Exploring the spatial needs of Autistic individuals in the built environment:

Towards a Learning Centre for Durban

by

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COLLEGE OF HUMANITIES

DECLARATION - PLAGIARISM

I, Roman Naidoo declare that:

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2. This thesis has not been submitted for any degree or examination at any other university.

3. This thesis does not contain other persons' data, pictures, graphs or other information, unless specifically acknowledged as being sourced from other persons.

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"WE CANNOT CHANGE THE CARDS WE ARE DEALT, JUST HOW WE PLAY THE HAND".

-RANDY PAUSCH

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The journey to become an architect begun as a childhood dream and has grown to one of my life's greatest goal, I thank God for being the light to my path and guiding me through every storm I faced to get this far!

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ABSTRACT

This study looks at the neurological condition of autism which impairs an individual's perception to interact with people and the built environment. Recently autism has become a frequent subject of study in various fields this includes architecture, and architecture for Autism. Through research it has shown individuals with autism experience sensory and perceptual difficulties and therefore require special spatial needs and consideration in order for them to be able to manage their condition within the built environment. Most centres for autism deal only with the social, imaginative and communicative difficulties experienced disregarding the specific spatial, sensory and perceptual difficulties. The approach taken by this study includes concise literature review precedent studies, case study and semi structured online interviews. The study has shown that autistic individuals experience multiples sensory and perceptual difficulties both in learning and social spaces. The theoretical framework explores the paradigm of phenomenology which responds to the sensory stimulation and socio-spatial theory which addresses the importance of the public interface and its role in public awareness towards the autistic community.

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CHAPTER ONE | RESEACH BACKGROUND AND METHODOLOGY

1.1. INTRODUCTION

1.1.1 Background

Autism has shown through research to be one of fastest rising developmental disability. Approximately one percent of the entire world population has been diagnosed with autism spectrum disorder. Through early diagnosis and proper treatment and facilities can make it possible and allow the individual to adapt to normal life without feeling out of place, lost and confused. Individuals with ASD feel much more relaxed and calmer in spaces that promote a sense of inclusion and considerations to their specific needs as a result this enhances their well-being and their ability to overcome their learning and social difficulties. However, the traditional care centre acts as an isolated utopia and is not enough for social demands and the treatment of autism.

Wilkes (2005) reports that: “some individuals, such as those with Autism Spectrum Disorders (ASD's), experience these built environments with impaired perceptions. These individuals find it difficult to make sense of the world, which in turn affects their abilities to cope, experience and relate to their surrounding environments. Everyday experiences, which the majority of people take for granted, for people with ASD become negative and upsetting experiences” (Wilkes, 2005). The result of the environment being unbearable on people with ASD leads them to withdraw from society and seek little or no interaction with others and their surroundings.

South Africa does not provide much awareness on this disorder and neither does the built environment cater to their needs. The city of Durban does not have a centre that caters for the specific needs of those in the ASD spectrum or much awareness and information easily available to its community.

1.1.2. Motivation/ Justification of the study

The built environment has made progress towards universal design by acknowledging physical disabilities, and not "readily visible "impairments. According to Smith (2009), the physical environment can support people with impairments, therefore it is important to establish that the aim of the approach should not be to "fix" as if the users are diseased or deficient. "It is more productive to consider the particular situation, as a relationship between person and place that needs to be understood, in order to improve an autistic individual's quality of life through the design of the physical environment" (Smith 2009, p. 221)

Therefore, the main motivations of this study are as follows:

Autism impairs the ability to communicate and socially interact with people. This impairment has an impact on an autistic individual's everyday activities and acts as a constraint. Another challenge is the inability to adapt to new environments without experiencing trauma as one becomes overwhelmed. Autistic individuals experience a sensory overload resulting in the inability to function. A sensitive, inclusive approach needs to be considered when designing environments. Inclusive spaces created through the built environment can act as a filter, reducing the negative impact of adjusting to new environments and socially interacting with people.

Due to the impairments experienced in Autism, it forces individuals to be completely dependent on supportive structures such as specialised care or family. In a specialised school, autistic behavioural and communication issues are addressed, but the concentrated focus on their impairments leaves much more to be considered, in order for an autistic to become a functioning entity in society. It is imperative for the learning process that has commenced in primary education to proceed into secondary, and also further develop into adulthood to allow an autistic individual to continue development and breaking restrictive barriers

The education system within South Africa provides very minimum support for ASD and non-visual disabilities and therefore has left many parents and care givers lacking financial support and knowledge about the condition of ASD in order to provide a fruitful and fulfilled future for their children. The city of Durban is a major node and provides various transport routes to many suburbs and peri-urban settlements therefore, provides a great opportunity towards a centre for the needs of ASD through awareness and exposure. The centre will become a resource hub to main stream schools and the public.

1.2. DEFINITION OF THE PROBLEM, AIMS AND OBJECTIVES

1.2.1. Definition of the problem

A few young adult autistic individuals, who were fortunate to attend high school, graduate with the hope of moving out of their parent's homes, and to become self-supporting individuals through job seeking prospects, however, reality soon dawns upon them that there is barely any employment scope suitable for their criteria. In most young adult autistic, cases especially those who are considered to be "low-functioning" are able to obtain the minimum skills and knowledge to function, but the time in which it takes to obtain this, creates a gap between autistic individuals and others in the job market. Employment is one of the concerns but housing is just as important, as naturally is the urge to be independent comes with age.

It is essential for the needs of young adult autistic individuals to be given a platform to access their basic rights and to equip them with "life skills". The built environment and on-going research need to further explore the autistic needs of individuals that go beyond adolescence.

1.2.2. Aims

- The main aim of the study is to implement the understanding of spatial needs of individuals with Autism into a learning centre that caters for the Autistic individuals going from adolescents into adulthood.
- Explore the impact, benefits and understand the concept of perceptual architecture and its relationship with the built environment.

1.2.3. Objectives

- To explore the spatial needs of individuals with ASD.
- Understand the nature of ASD and the current response to facilities provided for those who suffer from ASD.
- To apply architectural theory and sensory design principles to cater for those with impaired perception.
- To explore the impact that the built environment has on autistic users.

1.3. SETTING OUT THE SCOPE

1.3.1. Delimitation of Research Problem

This study shall explore the spatial needs of autistic individuals and how could the built environment aid in developing comfortable and adaptable spaces that would enhance the quality of life for individuals that suffer from ASD. The scope of the research is not one that will indulge in medical remedies or divert this study's focus of it being an architectural response to the recommendation of people with ASD. The sense of taste and its role in human perception is not much interest in the field of architecture therefore will not be discussed in detail in the scope of this study.

The main issues the proposal will primarily focus on is the lack of awareness that there is within the role of architecture and the design of a special needs centre for those who suffer from ASD. The research aims to understand the needs of individuals with ASD and how architecture could provide a learning centre that would create social inclusion and awareness on this growing disorder and bring more awareness to the city of Durban. The research will examine current Autism centres within the CBD of Durban and highlight the issues and key factors, this will aim to create inclusivity and awareness to the city and involve people to learn more about this rapid growing disorder.

1.3.2. Definition of Terms

Autism Spectrum Disorder:	It is the overall term for a group of the main five developmental disorders (Autistic Disorder, Asperger's Syndrome, Rett's Disorder, Childhood Disintegrative Disorder and Pervasive Developmental Disorder Not Otherwise Specified. Refer to Appendix A for more detail) that affect a person's ability to interact, communicate, relate, play, imagine and learn. The term is used interchangeably with Pervasive Developmental Disorder.
Built environment:	refers to components of the architecture that includes private and public buildings as well as parks, urban squares and playgrounds.

Senses:	Any of the body's main faculties, such as sight, hearing, smell, taste, or touch, by which humans and animals perceive stimuli originating from outside or inside the body.
Sensory stimulation:	Arousal of the brain through any of the sensory modes.
Experiential:	Something that is experiential originated from the real world - from experience. Experiential things can be seen, touched, and verified.
Perceptual:	relating to the ability to interpret or become aware of something through the senses.

1.3.3. Stating the Assumptions

The main assumption of this dissertation is that there is a lack in knowledge and provision for those in the ASD spectrum within the built environment. There is not enough awareness and importance given to the rising disorder in the context to the general public of Durban and those in underprivileged environments. They therefore live their lives without being correctly diagnosed and go through life feeling excluded and lost in the world.

1.3.4. Key Questions

Main question

- How can an autistic individual's perception of space be enhanced through the design of his/her physical environment?

Sub-questions

- What psychological influence does architecture have on an autistic individual's perception of space?

- What architectural concepts respond to the spatial needs of autistic individuals and their perception of space
- What facilities are required to enhance spatial quality of space for autistic individuals?

1.3.5. Hypothesis

Conditions which are supportive of those who are diagnosed with ASD can impact on the design outcome of the built environment. Spaces become a platform where social dynamics occur. Architectural design which is conversant by these dynamics will inform the built environment to be more supportive of those who challenged.

1.4. CONCEPTS AND THEORIES

Albert Einstein wrote, *"Everybody is a genius. But if you judge a fish by its ability to climb a tree, it will live its whole life believing that it is stupid."*

People with Autism have impaired perceptions that need extra guideness with sensory development. Little things that people take for granted on an everyday basis are challenging and strenuous on the brain of those who suffer from Autism which leads to aggressive and undesirable behaviour. The need for sensory architecture in such an environment is critically essential to the development of people with these special needs and care. Research shows that the epidemic of ASD is growing and the current statistic shows that "*1 out of every 150 children is estimated to fall in the Autism spectrum regardless of their socio-cultural and economic aspects*" (Mostafa, 2008).

1.4.1. Phenomenology

Phenomenology can be seen has the study of human experience and perception. Horvath states that: "These experiences are derived from the response of human senses to the elements, stimuli and spaces that surround them" (Horvath, 2010). People can be sensory stimulated through the built environment as well as natural setting. For example, Norberg-Schulz (1980) states: "phenomenology's potential in architecture has the ability to make the environment meaningful through the creation of specific places". For Merleau-Ponty (1962) describes phenomenology as the nature of an individual perceptual connection with the world in unification with their experiences.

1.4.2. Perception theory

Perception theory studies the understanding of how people observe the space they come in contact with and their experience as a whole. Walter Gropius theorized (cited in Barr, 1970) states: “that by understanding the nature of what people experience and the way they perceive it. The potential influence of man-made design on human feelings and thinking can be better understood”. Philosopher Taylor Carmen (2008) also explains that one can differentiate between two characteristics of perception: one being a sensory dimension which contracts with passive sense experiences, and the other being the active motor dimension which deals with the five bodily actions. In everyday experiences the sensory motor dimension is always experienced as one unified unit that provides a seamless continuous experience. These ambiences and perceptions are considered further over the theories of phenomenology.

Perception can be seen as a relation to emotion and sense. Many people perceive spaces differently and can be referred to as irrational and subjective (Schaap, 2010). There are three major concepts according to Kreij’s thesis, which are hapticity, kinesthesia and synaesthesia (Van Kreij, 2008).

1.4.3. Architectural Psychology

Humans observe the world through their senses. These are our tools in everything we experience and they communicate to our brain to express how we feel. Small enclosed spaces will signal through our senses fear and anxiety, where as too open spaces without a sense of scale will trigger a sense of isolation and a feeling of placelessness. A loud noise creates a sense of shock, while build-up and anticipation create a sense of excitement. According to Reeves thesis, senses are “referred to as modalities of sensation” (Reeves, 2012). These modalities are distinguished as five sensory modalities; visual, audacity, tactile, olfactory and gustatory. These senses are split up into the following groups; distance senses which are: seeing and hearing, skin senses such as; touch, taste and smell and finally the deep senses which are: kinaesthetic and vestibular (Hochberg, 1964). The deep senses will be explored in the perception theory as it deals with Autism.

1.4.5. Conclusion

The theoretical framework is primarily focused on the needs of Autistic and enhancing spatial quality that addresses human perception and senses that would enhance the quality of life for people suffering from ASD. These theories will set the foundation of understanding space and the concept of space within the place. They deal specifically with the human senses and experience man has with the environment. The above-mentioned theorist has explored and understood the importance of connecting man with his environment to create a holistic experience. To deal with the topic of this thesis, there first needs to be an understanding of what is wrong within the current situation of spatial planning and learning environments that has been set by global standards.

1.5. RESEARCH METHODS AND MATERIAL

1.5.1. Introduction

This research is one that is exploratory and qualitative, this is employed to investigate the current spatial quality and environment provided for those who suffer from Autism within the South African context and form a basis of identifying the spatial needs of those who live within this spectrum of ASD. The methods of research in this proposal are divided into secondary and primary research. The secondary data will be collected in the form of a literature review and precedent studies to explore the current body of knowledge. In the secondary data theoretical and conceptual frameworks of phenomenology, perception theory and architectural psychology will be explored, the precedent studies will focus on buildings that currently relate to these theories. Both methods aim to find a coalition between the quality of spaces conducive to the needs of those suffering from ASD and the built form. The primary data will be done remotely via desktop study through in-depth interviews. This research will be used to provide a deeper understanding through analysis of first-hand experience of the condition.

1.5.2. Research Philosophy and Strategy

The research philosophy and strategy will be set out by gathering secondary data, such as; literature on the study, current writings and studies such as Journals and current articles. This method of research will allow the author to get sufficient knowledge and in-depth understanding of the current issues and methods. There would be a need to then understand the correlation between the social issue and the architectural theory, therefore study will use an interpretive research philosophy that will respond to the social integration aspect. The interpretive approaches are subjective and will be based on the social problem of integration of Autistic individuals within the built environment. The study will further use the qualitative approach through primary and secondary data collection. A qualitative study is about engagement; therefore, the study will seek to record the current issues and problems that are experienced by Autistic individuals within the built environment. Toward an outcome of designing a learning centre.

1.5.3. Secondary Data Collection

Literature Review:

The literature review is essential to this study as it will provide a foundation and footing for this research, it will analyse and discuss the current scope of knowledge on the research topic. Published references such as books, journals and newspaper articles etc. will be looked at as well as unpublished references such as websites and theses. The relevant references will provide an understanding into Autism and Autistic needs in general, the lack of public knowledge available within the context of South Africa and substantially low architectural response to environments that address psychological needs will form a solid understanding of the research topic.

Precedent studies:

Precedent studies will be looked at to analyse the existing built environment and the approached taken to create a responsive and meaningful architecture to human perception. The buildings selected are of relevance to the research, including buildings that employ sensory and perceptual methods and show a fine example of responsiveness to human needs and spaces that respond to human senses and modalities. The precedents will be investigated further to ascertain methods other architects have used to create buildings that respond to people and allow this interaction to take place.

