, and support self-improvement. When it comes to treatment planning, the Five Factor Model can help the practitioner identify areas that require modification [124]. Clinicians need to understand the differences between typical adaptations and basic inclinations, according to Ten Cate and Taylor [125]. Characteristic adaptations are qualities that can be greatly influenced by one's environment and are frequently indicative of one's cognitions, whereas basic inclinations are biologically and genetically anchored within the individual [118]. Maladaptive behaviours and cognitive distortions are examples of characteristic adaptations that might prolong disease symptoms. By detecting a patient's maladaptive characteristic adaptations, personality assessments can help guide treatment planning and help focus therapy efforts [125].

For instance, cognitive-behavioral therapy may be used to reduce anxiety symptoms by addressing cognitive distortions linked to high neuroticism [126]. It is possible to reduce the clinical symptoms by addressing the distinctive adaption. Additionally, studies have shown that symptom improvement occurs when treatment interventions target cognitive processes linked to poor extraversion and high neuroticism [127-129]. The patient is more likely to make progress in treatment if their self-criticism and/or ruminations are particularly addressed. Overall, by identifying a patient's typical adaptations, that can be enhanced with the right intervention, the Five Factor Model can help guide treatment planning. Among a variety of psychological diseases, treatment interventions can have a significant impact on personality features [54, 130-132]. Cognitive-behavioral therapy for social anxiety disorder has been shown to promote extraversion and decrease neuroticism [133]. According to Zeyrek Rios [134] patients with borderline personality disorder who get dialectical behavioural therapy exhibit higher levels of conscientiousness and agreeableness. Antidepressant drugs for major depressive disorder have been shown to improve extraversion, conscientiousness, openness, and agreeableness while decreasing neuroticism. This study shows that by identifying the actions that are relevant and required for symptom reduction across a range of psychological diseases, a personality profile can help guide therapy planning.

Furthermore, a clinician may be able to establish realistic expectations for therapeutic success right from the start thanks to personality assessment [135]. A client may not comply with treatment if their personality profile shows that they are not very open. Conversely, a doctor may anticipate that a patient who exhibits great openness will participate effectively in treatment. Setting reasonable expectations and treatment goals for a new client might be facilitated by the clinician using a personality assessment. Personality tests may help physicians understand the therapeutic relationship in addition to establishing reasonable expectations and treatment objectives [136]. Based on each person's distinct traits, personality tests can be helpful in determining the best interventions. A patient with low neuroticism, for instance, will

benefit from treatment that concentrates on a particular behaviour or emotion, whereas a patient with strong neuroticism will gain more from a broad approach to emotions, according to Barlow, et al. [137] and Clark, et al. [138]. Additionally, Smith, et al. [139] thought that cognitive-behavioural therapy, as opposed to psychodynamic treatment, was more likely to help a patient with a high introversion score. Clark, et al. [138] emphasised how crucial it is to collect data from personality tests in order to develop a suitable treatment strategy. The Five Factor personality domains and the ways in which different theoretical stances and interventions impact them should be the subject of future study [138, 139].

Research on the relationship between personality test results and a patient's increased self-awareness is lacking [140]. Giving patients input on their personality type may help them become more self-aware, which may ultimately result in better therapy outcomes Qudrat-Ullah [141]. Kim, et al. [142] conducted a study in which participants were given feedback on their personality profiles using the Minnesota Multiphasic Personality Inventory-2 (MMPI-2). According to the study's findings, patients who received personalised feedback reported feeling more confident and knowledgeable about themselves. Giving patients feedback from personality assessments may help them better comprehend their experiences, which could result in better treatment outcomes. Research examining the connections between certain personality characteristics and therapeutic outcomes is lacking, despite evidence that suggests personality tests may have a favourable impact on treatment planning and outcomes. Furthermore, few studies have been done on whether treatments are more appropriate for particular personality types, which makes it difficult for physicians to use personality tests to customise care for each patient. In order to ascertain whether particular treatment modalities are most appropriate for particular personality features, future research should concentrate on investigating manualized treatments for particular personality traits [118, 143].