1.5.4. Primary Data Collection

Case study:

The Case study will be done through analysis and findings done by previous study and research of local buildings that facilitate and accommodates people living with ASD. An analysis will be carried out to investigate how people use the facility and if the facility provides suitable learning spaces and enhanced environments that accommodate the needs of an Autistic individual and for the people of that area. The case study also aims to investigate the architectural approaches employed to design a facility that allows for public interaction. The architectural design will be compared against the literature review to form an understanding of the social and architectural aspects of the research.

Online Interviews:

Thorough interviews will be carried out remotely to form a deeper understanding of the research problem. These interviews will take place through a video communication medium. The interviewees are selected in terms of knowledge of ASD and their daily experience working with autistic individuals.

The interviews will be conducted with:

- Three educators from a local school that specializes in the needs of autistic individuals. The educators will be interviewed to give an insight into the communicative, social and sensory perception difficulties experienced by autistic individuals and the design requirements of learning spaces.
- A chairperson of the local Autistic Centre and relevant personnel with the experience that can provide an understanding of the concerns of the communities and families of the autistic individuals. The facility will also provide information and statistics in terms of Autism in Durban.
- A therapist at a local Autism Centre as they have experience working with autistic individuals daily and will provide insight into the design requirements of spaces for autistic individuals.

1.5.5. Research Material

The research materials will be a combination of the primary and secondary data collected which will include interviews and surveys as empirical data. Secondary sources books, journals, newspaper articles, research papers, internet searches and archives will be used to approach and facilitate the process of carrying out this study.

- An Interview schedule will be carried out that includes a formal set of questions directed at the interviewee. These questions are structured to give a better understanding of the points highlighted in this research.
- Photographic evidence that has been previously captured by other study's as well as satellite images such as google map and gis. will be used by the author to analyze the case study.

1.5.6. Research Analysis

The analysis of the information provided from the interviews and questionnaires will be recorded using descriptive statistics method. This method is used to summarise data in ways that it can be meaningful and useful to aid in the outcome of the study. The data recorded would be presented in form of tables and analytical charts. The secondary data collected will be analyzed through thematic and content analysis and presented in form of pictures, text and narrative.

1.5.7. Summary

Objectives	Research Question	Data Sources	Sample size	Data Collection Methods	Data Analysis Method	Data Presentation Forms and Style
To determine the spatial needs of Autistic individuals	What are the specific spatial needs of Autistic individuals?	Specialist in Autistic care	8-10	Questionnaires	Thematic analysis, discourse analysis	Tables, analytical charts
To understand the nature of ASD and the current response to facilities provided for those who suffer from ASD.	What are the current conditions and quality of spaces in an Autism facility in Durban?	Autistic centres personals	3-5	Interviews	Thematic analysis, discourse analysis	Themes, Pictures
To understand how sensory architecture can impact on the lives and improve the quality of life of people suffering from autism	What is the impact of sensory design within the built form and development of people with special needs?	Published work, Journals and newspaper articles	2	Case study	Thematic analysis, discourse analysis, document analysis	Themes, Pictures, Text/ Narrative

1.5.8. Conclusion

This section has created a sense of structure to the research background and set out parameters and guidelines including methodology, the theoretical and conceptual of the literature review is aimed to assist the reader in the direction and outcome of this study. The combined primary and secondary sources will formulate a brief and as well as direct the design to the most appropriate architectural intervention, which will fully address the research problems. The research established will help inform spatial criteria, schedule of accommodation, philosophical understanding, urban response and architectural requirements for the proposed design outcome to meet the needs of its users.

Chapter two creates a basis of understanding of the psychological implications of the built environment. The literature review begins by defining psychology as the study of the mind and behaviour and investigates the contributing factors which influence behaviour such as ones sensory stimulus and perception of surrounding environment. A study of autism models assist in procuring the diagnostic procedure and impairments which categorises an individual as autistic. The model is further analysed and literature begins to indicate that the models lack consideration of the cognitive and sensory processing difficulties autistic individuals' experience. The literature review attempts to analyse the gap in literature and is able to find these sensory processing difficulties relevant to the built environment.

Chapter three explores architectural concepts responding to highlighted problems in the previous chapters. These concepts will be implemented through specific theories.

Chapter four and five investigates case studies and precedents which emphasise the highlighted issues and uses the theoretical framework as a basis to analyse the existing and possible architectural solutions.

Chapter six analyses the findings of the case studies and precedent studies. These findings are analysed in relation to common themes discovered in the research process.

Chapter seven reviews the research compiled in this dissertation in response to the main research problem and concludes important findings relevant to the design project.

CHAPTER TWO | THE SPATIAL INTERPRETATION OF AUTISTIC INDIVIDUALS AND THEIR NAVIGATION THROUGH THE BUILT ENVIRONMENT

2.1. INTRODUCTION

Architecture plays an active role in the learning process rather than just a neutral backdrop. There are many factors of architecture that informs a conducive and productive learning environment such as; proportion, size, legibility of space and way-finding that helps soothe and relax a student. A space without purposeful design can cause the complete opposite such as stress and anxiety. Spatial planning and meaningful architecture can fine-tune sensory intake and reduce distraction. While architecture does not necessarily provide learning content, it does provide a learning context that can either support or detract from one's ability to learn (Yates, 2016).

This chapter aims to understand the spatial and sensory needs associated with autism through understanding various autistic behavioural traits and sensory process perceived by autistic individuals in the built environment. The literature review will inform the principles and guidelines of an inclusive design towards a learning centre for Durban. Renate and Geoffrey Caine make the case that students do not detach the learning content from the context and can be strongly influenced by their immediate experience and the space around them. The writers recommend that students are better equipped to learn if their spatial context supports a state of "relaxed alertness". This can be seen when an individual feels motivated while experiencing a sense of wellbeing and safety. The role of the Architect is therefore vital in the shaping of these physical spaces which makes it possible for individuals with a range of needs to learn.

While all students have specific needs with their learning environment, those with ASD have spatial and sensory needs that are regularly left un-addressed in learning spaces. Hence architects and educators need to view the learning environment as an important player in the process of learning and must respond to the specific needs of its users. Anne Taylor argues that the learning environment is therefore a "silent curriculum" as it can influence either a positive or negative educational outcome.

2.2. THE SOCIAL IMPAIRMENTS OF ASD

Autism spectrum disorder is known as a developmental disability that causes social, communication and behavioural challenges (American Psychiatric Association, 2013). Therefore, autistic individuals often communicate differently from their peers. This spectrum

of the disorder means that individuals may have a range of deficits and behavioural conditions from mild to severe. Individuals with ASD face a range of challenges in the learning process. They may have difficulties deviating from strict routines and engage in ritualized patterns of behaviour. Individuals may display signs of extreme fixated interest with unusual intensity. They may display either hyper or hypo-reactivity to sensory inputs from the environment, such as fascination with light or movement, sensitivity to bright light, or adverse response to certain textures or sound (Yates, 2016)

Architecture becomes the mediator in calibrating the sensory information to which it decreases and reduces the excessive and stressful stimuli which cause interference and hinders the learning process. Sensory stimulation plays a critical role in how students with special needs learn, impacting on how they occupy and experience their spatial environment.

2.2.1. Social Disconnection

The social developmental impairment was discovered by researchers Kanner and Asperger in the 1940s and classified as ASD. Hans Asperger and Leo Kanner were both working with children that displayed uncommon behavioural attributes. Both psychiatrists observed children who rejected food, noises and any form of contact. It became clear that they did not feel the need to interact with others and instead desired to be completely undisturbed. These professionals conducted their research separately and were not able to acknowledge each other's findings therefore Asperger labelled the condition as Asperger's syndrome (Gerrard, 2006).

In 1991 researcher Uta Frith compiled various papers relating to Autism including Asperger and Kanner's paper in which she concluded that both professionals were analysing the same condition.

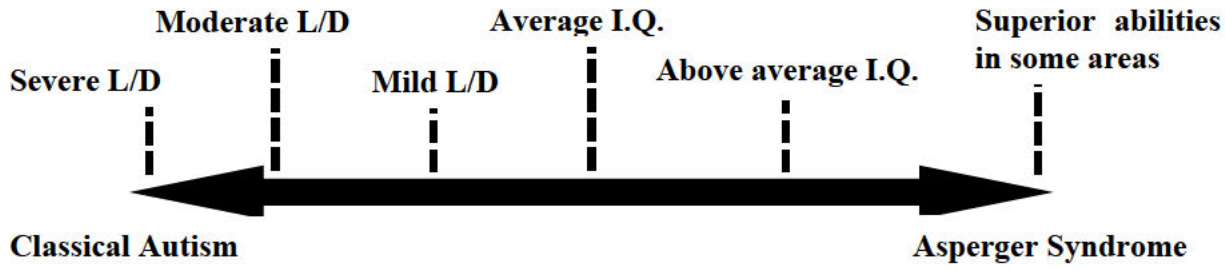


Figure 2.1. Diagram showing different levels on the ASD spectrum **(Source:** Author)

Lorna Wing through Frith's discovery developed an Analysis on the work of Kanner and Asperger, compiling a list of similar symptoms amongst the different study group and was able to prove that both findings were based on the same syndrome. These symptoms could be categorised into features of social interaction, two-way social communication, and imaginative activities. These features are known as the Triad of Impairments (Bogdashina, 2006).

Four groups were created by Wing to categorise Autistic individuals according to their social interaction impairments.

Group one is the **Aloof group** which individuals are unresponsive and indifferent as they do not react to social interaction with other people.

Group two is the **Passive group** may accept social interaction; however, they will not initiate any form of socialism

Group three is the **Active group** they initiate and participate in social interaction willingly but their approach is inappropriate. They may be ignorant to how people respond to their approach.

Group four is the **Stilted group** are usually high functioning autistic individuals who are comfortable with socialising and communicating. What makes them different is their formal and stilted manner of approach.

These social groups provide a range from non-social to excessive social traits. Therefore, social interactive spaces need to bridge the gap and find a balance to support a coherent relationship that would welcome and immobilise individuals to communicate without feeling over-whelmed and isolated by their environment and their senses.

2.2.2. Communication in Autistic Behaviour

Individuals with ASD and others that fall inside the spectrum have difficulties and encounters challenges in communicating. They also demonstrate behavioural challenges that can prevent them from successfully participating in everyday activities. Most individuals with ASD are graphic learners. This means that they recognize what they see better than what they hear (Hodgdon, 2001). Communication impairments play a vital role in a student's life and can be a major disadvantage in the ability to learn and comprehend information. While traditional educational programs focus on developing expressive communication skills, slight attention is

focused on training the individual's skill to understand the communication in their life. It is essential to recognize the difficulties for an individual to successfully take in and understand information, which can be a substantial challenge in a student's life.

Autistic individuals experience many difficulties in communication and are affected by a widespread of skills which includes the individual ability to:

- comprehend social communicative skills
- recognize environmental signs
- Understand and follow directions
- accomplish self-management or organizational responsibilities
- develop and show effective sensitive communication.

According to Lorna Wing the impairments in social communication vary amongst autistic individuals, where some are capable of communicating whilst others may not. The list is as follows:

1.Those who are capable of speech may not use their ability to communicate effectively. Their ability to speak does not align with wanting to communicate and experiencing any form of pleasure from it.
2. The means of communication is seen only as a method to express their needs, but there is no emotional connection or expression in their form of communication.
3. The inability to coordinate their speech with facial expressions, gestures, and body language.
4. Individuals with good communication and comprehension abilities are efficient but lack a range of vocabulary and have a pedantic understanding and use of words.
(Wing as cited in Bogdashina, 2006)

Autism Spectrum Disorder symtoms and communication consideration:

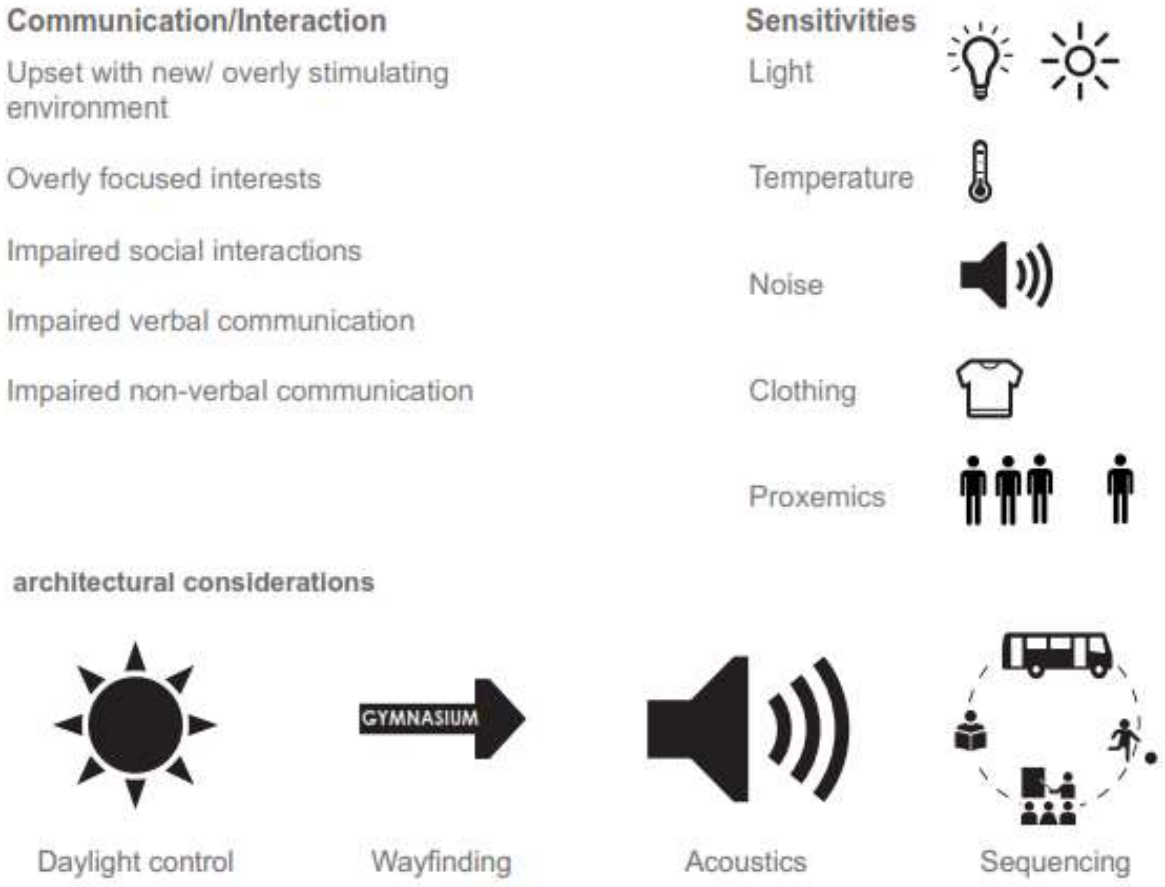


Figure 2.2. Communication consideration (**Source:** Yates, 2016)

2.2.3. Environmental Alienation

Pallasmaa states that: “contemporary architecture is in search for visual and aesthetic beauty, has resulted in environments that have no meaning, do not cater for their user's needs and disconnects these users from the 'genius loci', the sense of the place” (Pallasmaa, 2005). Individuals experience a disconnection or alienation from the environments they inhabit. The disconnection from an environment can weaken one’s sense of self and result to mental and psychological disconnection which can cause mental and physical illness. People spend the majority of their lives within the built environment and if the psychological and physical needs are not met this can cause a negative impact on their well-being.

The human factor should be a vital part of the design process in the built environment. Structures can no longer only meet the physical requirements that people need such as shelter and thermal comfort but also the need to offer support to emotional and specialised needs.

Peoples moods are affected by spatial quality, visual character, acoustic property, texture, colour, and geometry. When taken into thought the built environment should results in spaces that are more conducive to production, well-organized and comfortable. Rapoport (1995) explains: “that the design of any environment must be based on the psychological impact of such an environment on people, their moods, behaviour and social interaction." He emphasizes on humans aspect being the centre of the design process.

Image below shows the multiple sensory input the environment has on an individual:

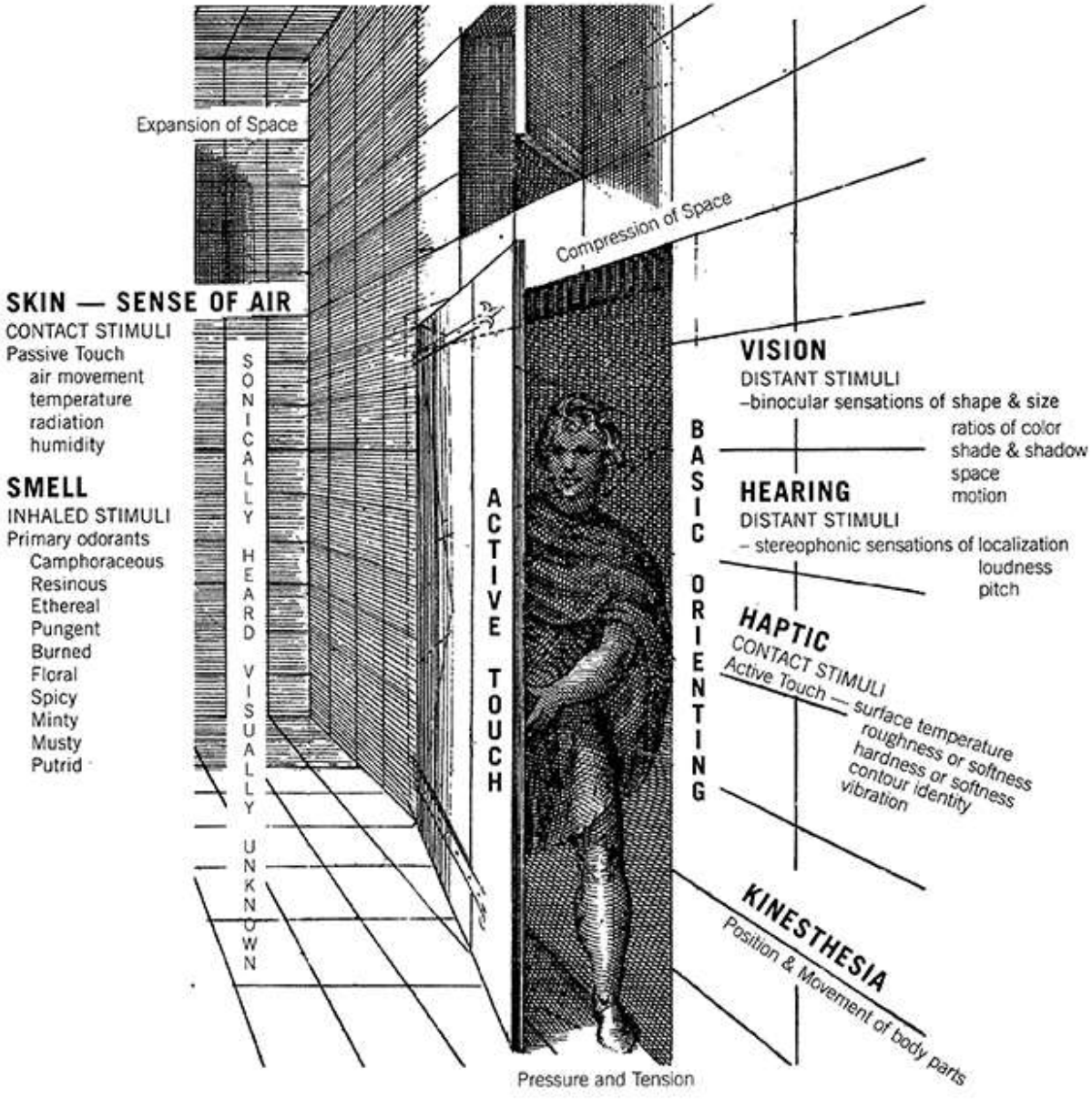


Figure 2.3. Multiple sensory input (**Source:** www.cooperhewitt.org)

For young children and teenagers with autism, the environment is a key factor and is important to be sufficiently balanced to stimulate and enable to connection. A person can become disengaged from a task at hand and not relate to the world at a sensory level, if the environment is "under-stimulating" Environments can also be over-stimulating and distract its users from keeping focused to the task, therefore it is important for architecture to create a balanced environment that responds to the user's needs.

2.3. SENSORY STIMULATION

Sensory stimulation can be seen as a method or tool to provide a sensory input. This stimulation may take any form of sensory input, this may include sound, light, touch, smell, taste and vestibular. These sensory inputs are used for improving ASD symptoms with sensory stimulation.

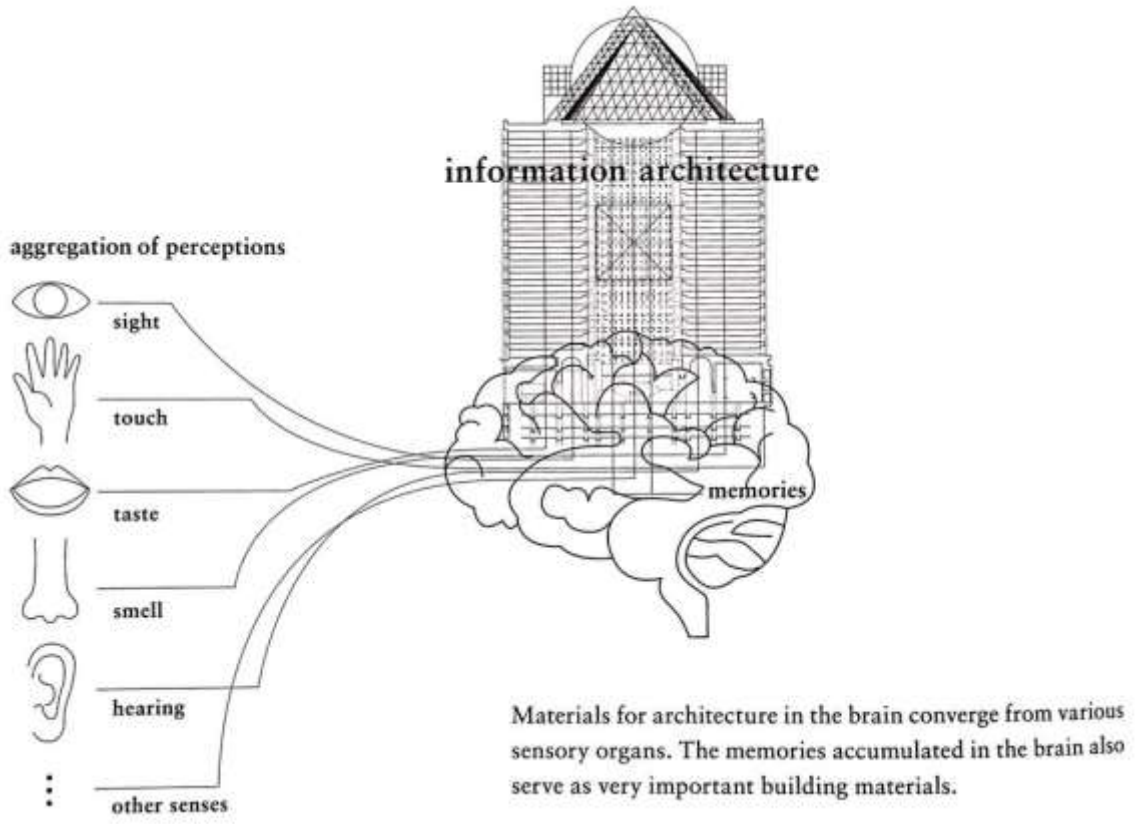


Figure 2.4. Information communicated to the brain through various sense
(**Source**: http://www.aknamarquez.com/)

Autistic individuals have problems processing sensory information. Some people may feel overstimulated or a sense of sensory overload, while others people with ASD experience under-stimulation. These conditions are listed under the category of a sensory modulation disorder.

Most individuals won't notice but there are people who experience overstimulation, or what is known as hyper-reactivity. Overstimulation can cause distraction and make it difficult for an individual to focus on lessons and task at hand. This condition can make it difficult for an individual to focus on any kind of stimulation due to the constant flow of sensory data.

Study has shown that there are specific forms of sensory stimulation that can assist individuals within the spectrum. There are certain methods and tools that can help soothe individuals and act as a stable centre that helps them organize the information they are receiving. Sensory stimulation is a process that can help autistic individuals focus and cope with their environment around them.

2.3.1. The Sense of Modalities

2.3.1.1. The sense of sight

Sight is the preferred channel of movement and comprehension with the physical world. It is the sense that allows judgment for distances and orientation in the physical world. People make visual interaction between positive and negative elements.

The field of sight consist of diverse elements. They may differ from profile, size and colour. To understand the complex structure of the visual fields, humans establish elements into two opposite groups. Ching states: "These groups are positive elements that are perceived as figures and negative elements which provides a background for the figures" (Ching, 1979). The image can be defined as something which an individual directs their attention too. It can be perceived as something bright and having more intensity that its background. Therefore Ching states: "human perception and understanding of an architectural composition depends on how they interpret the visual interaction between positive and negative elements". (Ching, 1979).

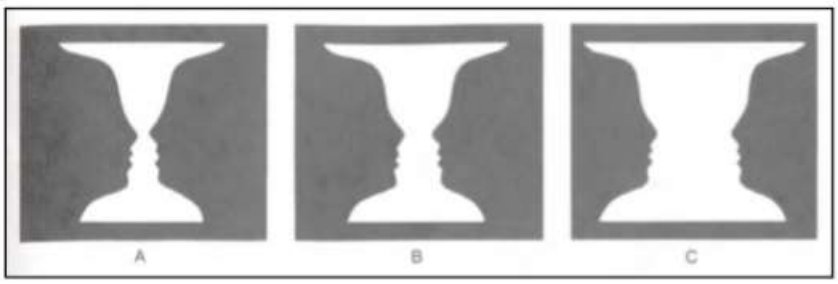


Figure 2.5. Reversible figure ground effect **(Source:** Coren, 1999:297).

Pallasmaa states: “The differential between focused peripheral and vision. Architecture continues to be interested on focused vision but the essences and quality of an architectural environment depends fundamentally on peripheral vision which surrounds a person in space. The peripheral vision transforms retinal gestalt in spatial bodily experiences” (Pallasmaa, 2005). Outlying vision integrates people with space, while a specific vision makes people spectators of space.

2.3.1.2. The sense of sound

Sound creates a three-dimensional atmosphere and enhances a person’s spatial experience. Hearing is an interesting sense in architecture. It allows for creation of spatial experiences. Sound is predictable by rhythm, if there is a rhythm of flow, people will move at a relaxed pace, but if there is an unpredictable rhythm it encourages haste (Augustin, 2009). The time it takes the sound to bounce back indicates the size of space and shape, the tone and can indicate the type of materials, its textile quality and structure. A space is "understood and appreciated through its echo as much as through its visual shape" (Pallasmaa, 2005: 50). Architecture uses the forces of nature to create a sense of ‘zen’ and tranquillity.

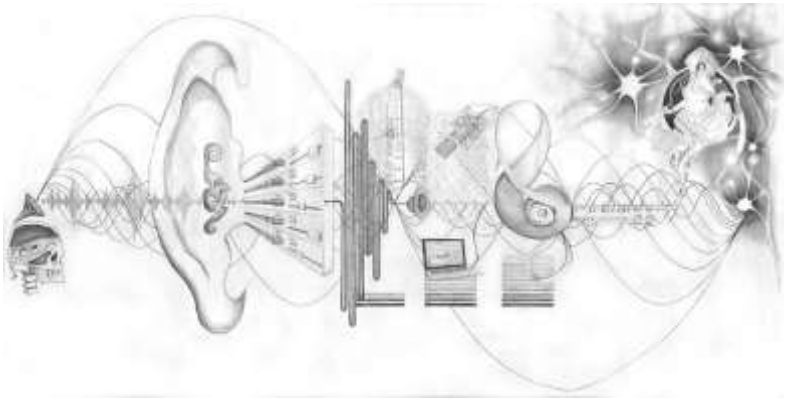


Figure 2.6. Information interpreted through sound (**Source**: https://wordsinspace.net/)

The image above indicates the amount of information that is received through the sound modalities and the impact it can rely on the rest of the senses. Although sound plays a vital role in how individuals perceive their environment, it has been sadly neglected in a contemporary aesthetic society. “Some consider sound to be an unwanted noise and believed that is needed to be suppressed” (Wilson,1984).

2.3.1.3. The sense of smell

The sense of smell is one of the longest senses to register to the brain, but when it reaches it lasts the longest than the other sense. The olfactory sense is regarded as the sense that has the most effect emotionally to the body. People relate to smell with memories. A certain smell can trigger a memory or make a space very undesirable.

Modern methods tend to cover up and "clean up scents" instead of expressing its great potential (Lehman, 2012). Hall (1966) explains that olfaction's provide a sense of ambience to an environment. The shift of smells can help a person find themselves within spaces and differentiate different spaces according to their memories.