8. Discussion

The subtle nuanced distinctions and overlapping characteristics of social anxiety and introversion in children with autism spectrum disorder (ASD) are examined in this literature review. Accurate diagnosis, intervention, and support planning depend on a knowledge of the underlying mechanisms of these qualities, even though they can show up as social disengagement or decreased interaction. One of the main conclusions is that social anxiety in children with ASD is usually fuelled by past social failure experiences, uncertainty in social situations, and worry over academic achievements. These children may want to interact with others, but they are unable to do so because of a severe fear that is frequently made worse by the cognitive and communication difficulties that come with ASD. In contrast, introversion is better understood as a temperamental predisposition for surroundings that are low-stimulation or isolated. Children with ASD who are introverted may not feel distressed in social settings, but rather feel unconcerned or even happy to be by themselves.

The differentiation becomes particularly salient when one considers emotional and physiological markers. When put in social circumstances, children with social anxiety frequently exhibit elevated stress responses, such as elevated heart rate, avoidance behaviour, or vocal self-consciousness. On the other hand, without displaying obvious symptoms of anxiety, introverted children could just opt to play alone or withdraw. Crucially, this implies that not all social disengagement in ASD needs to be pathologised because introversion may be a normal personality trait rather than a medical issue.

Furthermore, clinical judgement may be hampered by the overlap between introversion and ASD features like decreased eye contact, a preference for regularity, and little peer interaction. Practitioners and carers may mistakenly interpret the behaviour of an introverted child as social anxiety, or they may overlook crippling social anxiety concealed by communication difficulties associated with ASD. This highlights the necessity of individualised, developmentally appropriate evaluations that consider the child's emotional experience in addition to visible behaviour. Intervention tactics are the subject of another significant implication. Targeted treatments for children with social anxiety may include social skills training, gradual exposure to social situations, and Cognitive Behavioural Therapy (CBT) modified for ASD. Such treatments, however, might not be necessary for introverted children, and forcing them on them could be upsetting or ineffective. Rather than portraying loneliness as a problem in and of itself, helping introverted children with ASD entails honouring their preferences while subtly promoting social adaptability.

In the final analysis, cultural perspectives on sociability could make the distinction even more difficult to understand. Extrovert behaviour is frequently idealised in educational and clinical contexts, which causes introversion to be misunderstood as maladaptive. This pressure might exacerbate feelings of alienation or inadequacy for children with ASD. It can be beneficial to reframe social behaviours within a wider range of typical development by using a strengths-based approach that acknowledges neurodiversity, including temperamental characteristics like introversion.

In conclusion, whereas introversion and social anxiety may exhibit behavioural similarities in children with ASD, they are actually caused by different internal processes and call for different strategies. Making a precise distinction between the two promotes better respect for individual heterogeneity within the autism spectrum, increases the appropriateness of therapies, and improves diagnostic clarity.

9. Conclusion and Recommendations

The juxtaposition of social anxiety and introversion in children with Autism Spectrum Disorder (ASD) reveals a critical yet often overlooked complexity in understanding social behaviour within this population. While social anxiety is characterised by fear and distress in social situations, introversion is a temperamental preference for solitude or little social stimulation without any underlying discomfort. Despite the fact that both traits may manifest as social withdrawal or decreased engagement, the underlying motivations are very different. This literature review proposes how behavioural similarities can result in diagnostic uncertainty, whereby introverted characteristics could be mistaken for anxiety-driven

avoidance or, on the other hand, clinically severe social anxiety could be written off as personality-based reticence. These misclassifications have important ramifications for intervention. Introversion usually calls for understanding and accommodation rather than correction, but social anxiety in ASD frequently benefits from focused treatment approaches.

The research also suggests the significance of multimodal evaluation techniques that incorporate physiological, cognitive, and emotional markers in addition to observed behaviour. Since not all social interest indicates comfort and not all social retreat indicates distress, clinicians and researchers must continue to be sensitive to the inner feelings of children with ASD. The results also highlight larger societal and conceptual biases that pathologise social silence, particularly in children with neurodiverse traits. It is crucial to take a strengths-based, customised strategy that makes a distinction between characteristics that need assistance and those that represent inherent variance in social temperament. Proposes

In conclusion, distinguishing between social anxiety and introversion in ASD is not just a diagnostic improvement, rather it is a critical first step toward providing autistic children with more moral, individualised, and successful support. This study recommends longitudinal studies and child-centred approaches should be used in future research to elucidate these differences, and practitioners should use this knowledge to better customise therapies and create environments where all children regardless of social orientation, may flourish.

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