2.3.1.4. The sense of touch

Touch fits people's experience of the surrounding with themselves. These tactile experiences provide information of spaces, it gives a sense of texture, weight, densities and temperature (Chow, 2009). An example of this can be seen in the works of Steven Holl and how he expresses this by covering a wall surface with beeswax, surrounded with a gold leaf prayer text, creating a rich experiential environment (Hall, 2008; Olsen, 1997).

Figure 2.7. St Ignatjus Chapel, Seattle, by Steven Holl (**Source:** Olsen, 1997:50)

A school in Hazelwood (2009) encourages children to use touch as a means of finding there way different textured walls differentiate different spaces and classroom within the school.

Figure 2.8. Hazelwood School (**Source:** Rodger, 2007: 30)

As with the other senses of smell and sound, the contemporary society has given little concern to the vital role of touch in the built environment. Pallasmaa explains that architecture may seduce and amuse the eye, but it should also offer for the sense of touch and experience of people's bodies.

2.3.1.5. Vestibular and Kinaesthetic

Kinaesthesia is understood as; "a sense mediated by end organs that lie in the muscles, tendons, and joints and are stimulated by bodily movements and tensions." (as cited in van Kreij, 2008:19). Kinaesthesia doesn't directly relate to the sensory system such as giving the body emotion. However, it does impact on the senses people experience. This takes place through their position and motions. Kinaesthesia deals directly with people's movement inside a space and this can impact on the way people perceive the built environment. This can be seen in Le Corbusier's idea of the promenade in which he describes that human perception of space changes progressively depending on their location (cited in De Vega, 2009). Careful planning that creates a connection between spaces and allows for a gradual exploration can control and enhance users experience.

The concept can be seen clearly in: Le Corbusier's design of Villa Savove (1931). The individual spaces are programmed to lead the user from one space to the other, while providing a gradual transitional allowing the spaces to create a seamless flow.

Figure 2.9. The Concept of Promenade by Le Corbusier's Architecturelle in the Design of Villa Savoye (**Source:** Samuel, 2010: 115 123)

The user is confronted by dominant central ramp upon entrance, the central ramp which directs the user up through the building, whereas a spiral staircase is positioned away from the entrance, which discourages immediate use. (Refer to the image)

"The vestibular system, situated in the inner ear, provides information regarding where the body is in space and its speed, direction and movement in relation to the pull of gravity" (Wilkes, 2005). This can be seen as what is responsible for a person's posture and balance.

Figure 2.10. stepping stones in garden of the Heian Shrine in Kyoto, Japan (**Source:** https://japon-fr.com/)

The spatial organisation of the stepping stones in a rhythmic pattern allows people to participate with its journey through the space. "Their body is considered as a tool for spatial interpretation thus, its movement and orientation determine peoples experience and perception of the built

environment". (Hall, 1966). The contemporary spaces and the built environment provide very little enthusiasm or sensory variation and almost no opportunity to create kinaesthetic range of spatial experiences. The modern age of technology and transportation left people distant from their movement and journey through spaces from one space to another.

2.3.2. Sensory Design Theory

2.3.2.1. Sensory integration

Herbert states: "The common characteristic of autistic individuals is their difficulty with sensory processing and their inability to make sense of sensory experience. Individuals with autism show signs of orientating responses, filtering incoming stimulation, processing and interpreting sensory information, especially information that is complex and requires multiple modalities" (Herbert, 2003). There are three main components that comprise of sensory integration theory; Integrative dysfunction, normal sensory integration functioning and intervention program that uses sensory integration techniques.

Dr. A. Jean Ayres is an occupational therapist that developed Sensory integration theory (Herbert, 2003). Ayres defines sensory integration as: "a neurological process that organises sensations from a person's body and from their surrounding environment. Information from all the senses needs to be integrated in order for suitable responses to be elicited" (Whitman & DeWitt, 2011). Sensory integration occurs when stimulation is received, organised, formulated and interpreted to form an emotion and behaviour output. (The process shown in a diagram on the next page).

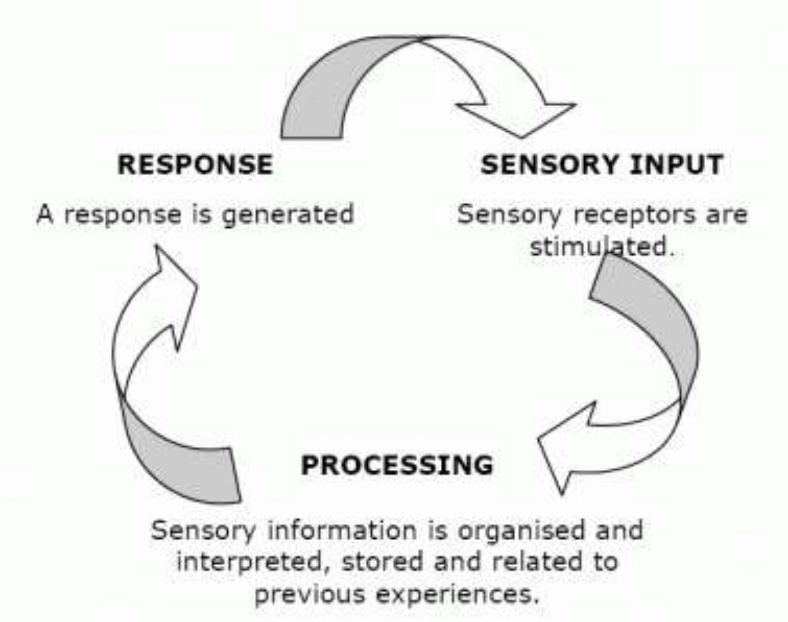


Figure 2.11. Diagram showing the steps to sensory integration.
Source: (https://www.emaxhealth.com/)

2.3.2.2. Sensory Integrative Dysfunction

Paron-Wildes states: "Individuals that experience difficulties with sensory integration may experience deficit associated with one of their sense while experiencing no problems with their other senses" (Paron-Wildes, 2008). Sensory integration dysfunction takes place in almost 80 percent of individuals with autism. An individual with autism suffers from one or more of the following sensory related problems; hyposensitivity, hypersensitivity, sensory overload, sensory fixations, unusual sensory attractions and sensory tune-outs (Whitman & DeWitt, 2011). Sensory dysfunction can make it difficult for autistic individuals to understand the built environment. Daily experiences, that neuro-typical people take for granted, can be negative and upsetting for those who suffer with ASD. These feelings not only are unpleasant but can be accompanied by pain, stress anxiety and fear. Those with ASD create a series of behavioural dissipations and managing strategies to evade these negative sensory experiences.

Sensory strengths and challenges in a cafeteria-simplified:

Figure 2.12. Image of different sensory profiles, hyper and hyposensitive (**Source**: https://theenthusiasticlife.com/wp-content/uploads/2017/04/Sensory-in-lunch-room-768x768.png,)

2.3.2.3. Sensory integration techniques

Sensory integration therapy provides appropriate graded sensory experiences to facilitate adaptive behaviour. When attempting a task autistic individual are aggravated by simple stressors therefore it evokes multiple emotions. "The aim of the techniques works with the senses calming or arousing the individual, creating the optimum level of arousal for performing specific task. The therapy involves gentle exposure to various stimuli" (Wilkes, 2005) Appropriate structured physical environments that facilitate unique processing patterns allow for those with ASD to overcome these negative sensory experiences and cope with everyday changes in a positive manner.

These integration techniques make use of simple learning environments. This eliminates any distractions that can divert an individual's attention. The easy and predicable surroundings can give the person with a sense of safety and security. The process will then gradually increase in

complexity without causing too much anxiety or stress. Once the individual starts to show a positive response the slow introduction to sensory inputs are then implemented in a suitable manner (Wilkinson, 2010). Beaver states that: "sensory rooms and gardens are used to stimulate, develop and balance the sensory systems of individuals with sensory problems and have shown great strides in the development of certain individuals" (Beaver, 2010). These are structured according to separate sensory zones has individuals with ASD find it difficult to focus on more than sense at a time. Larkey states: "Individuals with sensory difficulties do not explore their environments in the same way as neurotypical person. Consequently, individuals with ASD have limited environmental experiences and are fearful of change. Sensory programs encourage people with ASD to interact with their environment thus, reducing the fear associated with it" (Larkey,2007).

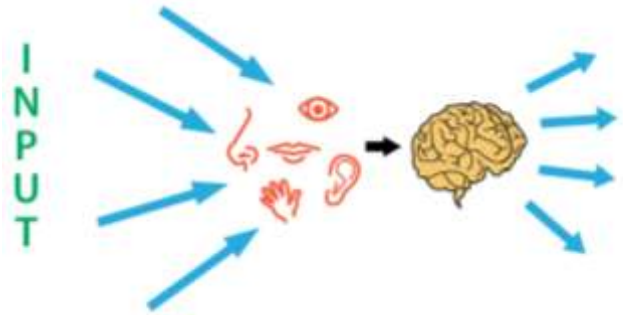


Figure 2.13. Sensory input illustration (**Source**: https://childsuccesscenter.com/)

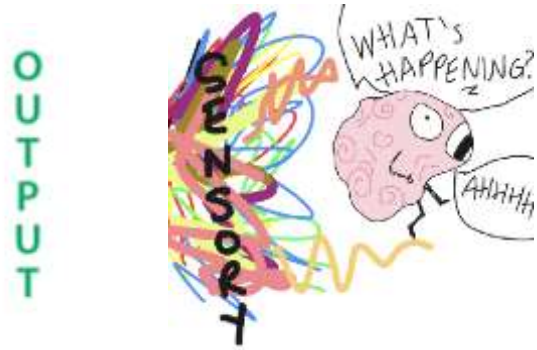


Figure 2.14. Sensory output illustration (**Source**: https://eatingoffplastic.wordpress.com/)

2.3.3. Neuro-Typical Design

Neuro-typical design theory is an opposing theory to sensory design theory. Kern states that the latest global research on the sensory processing difficulties do indicate that it influences an autistic individual's "modalities and multisensory processing systems" (Kern as cited in Henry, 2011). Autistic individuals need a sensory controlled environment, through neuro-typical design approach they will be able to concentrate whilst developing and refining their skills. The environments that are controlled will need adjacent sensory saturated environments as this will help individuals practice their skills in different areas and not become adapted to one specific, controlled environment. This will allow their minds to transition into real life setting much easier and be encouraged to implement their acquired skills outside the classroom.

The diagram below shows design methods that can be used in a three-stage design

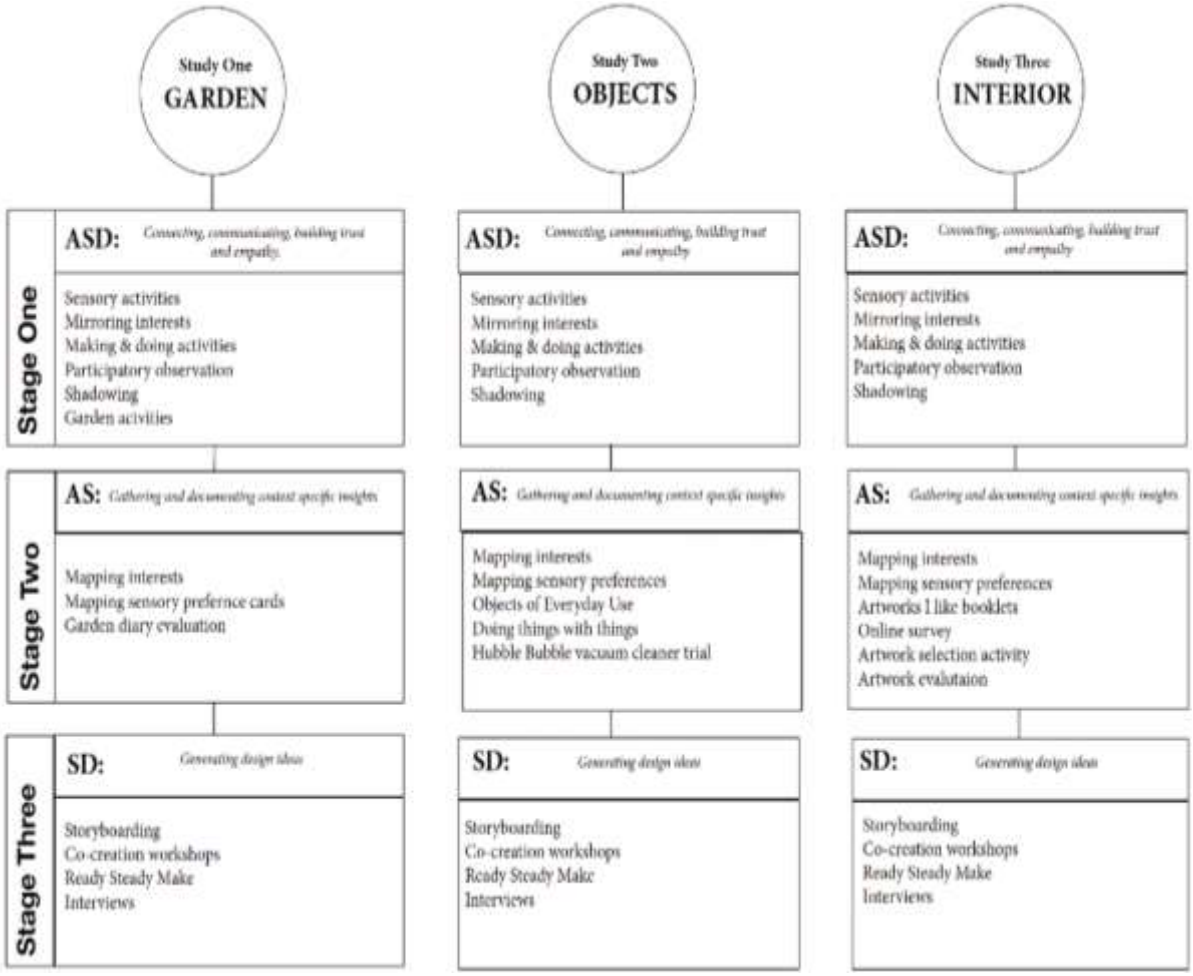


Figure 2.15. Design and wellbeing by Katie Gaudion, Ashley K. Hall

(Source: https://www.semanticscholar.org/)

According to Leestma (2015), both theories have valid approaches and principles, however, it is important to implement both theories to balance and counteract the opposing gaps outlined by each of the theory's proponents. The both theories applied together plays a role in the development and acquiring of skills in autistic individuals through the built environment. This study is tasked with implementation of both theories addressing the questions and concerns. Through the approach of sensory architecture has brought light to successfully obtaining the balance of creating three types of environment in one learning facility. The controlled environment, the sensory saturated spaces and the public environment. Sensory and neuro-typical design will develop an architectural framework to generate a response to the sensory difficulties experienced by autistic individual.

2.4. THE IMPACT OF THE BUILT ENVIRONMENT ON AUTISTIC INDIVIDUALS

Autism has always been diagnosed from an analysis and measured by their impairments, but to fully understand how those with ASD perceive the world around them, we need to listen to their experiences and views. Through literature published by autistic individuals, authors derived that sensory perception difficulties influence the way in which they interact in environments. Norberg- Schulz defines existential space as a "concept of space" which allows an individual to create an image of his surroundings. The experience, understanding and perception of space i.e. the environment is unique to each individual (Serrano, 2011).

Figure 2.16. Image of a world cloud illustrating design challenges and design principles
(**Source:** Magda, 2015; 68)

In generating an image of the environment many cognitive processes are being enabled and this allows one to engage with the environment on various sensory levels. Those who have sensory difficulties their perception becomes distorted of the reality of their environment. One of these sensory difficulties is explored by Baumers and Heylighen (2010) through an analysis of published literature from autistic individuals explaining their perception of the world and has identified that many individuals perceive the physical space as a fixed entity with expectations that it never changes. Within this physical entity individuals seek security however the physical space is ever changing, contradicting with the need to seek a sense of grip.

The built environment continues to be designed following universal codes which may include the consideration to disabled bodies, but this lacks the consideration for non-visible

impairments. When designing there is always a desired atmosphere or perception created. However, the perception desired commonly lacks the consideration of users with non-visible impairments. The cognitive process of perception has an enormous effort to gain understanding of the environment, through the overwhelming amount of sensory information needing to be processed. This struggle often results in self-stimulated behaviour, such as repetitive movements or utterances which is used as a mechanism to endure this sensory overload (Smith as cited in Pilar et al, 2011)

Figure 2.17. Image of person and person in a wheelchair with caption (**Source:** https://blog.senedd.wales/2016/07/07/not-every-disability-is-visible-invisible-disabilities/)

Through the understanding of the social, communicative and behavioural impairments, architects with the aid from psychologist have been able to develop architectural concepts in response to creating environments that is inclusive of autistic users. Some of the contributors to the development of this design criteria has been Christopher Beaver (2006), Simon Humphreys (2008), Ian Scott (2009), Baumers and Heylighen (2010) and Magda Mostafa (2015). The architectural concepts that have been found to be most relevant to this research and aim, is a combination of concepts or principles by Humphrey and Mostafa. The architectural aim to create a sense of calm, order, and simplicity as indicated by Humphrey and Mostafa but also carefully highlighted by Osgood that only focusing on the sensory challenges may lead to designing environments that create isolated success within these customised environments (Henry, 2011). Using Sensory Design Theory as a basis Mostafa has derived an Autism ASPECTSS Design Index to create a sensory inclusive and responsive environment (Mostafa, 2015). These autism inclusive architectural concepts will be emphasized later on in this study.

2.5. CONCLUSION

To conclude, the literature review explored the sensory and phycological impairments of autistic individuals and allowed the study grasp the basic impairments outlined by existing theories and models on autism. The focal argument amongst the literature has been based upon the spatial needs and perception of space by autistic users. This guided the literature review to explore the sensory perceptions and profile of those with ASD, through published sources that expressed the voices of autistic individuals. This has successfully and evidently expressed the important role of architecture within this spectrum.

The research which is based on the sensory experience and perception of autistic individuals as they experience the built environment. It will allow the creation of an architectural response to the spatial needs of autistic individuals. This chapter has set a foundation that further on in the study will build and use to apply the appropriate architectural theories and themes that will set the guidelines and principles towards an architectural model for a learning centre for Durban.

CHAPTER THREE | ARCHITECTURAL FRAMEWORK PERSPECTIVE IN RESPONSE TO SPATIAL NEEDS OF AUTISTIC INDIVIDUALS

3.1. INTRODUCTION

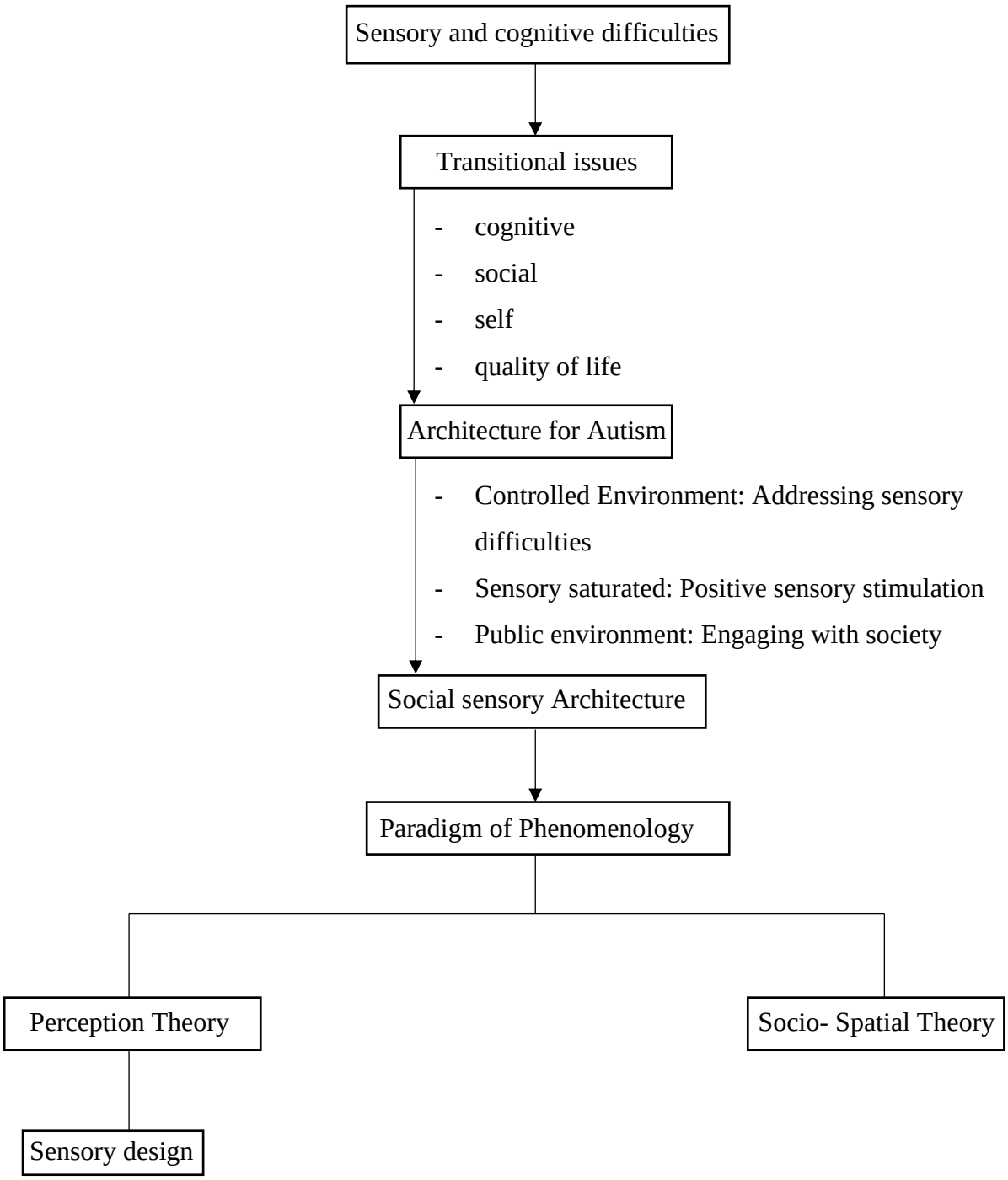
The previous chapter is used as a foundation to gain an in-depth understanding of the vital role of the built environment and its relation to autistic needs and behaviour. Chapter three will provide an outline of the specific spatial needs, understanding the sensory input from surrounding environments, architectural theory and concepts related to sensory design and architectural psychology. "Architecture and Autism Recent research have indicated that autism is growing at almost epidemic proportions" (Hill & Frith, 2003). A large amount of the architectural community still ignores this growing epidemic in learning environments by the simple exclusion of the need for sensory stimulation and non-visible disabilities such as Autism.

Only until recent, individuals that previously displayed symptoms of ASD were admitted in psychiatric facilities and institutions due to lack of knowledge and awareness about the condition. (Beaver, 2010). Beaver states that: "these establishments paid no heed to the quality of the environment, using corridors with rows of doors on each side, shiny surfaces which reflect noise, inadequate spaces for children to feel comfortable, flickering florescent lighting, multiple changes in level and complicated building layouts where it is easy to get lost. All features that are deeply confusing and frustrating to the autistic mind" (Beaver, 2010). Autistic individuals that experience negative impact of the built environment such as frustration and distress end up resulting in common challenging behaviours associated with ASD.

The design should answer to the requirements of its users that it come with interaction. The nature of the requirements of individuals with ASD are complex and not fully understood, to design suitable environments for the needs of those with ASD, their treatment models and specialised needs must be understood.

For one to better understand this disorder and to design for the spatial needs of autistic individuals, one has to study the theories and principles outlined in the past related to the mechanism of autism.

Figure 3.1. Conceptual framework on the theoretical perspective used in this architectural study as shown below: (**Source**: Author)



3.2. PARADIGM OF PHENOMENOLOGY

The philosophy of phenomenology was initiated by Edmund Husserl and Martin Heidegger (Habib, Sahhaf, 2012). The philosophy was approached from an architectural perspective through the work of Christian Norberg-Schulz, to which he developed it into a framework of Existence, Space and Architecture. He quantified space as "existential space" and also defined the "spirit of place" as the genius loci. The existential space was divided into various levels of geography and landscape, urban level, the house and the thing. The house remains the central node of this theory and justifies that the house is the central component of one's existence. It is the place from which one understands and interprets his connection to the world (Norberg-Schulz as cited in Habib et al, 2012).

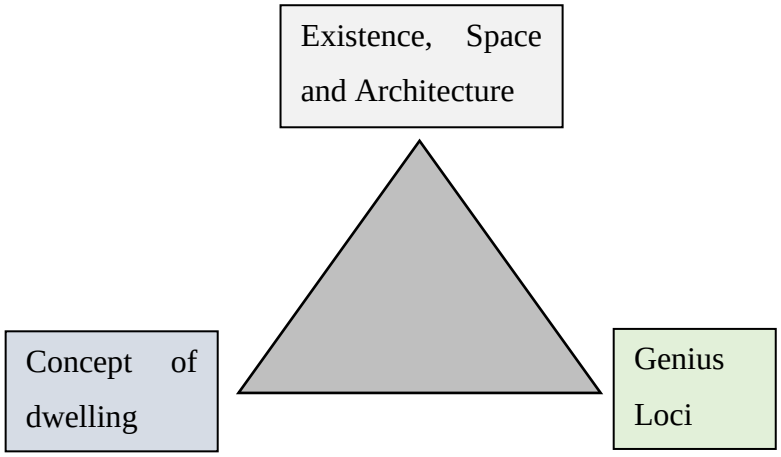


Figure 3.2. Diagram showing the Phenomenology trilogy in architecture (**Source**: Habib, Sahhaf, 2012; 46)

3.2.1 Sense of Place

Meaning and memory encapsulate a certain place which can be different from specific individuals, these meaning and memories can be associated in either a positive or negative manner dependent on the character of the individual. The physical and atmospheric characteristics of a place gives a space meaning. Norberg-Schulz explains that the centre of one's existence of space is their house and the aspect that makes up their sense of place derives their identity and quintessence in the world. This expresses the influence space has on an individual and their construct of the world. "Even visual perceptions are fused and integrated into the haptic continuum of the self; my body remembers who I am and where I am located in the world" (Pallasmaa, 2005, pg. 11). Individuals make various attachments with space through engaging experiences, memories and choices. Quality of spaces can be defined by the

characteristics of its environment such as; noises, lighting, tones, the ability to feel secure and visual elements.

These qualities influence an individual's experience which creates a sense of space that is perceived by the individual of their environment. A "sense of space" of an individual's personal experience is influenced through their sensory processes of smell, touch, hearing, imagination, and anticipation (Vanclay et al, 2008, pg. 4-7). These are the processes in which autistic individuals find most challenging in everyday life.

3.2.2. Enactivism through Sense-making

Enaction refers to the sense-making aspect of cognitive processes and how we use the sensory processes to connect to the world to facilitate our needs and objectives (Jaegher, 2013). Pallasmaa (2005, pg. 64) states that we interpret the world through our senses and bodily existence and the world around us becomes organised around our body. Hanne De Jaegher paper on embodiment and sense-making in autism explores the influence of autism impairments has on the sense-making of their surrounding world. The interpretation of sense-making in Jaegher's research is that sense-making is based on fulfilling our needs and goals through our bodily processes of organising and maintaining, whilst still having a developing perspective of the world (Jaegher, 2013).

Architecture has the responsibility to act as a response to the transitional phase through creating a built environment where an autistic individual can experience a sense of belonging and develop a self-identity in the neuro-typical world. Sensory inclusivity and interactive architecture for autistic individuals is justified through the theory of Phenomenology. The theory acts as a paradigm which supports the theories of perception and socio-spatial theory which conveys the fundamental principles of Phenomenology.

A learning environment needs an approach that "integrates the cognitive, social, communicative, embodied, interactive, experiential, and affective components of autism" (Jaegher, 2013, pg.3). The enactive approach is applied by the use of the bodies various networking processes which includes the cognitive process to connect to the world which is the same approach that can be applied to learning environments of autistic individuals. This approach can also be used to include one's experiential sphere as an integral process of connecting to the world.

3.3. PERCEPTION THEORY

The relationship between humans and the environment are connected through various perceptions. Through understanding these perceptions one can understand how humans experience space and the built environment around them. Norberg-Schulz (1965) states that: "by better understanding the process of perception a deeper understanding of the experience of architecture can be attained".

3.3.1. The Process of Perception

The built environment consists of various elements and stimuli. The place is not just made up of individual rooms, buildings or outdoor spaces but the total environment. "The phenomena of experiencing these places through the senses of sight, sound, touch, smell and taste is known as perception" (Hesselgren, 1975).

There are two kinds of perception distinguished by philosopher Taylor Carmen (2008) one is the inactive sensory dimension of sense experiences, the other is an active motor dimension, which relates to bodily actions. These two kinds of perceptions do not work on their own but rather work simultaneously with one and the other (Seamon, 2010:6). Individuals with ASD often have a deficiency with this perceptual process, they find it difficult to acquire the same continuous experiences of their surroundings. (Joiner, 2007) The diagram below shows how external information permits through certain areas of the brain and how sensory perceptions are linked and assured to universal types of things in memory.

The perception of the pencil, for example, is joined with the concept of writing.

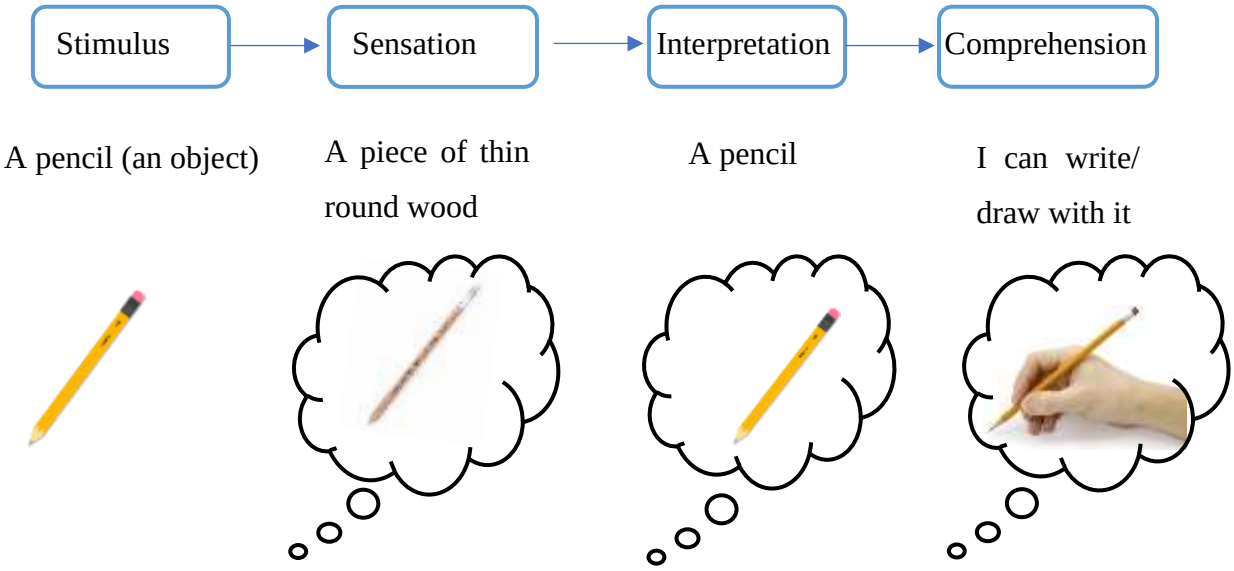


Figure 3.3. The process of perception (**Source:** Author)

The physical medium for autistic individuals is perceived as normal and function properly such as the ears or eyes. It is the progression of perception which differ and doesn't work in the order alike to neuro-typical individuals so the environment is supposed different. According to Leestma: "The different types of perceptions experienced by autistic individuals can cause some kind of psychological pain to the individual such distress, anxiety, fear of confusion and cause the person to act in abnormal ways when they are trying to block out the unwanted stimuli. Some of the most common difference in sensory perception are intensity, sensory overload, gestalt perception, fragmented perception, delayed perception, distorted perception, sensory shutdowns, and compensation" (Leestma, 2015).

3.3.1.1. Intensity- Hypersensitive

Hypersensitivity is when the canal between the stimulus and brain is too open; therefore, the brain receives too much information for it to handle. To block out this hypersensitivity the individual will either rock themselves, swing back and forth, hit their ears, twist, flip or spin.

Figure 3.4. A neurotypical view compared to hypersensitive (**Source:** Leestma, 2015, P. 20)

3.3.1.2. Hyposensitivity

Hyposensitivity is the opposite of hypersensitivity; this is where the channel is not open enough and does not let in as much information as needed and the brain is deprived. The individual is incapable to feel their own body and withdraw from the environment around them. For autistic individuals to get their nervous system working again they might bang doors, seek out loud noises or self-injury.

Figure 3.5. A neurotypical view compared to hyposensitive (**Source:** Leestma, 2015, P. 21)

3.3.1.3. Sensory Overload

Sensory overload is when the environment becomes too unbearable for the individual and is unable to take in all the information. The nervous system of an autistic individual does not function fully filter out the irrelevant information such as patterns on walls, feeling of clothing or people moving. The brain processes all the information at once therefore creating a sensory overload. Sensory overload for autistic individuals can be triggered by "bright lights, fluorescent lights, colours and patterns makes the body react as if being attacked or bombarded, resulting in such physical symptoms as headaches, anxiety, panic attacks or aggression".

Figure 3.6. A neurotypical view compared to sensory overload (**Source:** Leestma, 2015, P. 22)

3.3.1.4. Gestalt Perception

Gestalt perception is when an individual is unable to differentiate foreground and background information, therefore information is perceived as "a whole" instead of an amalgamation of different items. A person that experiences visual gestalt finds it difficult to focus on an individual parts of a scene and find it difficult to separate it from the whole picture. A slight change in detail can cause difficulty for an individual with a gestalt perception to adjust. An example of this if an image on the wall is not square or a piece of equipment has been moved this changes the gestalt of the entire scene and the setting will feel unfamiliar and therefore can cause anxiety, tension and frustration.

Figure 3.7. A neurotypical view compared to gestalt perception (**Source:** Leestma, 2015, P. 23)

3.3.1.5. Fragmented Perception

Fragmented perception is associated with autistic individuals not fully able to breakdown the whole image into meaningful units. The individual might process partial information of a scene or sentence and completely neglect the other components. Autistic individuals with fragmented perception may have difficulties connecting socially with others because several parts can seem isolated. This also leads to trouble rendering facial languages and body expression.

Figure 3.8. A neurotypical view compared to fragmented perception (**Source:** Leestma, 2015, P. 24)

3.3.1.6. Delayed Processing

This is when an autistic person takes much longer to process information compared to neurotypical individuals. This creates the issue of the individual finding it difficult to understand and absorb new things. Delayed processing makes it hard for an individual to learn things in the right context in which the learning process took place. If the person has learnt a specific skill in a particular context they might not be able to transfer it to a different context and might have to relearn it.

Figure 3.9. A neurotypical view compared to delayed processing (**Source:** Leestma, 2015, P. 25)

3.3.1.7. Distorted Perception

This particular perception is related to when the individual's senses get distorted or misinterpreted for example when something may seem smaller than it is, also this can cause poor self-awareness and seeing things in two dimensions. Distorted perception becomes worse when there is an overload of information.

Figure 3.10. A neurotypical view compared to distorted processing (**Source:** Leestma, 2015, P. 26)

3.3.1.8. Sensory Shutdown

A sensory shutdown is when an individual experiences an overload of information. Its either some or all of their senses are being overstimulated and the individual is unable to manage. The overload of information causes some of their senses to shut down or block out stimuli that allow other senses to function better. Often this causes individuals to retreat or withdraw from the world around them and ignore any stimuli around them.

Figure 3.11. A neurotypical view compared to sensory shutdown (**Source:** Leestma, 2015, P. 27)

3.3.1.9. Compensation

Due to the above processing disorders an autistic individual might rely on or compensate through more reliable senses such as touch and smell to better understand their environment.

They may use these senses to navigate through their environment and create a better understanding of their environment around them.

3.3.2. Perception and education

The role of sensory perception plays an important part in the lives of autistic individuals and impacts their performance in the learning environment in how the individual's process information and learns. There are three basic categories of how an autistic individuals brain works concerning learning and they are grouped into: “sensory oversensitivity, perceptual problems, and difficulties organizing information” (Leestma, 2015). In the autism spectrum children from mild to serve cases express different signs of difficulties processing information the three categories help understand what kind of difficulty the child is experiencing and what sensory stimulation will aid in creating an environment to the needs of their condition.

Sensory oversensitivity can range from mild (which includes signs such as mind nervousness when the surrounding setting is too loud, lively or chaotic) to serve case could lead the individual to go into a tantrum every time they are in a large public space such as a supermarket (Leestma, 2015). Attention and concentration are two important attributes to learning becomes distorted when senses are disordered and makes it difficult in some cases or impossible to learn. This makes the training and learning process problematic as children apply their days dreadful of people and spaces due to experience because they have been overwhelmed by their senses. For children to feel calm, relaxed and safe they need to be in an environment they understand and responds to their specific needs.

Perceptual issues can determine the most effective style of learning needed for specific individuals. An individual that may have issues with auditory perception may not notice the noises coming in and out a poor phone reception. This individual is therefore more expected to perceive information and acquire best through visually accessible information. Individuals with visual perception issues may learn best through the audio channel as that may be more relaxed for them to process. While the possibility of a person with equally visual and auditory processing problems. “These individuals may learn best through their sense of touch and smell. They may learn letters and numbers best when they can touch them, and trace their shape with their hands or fingers. Representative objects rather than visual charts can be useful in helping these individuals know when it is time to transition to a new activity. Schools need to be adaptable to teach students with all degrees of perception issues and be able to adapt the environment to a student’s specific needs” (Leestma, 2015).

Individuals that have problems organizing information, may be able to receive information fine but not make sense of it. The lack of cognitive organisation may have an impact on the individuals. Leestma states that: "problems with organizing information affect a child's ability to form categories that are the foundation for later concept formation. Difficulties that people on the spectrum have with multi-tasking would also fall into this category. These difficulties are highly variable and range from mild to severe depending on which brain circuits connected and which ones did not" (Leestma, 2015). The ability of an autistic person to learn in a traditional classroom becomes compromised due to this problem. Learning environments that can adjust to their users and offer flexible learning means can create a greater influence on the lives of their learners.

3.4. SOCIO-SPATIAL THEORY

Socio-spatial theory focus is of a political stance and empowers the public to use their social space to act as a united front against the political measure. This architectural study aims to counteract the universal institutionalised design and to design the spatial needs that are specific to its user group, yet still interactive and inclusive with society. The aim is to create a social space that encourages an experiential engagement between autistic individuals and neuro-typical society. Henry Lefebvre encourages a public space of representation where marginalised groups of people are more vocal and interactive in society (Lefebvre as cited in Haas, 2012).

Lefebvre established a theory to explain the connection between space and social relations (Haas, 2012). Lefebvre recognizes space beyond its physical characteristics and concedes it as an element which exemplifies social interaction in society. This space of social interaction is formed by ourselves and we all interpret it and engage with it through our senses. Lefebvre further categorises space into the Triad of Space and relates this theory from a political understanding in relations of the right to the city. The first constituent to the triad is the conceived space which are political systems required to rein control over society, secondly is the perceived space that is experienced within our immediate context and thirdly is the lived space in which we use for social practices in our daily living (Lefebvre as cited in Haas, 2012).

Dear and Wilson (1997) explores the perception of society on interrelating with the disabled. The substance of this considerate witnesses the method in which we understand the world and this is through distinguishing between similarities and differences. We frequently set boundaries and limits to understand where we fit into the social context of the world and it

leaves us untying ourselves from those that are different. Those that are unlike in society are generally the disabled and within the disabled community are levels or severity of a disability. Physical and mental impairments are observed differently and have an impact on society choosing to socially interact with either form of disability (Dear et al, 1997, pg. 455-457).

Social interaction with the disabled has an order of hierarchical acceptance. One form of disability may be more acceptable than another. According to Takahashi hierarchy of acceptance (1992), the mentally impaired are regarded as 6th on the list out of fourteen disabilities and differences (Takahashi as cited in Dear et al, 1997). Autism has been recognized as a disability however there is a limited attempt from the government to create awareness and facilities or strategies to alleviate the boundaries between neurotypical and atypical individuals. Special facilities and design aid autistic individuals and assist them with managing their impairments but the very same design also isolates them from the real-world environment and restricts from social interaction with society. According to Dear and Wilson (1997, pg. 474), physical space has a role in adjusting and eliminating the boundaries between the able and disabled by lessening the social distance placed between the two communities in society.

3.5. SENSORY DESIGN

Through studies done in the last decade and continued research, architects can now better understand how to design for people with ASD. Architect Magda Mostafa a pioneer in the field of study created the Autism ASPECTSSTM Design Index through the interpretation of Sensory Design Theory. In this index Mostafa outlines seven issues that affects positive behaviour and skills development in users with autism and ASD:

3.5.1. Acoustics

The management of sound in an environment, through the adjustment of the materiality within a space and type of walls which defines a space. Careful consideration needs to be given to the particular lighting fixtures which does not exude a noise frequency. The focus of sound management is to limit the background noises and allow an autistic individual to experience their surrounding environment without unpleasant interference allowing them to focus on either engaging with a task or others.

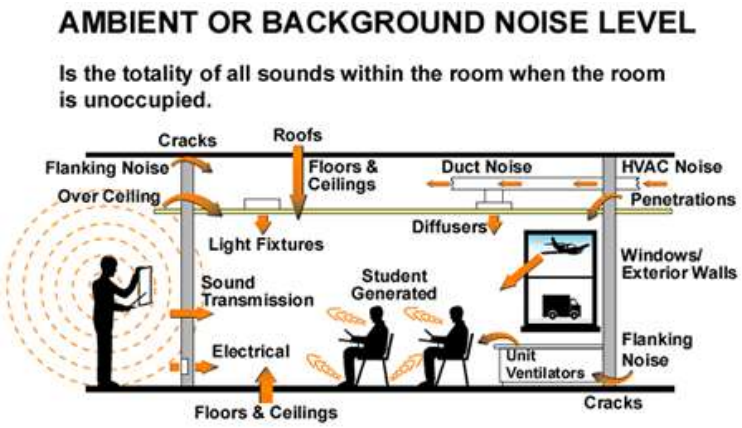


Figure 3.12. Background noises in a typical classroom

(**Source**: https://www.acousticalsurfaces.com/, Accessed: August 2020)

3.5.2. Spatial Sequencing

Spatial sequencing requires a sense of simplicity, calm and order. The transition from one space to the other needs to flow without many sensory distractions. Humphreys (2008) states that: "complexity within the built environment causes stress to individuals with ASD as they are incapable to filter or differentiate between separate stimuli such as noises, shapes and colours. Therefore complex environments with a lot of stimuli are experienced by them as perplexing and extremely troubling. By keeping spaces clear, calm and ordered the confusion experienced by individuals with ASD is reduced (Humphreys, 2008). A sense of simplicity in the arrangement and organisation of spaces allows individuals with ASD to effortlessly navigate a building without undergoing high levels of anxiety.

Figure 3.13. Image symbolic of the spatial sequence design principle.(**Source**: https://www.autism.archi/aspectss, Accessed: August 2020)

Creating a sense of tranquil and order does not only remain restricted to the building plan and section but similarly through the choice of materiality, an example, employing a selected palette of materials helps to create clearness within the spaces. Busy patterns and bright colours in building materials confuse and disturb children (Scott, 2009), this exposes the individual to the negative spatial experience. Humphrey states that: "complexity in the details of a building can cause visual distractions and some children with ASD develop obsessions with these details" (Humphreys, 2008). An example of this can be seen by a patterned floor, this can often cause confusion and unease when those with ASD tread on them. Some individuals get hooked when looking at a certain pattern and can spend extended periods staring at it (Nguyen, 2011). A simple minimalistic environment provided can be ideal, to which stimulus can be added as suits the specific user's needs.

Herbert (2003) defines that order, clarity and structure as vital elements in designing autism-friendly environments; these elements decrease sensory demands, encourage freedom and reduce unsuitable behaviour. Thus, buildings ought to represent a modest layout that echoes order, calm and clarity with clear spatial sequencing and way-finding.

3.5.3. Escape Spaces

Escape spaces is a collective term encompassing all spaces or a place in which someone in the spectrum retreats too. This allows them to retreat to change the level of stimuli. This change can involve increasing or decreasing the level of stimulation. An example of this could be seen in 'a sensory suite' that allows the environment to be adjusted according to the user's sensory needs either being over or under-stimulated.

Figure 3.14. A time out escape space for students (**Source**: https://www.todaysparent.com/)

The purpose of escape spaces is to provide an interval for the individual from the over-stimulation experienced in their environment. Experimental research has substantiated the constructive effect of such escape spaces, specifically in learning environments (Mostafa, 2008, 204). Such environments may contain a small subdivided area or crawl space in a quiet segment of a room, or through a building. These spaces should offer a unbiased sensory environment with slight stimulation that can be modified by the user to offer the necessary sensory input.

3.5.4. Compartmentalization

Compartmentalization of learning spaces or an entire building into compartments to outline and limit the sensory environment to each motion to help control sensory stimulation and breakdown the level of intensity within the environment for its users. Each section should include its clearly distinct function and consequential sensory quality (Mostafa, 2015).

The configuration of independent spaces within the learning environment will help the individual develop skills to deal with the identification of different environments and the change in sensory perception of multiple environments in the outside world of chaos, incompetence and volatility.

Figure 3.15. compartmentalized study of a classroom showing synchronized use of various stations. (**Source:** Mostafa, 2008).

This separation of compartments should not be strict or harsh but rather done through furniture layouts and floor finish materials. The change in levels and the variance of lighting can also impact on the change in atmosphere and sensory environment. The sensory quality of each environment should be used as a tool to outline its function and isolate it from its neighbouring section. Once these sensory elements are coupled with their activity counterpart, it will offer sensory clues as to what is anticipated of the individual in respectied spaces, with minimum uncertainty (Mostafa, 2015).

3.5.5. Transition

Transition zones help an autistic individual re-establish balance in their senses as they move through the various spaces and sensory zones. Transition zones help facilitate spatial sequencing and sensory zoning. Transition zones can vary from distinct transition nodes to a complete sensory area that re-calibrates the user's senses from the transition of a high stimulated area to a low stimulated area (Mostafa, 2015).

These transition zones must ensure that the individual has a smooth transition from one space to another and not create abrupt breaks in the transition that will cause disorientation and sensory 'shock' to the individual. The purpose of these zones is to help the user adapt to changes and learn to adjust to the outside world through a gradual process.

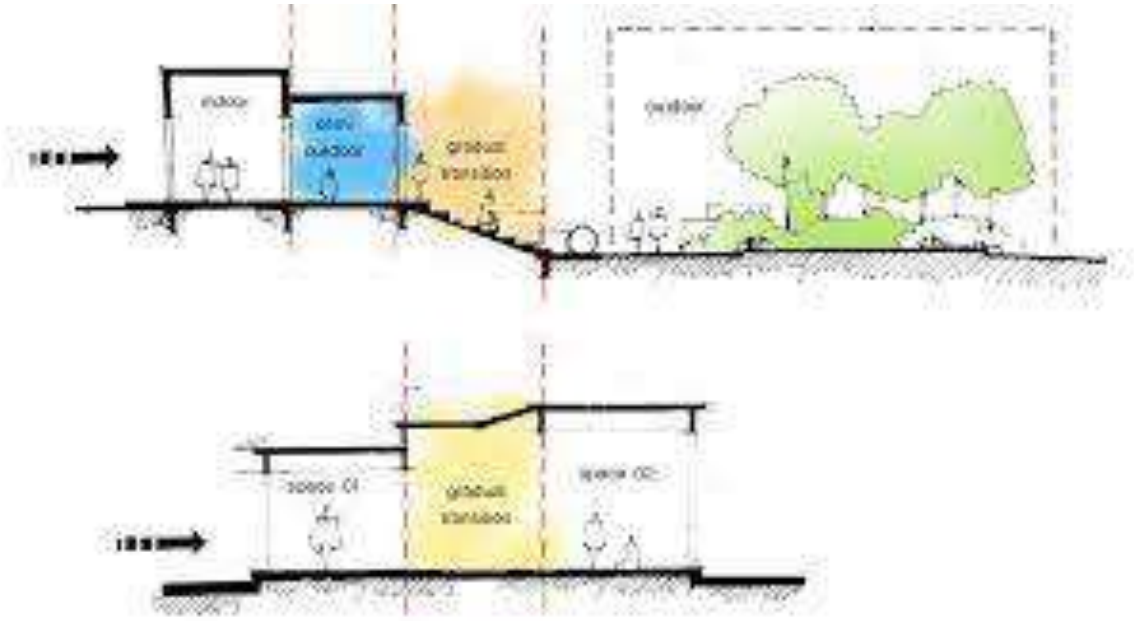


Figure 3.16. The different transition zones (**Source:** https://www.utas.edu.au/)

3.5.6. Sensory Zoning

Sensory zoning dealing with autism should be designed and organised according to their sensory value, relatively than the distinctive functional zoning. These zones should be organised and grouped to allow variance in stimulation from high, moderate to low sensory qualities. The transition and circulation zones need to be incorporated between spaces to create a gradual change in spaces.

3.5.7. Safety

The safety of individuals within the autism spectrum is vital since often they do not recognize the risk of the circumstances or environments in which they find themselves. Autistic individuals have a unique spatial orientation which could cause them to injure themselves easily. Therefore, the environment around them should be well thought off. The type of materials, fixtures, surfaces and barriers are vital considerations when designing for those in the spectrum. There should be a visual connection and a sense of transparency so individuals are easily monitored.

3.6. INTEGRATIVE SENSORY ARCHITECTURE

Autistic individuals have difficulties integrating into society and therefore are often excluded and live a life of isolation. Pomana (2015), has conducted a study in research that focuses on architecture that considers the integration of autistic individuals to be a part of the public realm. Individuals diagnosed with autism follow a strict treatment program from initial diagnosis, but this does lighten the chance of an autistic child developing into an autistic adult. Majority of our lives are lived as an adult and it is important to consider the life of an autistic individual and their integration into society from a child into an adult (Pomana, 2015, pg.1).

Autistic life learning centres are needed in providing skills development that are specific to the abilities of autistic individuals. It is vital that these centres are not designed in isolation, but consider society and public awareness. These centres should be designed to successfully function with its context, its surrounding education, cultural, and health institutions. Literature has indicated that these centres need to involve different transitioning spheres such as (Pomana,2015);

3.6.1. Controlled Environments

The environment for therapy and skills development needs to simplify and ease the implementation of this process. The architectural elements and design need to respond to the users sensory, communicative and behavioural impairments.

3.6.2. Sensory Saturated Spaces

To adapt to new environments and understand your surrounding an individual has to be exposed to various sensory stimuli, these spaces assist autistic individuals to learn to adapt and measure of control over sensory issues such as hypersensitivity and other sensory disorders. An example such as exposure to indoor and outdoor functions creates a variety of atmosphere in relations to sound and sensations.

3.6.3. Public Interface

One of the major daily struggles of autistic individuals is to overcome communicative, behavioural, and social difficulties. Public awareness and interaction are vital for autistic individuals to be accepted within society. These public spaces need to be incorporated as part of a learning centre environment to allow the individual to develop their skills and not be confined to a limited situation of the environment. Through these experimental situations, it should create an opportunity for awareness of autism in society.

3.7. ECOLOGICAL SENSORY RESPONSE

As cited by Herbert: “nature is believed to have healing and restorative powers, historically healing spaces were nearly always found in nature...a healing spring, a sacred grove, a special rock or cave." (Marcus and Barnes, 1999 cited in Herbert, 2003: 1). The natural environment such as outside spaces and green spaces are beneficial and calming agents for people with autism as these spaces can be safe environments for them to reduce stress. The natural environment provides for motor actions such as balancing, skipping and playing on a trampoline or climbing. “The environment is also more suited for sensory integration activities, such as tactile activities that involve sand and water” (Herbert, 2003).

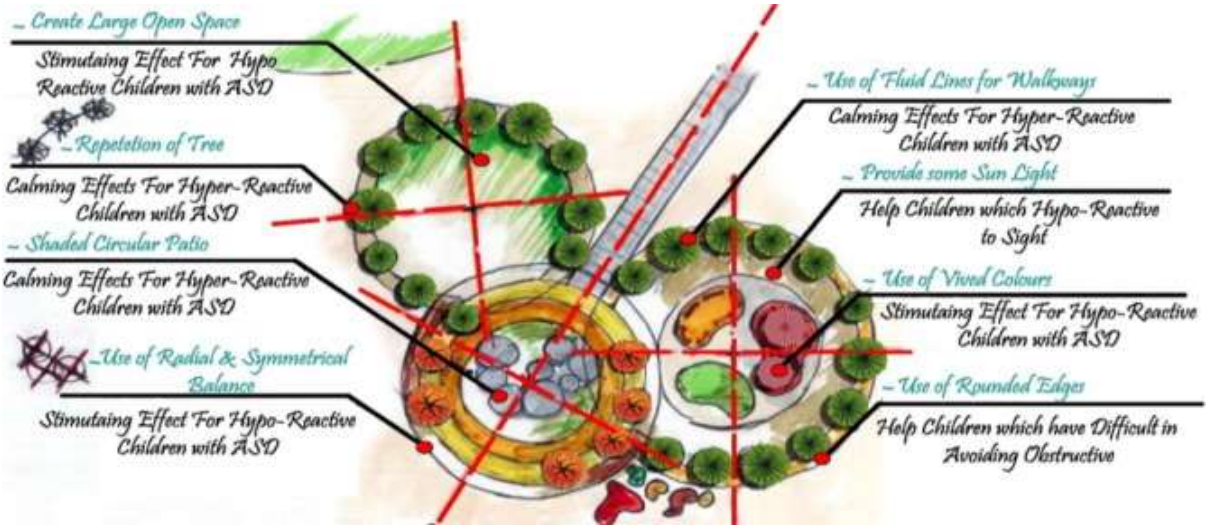


Figure 3.17. Different methods of integrating the environment on sensory perception (**Source**: https://www.sciencedirect.com/)

3.7.1. Connection with Nature

The connection with nature makes a person aware of natural cycles of life and the seasonal changes that take place around them. It connects people with the natural systems and creates the experiences that are relaxing and nostalgic. The exposure to nature and its natural process can play a vital role in perceptual experience on what an individual experience and see (Ryan et as cited in Fischl, 2016).

The response to nature is done through the patterns of biophilic design, the framework of the design may be altered to adapt to its context and its user's needs. The solution conceived from biophilia is to be 'user-centred' and specific to the design program through natural methods. To use the concept of biophilic architecture successfully the architect needs to understand the spatial requirements and needs of the user group to create a response through biophilia (Kaplan as cited in Ryan et al, 2014).

The earliest man-made structures and designs have expressed the significance of Biophilia which is the humanistic need to connect to nature. The significance of integrating nature with the built environment is evident in the psychological studies of an individual's stress levels and state of mind when exposed to natural elements (Ryan, Browning, Clancy, Andrews, Kallianpurkar, 2014).

3.7.2. Visual and Non-visual Connection with Nature

Studies have proven that natural environments are favoured over the built environment and the natural environment provides beneficial to psychological health (Ulrich, 1983). The connection with nature and specifically visuals connection has been proven to reduce stress and have a positive impact on the mood and emotions of human beings. While inbuilt environments that do not have a visual connection with nature it is substituted by adding elements such as plants and water features to balance and naturally enhance the physical space.

Figure 3.18. Visual connection with nature (**Source**: https://za.pinterest.com/)

Non-visual connection with nature

A non-visual connection can be achieved through stimulation of the other senses, such as auditory, haptic and olfactory (Ryan et al, 2014, pg.65). These stimuli are about nature such as natural sounds and aromatic scents. Alvarsson (as cited in Ryan et al, 2014) comparison between the effects of natural and urban sounds depict that natural sounds allow for a more active psychological and physiological restoration process within an urban environment.

3.7.3. Presence of Water

The presence of water from simply crashing waves to wading pools enhances the experience of a place. The presence of water and access to water is a biophilic design pattern that has risen from research to benefit health and well-being, which includes lower heart rate, increased feeling of tranquillity, reduced stress improved emotional responsiveness and improved concentration and perception.

Figure 3.19. Wading pool showing a sense of relaxed environment
(**Source**: http://architecture-corner.blogspot.com/)

the water creates a pleasant visual stimulation and the soothing sounds of flowing water ease one's state of mind. Study shows that flowing water is always preferred over still standing water (Orians and Heerwagen, 1993).

3.7.4. Sensory Garden

The literature study has shown that autistic individuals experience two major forms of sensory difficulties which is either hypo-sensitivity or hypersensitivity. The natural environment which is a multi-sensory stimulus which can be used to achieve a sense of balance and accommodate both sensory difficulties (Gaudion and McGinley, 2012, pgs. 23-29).

Research has indicated that an outdoor, natural environment allows for spontaneous interaction and play for both autistic adults and children (Louv, R and S Kaplan, Faber Taylor, Kuo, and Sullivan as cited in Sachs and Vincenta, 2011).

A garden space can also be used to help individuals learn skills and ability to nature and tend to plants and nature. The image below shows an example of a sensory garden that incorporates multiple activities and different spaces for those individuals that require a range of different stimulus spaces.

Figure 3.20. Illustration of integrated sensory garden (**Source**: https://www.henshaws.org.uk/)

Contact with the outdoor and nature can be contrasting with the confined learning environment, outdoor spaces and sensory gardens can assist autistic individuals in using their skills they learnt in a different sensory stimulus environment and social setting. The open outdoor spaces can help restore attention, and recover mental fatigue to enhance optimal mental focus.

3.8. CONCLUSION

The paradigm of phenomenology is an umbrella to theories that follow a similar design concept. Each theory has been critically analysed and explored in its relation and relevance to sensory design and its role in the lives of autistic individuals. Phenomenology is a user-centred paradigm that focuses on the existence of people in space.

Perception theory deals with the sensory response to the architecture and the embodiment of people and their sensory needs in the built environment. The role of perception was vital to analyse and its impact on autistic individuals. It allowed the study to explore theories of sensory design and neuro-typical design. The socio-spatial theory allows for interaction between autistic individuals and society. The theory explores inclusivity and acknowledgement of the autistic community within society. Finally, the ecological approach examines how one can create a homogenous blend amongst nature and the built environment that responds to the senses and caters to needs of autistic individuals and critically to their spatial and sensory needs.

4.1. INTRODUCTION

The selected precedents studies have been chosen on their bearing to the key issues discussed in the previous two chapters. The literature review addressed the main research problem and supported the aims and objectives of this study. The review studied the nature of ASD and the spatial needs of autistic individuals. This chapter will analyse two current learning centres for autistic users and the relationship of the user and their perception of space within the built environment. The analysis of these precedent studies will assist in further understanding the spatial needs of autistic individuals and the response architecture has to its specific users. The analysis would not be able to cover all aspect of the precedent therefore in this study the analysis will be in relation to design principles created in the Sensory design theory and Autism ASPECTSSTM Design Index by Magda Mostafa. These principles provide guidelines on design for sensory inclusivity and autistic needs.

4.2. NEW STRUAN CENTRE FOR AUTISM

Architects: Aitken And Turnbull Architecture

Location: Alloa, Scotland

Location map of the new Struan Centre identifying its location within Alloa, Scotland. The site surrounded by a lush green context adjacent to a primary school in residential setting.

Figure 4.1. Locality map (**Source:** https://earth.google.com/)

The New Struan Centre for Autism was opened in 2005 for children diagnosed with Autism. The school roles serves as a national centre for Autism, facilitated for autism advice-giving, teaching and training in autism, education outreach amenities and explore, diagnosis assessment centre (Scott, 2009).

Figure 4.2. External façade of the building (**Source:** https://www.archdaily.com/)

4.2.1. Acoustics

The building is designed to block out the external factor of noise from its surrounding context. The building is situated in the centre of the site surrounded by lush green vegetation that creates a noise barrier from its surrounding context. The t-shape plan is separated between public and private, with the spine of the T being the private learning spaces which is situated towards the rear of the site for its private quieter character to the site.

Figure 4.3. Ariel view of New Struan Centre (**Source:** https://earth.google.com/)

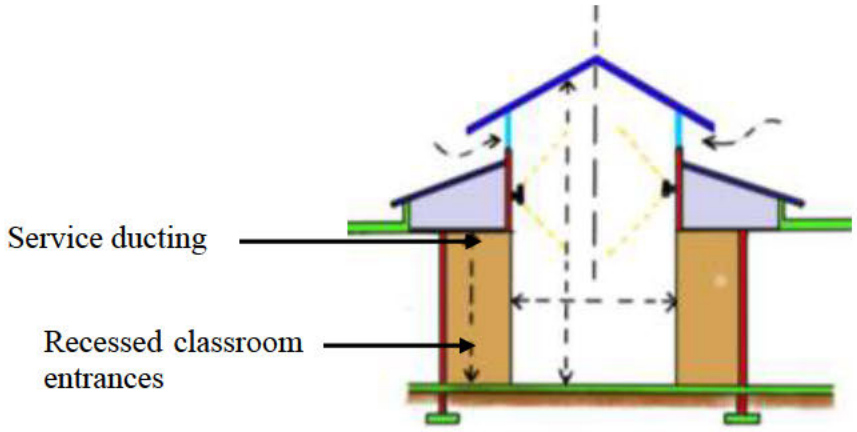


Figure 4.4. Sketch section of main circulation space (**Source:** Author)

The acoustics of the internal spaces of the learning area was dealt through well concealed services within sound dampened ducts to avoid unwanted noises from the HVAC systems that may trigger unwanted outburst from the learners due to over stimulation of the senses. The classroom entrances have been recessed in to create a sense of transition between the main central walkway and the classrooms but it also serves a secondary function has a noise buffer between the busy walkway and the much quieter environment of the classroom.

4.2.2. Spatial Sequencing

The building in plan forms a 'T' shape, the street edge is faced by the horizontal section of the 'T' which accommodates the public activities of the centre. The learning spaces, diagnosis and assessment rooms are along the centre of the 'T' are divided from the public interface through controlled access.

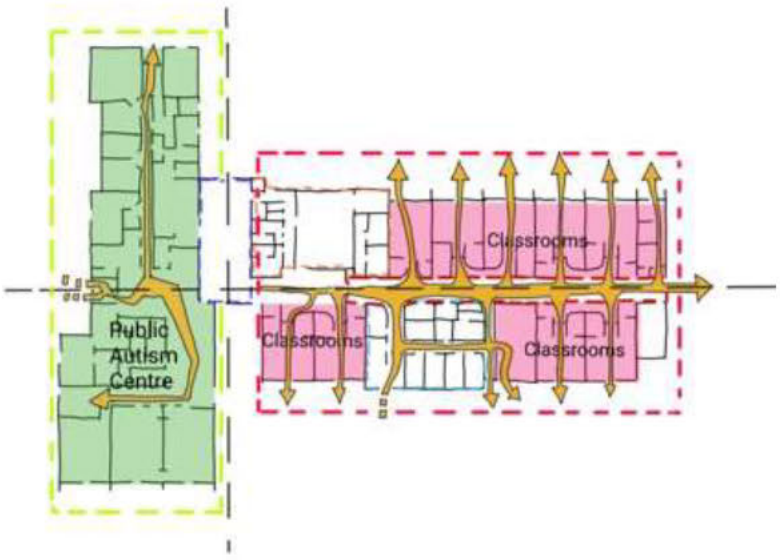


Figure 4.5. Floor Plan layout (**Source:** Autor)

The centre is a single-story building with a central north to south axis called ‘the street’. The street provides easy access to each learning space avoiding narrow corridors and spaces that may cause confusion and anxiety to its user. The street is stretched to the entire length of the building and is essentially a glass atrium. The atrium provides natural daylight and ventilation to the interior spaces. The layout of the spaces promotes a modest order and autonomous movement from one space to the other. A simple use of a limited palette of material with little detail in the central areas enforces the sense of calm and simplicity to the space.

4.2.3. Escape Spaces

Each classroom is designed with a breakout space that allows learners to go to if they are feeling over whelmed or over stimulated. The space is isolated from the main learning area and equipped with sensory calming and sensory stimulation activities. There are no windows in this part of the classroom as the light from outside might be over bearing while the individual is trying to calm down.

Each classroom also has access to its own outdoor play area. This allows for motor skill activities and for when learner have too much energy and need to burn off by running or doing physical activity to reduce their energy levels which may cause anxiousness and hyper activity which indoor spaces may not be equipped with.

4.2.4. Compartmentalisation

The circulation is the “spine of the building” or known as the ‘street’ which learning spaces are opened from either side of it. The street serves as a strong location device and provides an open interpretation of the entire school as well as views of the outside play area, which permits the users to easily orientate themselves. This gives the children self-assurance in their navigation skills and the extensive circulation spaces lets the children move freely and not be afraid of collision or incursion of their personal space. The semi-public areas are also accessed of the main circulation space, will allows ease to access to the spaces and gives the users an idea of what to expect before entering a space.

Figure 4.6. Atrium circulation spine of the building (**Source:** https://www.aitken-turnbull.co.uk/project/centre-autism-new-struan/)

The surface textures and colour scheme play a role in the compartmentalisation as well. The variation in texture and colour support the spatial order. The central aisle is painted white which enhances the natural lively light and expresses a sense of spaciousness. The floor has a dark blues which runs the length of the corridor which defines a clear line of separation from the threshold spaces. The threshold space is a natural earthly red- brown colour with the flooring in the niche spaces a light blue to give emphasis to the central corridor. Visual hierarchy assists the children to create a sense of independent navigation of the building. Each classroom is equipped with independent access to outdoor play areas, with each door painted a different colour to indicate which door is to access outdoor play areas. This allows the children to have access to outdoor spaces in a secure space and play freely with the comfort of finding their way back to their specific classrooms.

4.2.5. Transition

In the previous chapter literature has indicated that individuals with ASD have different levels of perception threshold. This includes spatial and environmental differences, which suggest that this can often be threatening when individuals transition from one space into another.

Figure 4.7. Transitional space (**Source:** http://www.designhub.it/)

The figure above shows how the new Struan School uses a transitional threshold zone between the street and the classroom to allow the students to pause and slow down before transitioning into the classroom to permit for a even and independent shift between play and movement space and teaching zones. It expresses a clear boundary shaped by use of finishes and colour. The change in height of the ceiling expresses a much more intimate space and for smaller group activities. This initiates that the classroom starts outside with the hints of a table chair and bags. The threshold space is structured, with everything organised to assist in maintaining a sense of order, calm and simplicity.

4.2.6. Sensory Zoning

The visual sense is activated by the appearance of the building. The exterior of the building is kept simple with simple form texture and material. This is done not to create any unwanted stimulation that would cause anxiousness to its users as they approach the building. The entrance is defined in a subtle change in material to enhance its symbolism as an entrance.

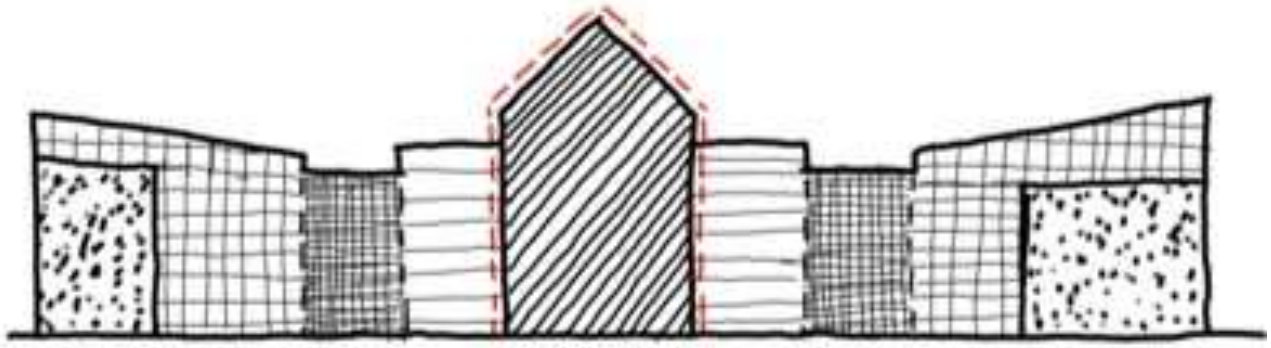


Figure 4.8. External sketch of the entrance of the centre. (**Source:** Author)

Figure 4.9. Internal view of a classroom (**Source:** https://www.archdaily.com/)

The internal spaces are zoned with different colours to express their functions and create a sense of identity in which the learners can build a relation to the spaces by their specific character. The classrooms are zoned with bright colours, being high stimulated activities and low stimulated space surrounded by subtle colours. Textures such has carpets, bean bags and repetition of materials along paths help self-stimulate individuals as they move through spaces. The use of different textures and the repetition of it within spaces helps individuals find a balance in stimulation when they experience sensory difficulties. The use of common objects in daily lives helps adjust the individual to adapting to a self-sustaining life as these simple skills help them manage their sensory difficulties without the need of special aid or constant supervision.

4.2.7. Integration with Nature

Creating a connection with nature is vital has it enhances the user's perception and allows for a person to feel at ease to the open environment. Each classroom in the New Struan School has an exterior door that leads to its own outside play area. This makes it easy for the learning to be extended to an outside space. The outdoor space consists of cycle tracks, play apparatus, a ball park and sensory garden. The range in activities allow for the children to either play in groups or independently.

Images below show outdoor activity area

Figure 4.10. Outdoor gym area
(**Source:** https://www.scottishautism.org/)

Figure 4.11. Outdoor play area
(**Source:** https://www.archdaily.com/)

The school is designed and structured to generate a calm and organised environment which allows for individuals with ASD to concentrate on learning the important life skills they need. The outdoor equipment is simple to use and well differentiated with a flow of movement of the space in between them. The outdoor spaces are well secured and safe which allows the individuals to explore freely and independently.

4.2.8. Conclusion

The building takes notice of the specialised needs of its users and incorporates them into every aspect and detail of the built environment. The wide street is the key feature of the New Struan School as it emphasizes the importance of connection between spaces and the transition from one space to the other and its impact on autistic individuals. The core idea of the design of the school is to keep the spaces simple to allow the individuals to become independent and confident in themselves and their abilities. In respective detail of the design of the building it suggestion a declaration of respect to the pupils in accepting their complications they experience.

4.3. EDEN AUTISM SERVICES, PRINCETON, NEW JERSEY

Architect: Kss Architects

The Eden organisation was founded in 1975 and initially located at the basement of a church. Once people started being frequently diagnosed with autism as time progressed there was a need for a specialised facility that responded to the needs of autistic users and the implementation of sensory design theory. One of the key design principles of Eden autism services facility was to create a space that resembled a house and office setting, so it could relate to the activity's individuals would face daily in society.

Figure 4.12. Locality map (**Source**: https://earth.google.com/)

The facility comprises of a vocational program, which educates individuals on administrative skills, which in return allows them to practice their skills at an on-site convenience store which serves the public. The idea of the recreation of a home environment aims to teach the students different levels of independence and self-sufficiency, from skills of basic hygiene to complex task such as cooking and running a household. (KSS Architects, 2012).

Figure 4.13. Eden Autism Services entrance (**Source:** https://kssarchitects.com/)

4.3.1. Acoustics

The site is surrounded by streets, therefore there has been multiple trees added around the edge of the site to act as a noise buffer from the vehicles moving along the street. The materials used on the exterior of the building is timber which serves as sound absorbers to noise of people movement and to filter any loud noises from the playground area and external sounds from the surrounding context.

Figure 4.14. Site map (**Source:** https://earth.google.com/)

The classrooms are fitted with acoustic ceiling panel boards to absorb noises and avoid unwanted noises from moving chairs and screaming children. All classrooms are fitted with self -closing this allows for the rooms to be enclosed at all times to avoid unwanted noises from the walkways.

Figure 4.15. Interior view of classroom (**Source:** https://kssarchitects.com/)

4.3.2. Spatial Sequencing

The facility connects to its immediate context and forms a part of its mixed-use community. The facility connects to an open public gathering space and walking trail for the public. The building itself forms a U-shape which creates its own private central courtyard. The courtyard is over looked by the administrative and learning spaces.

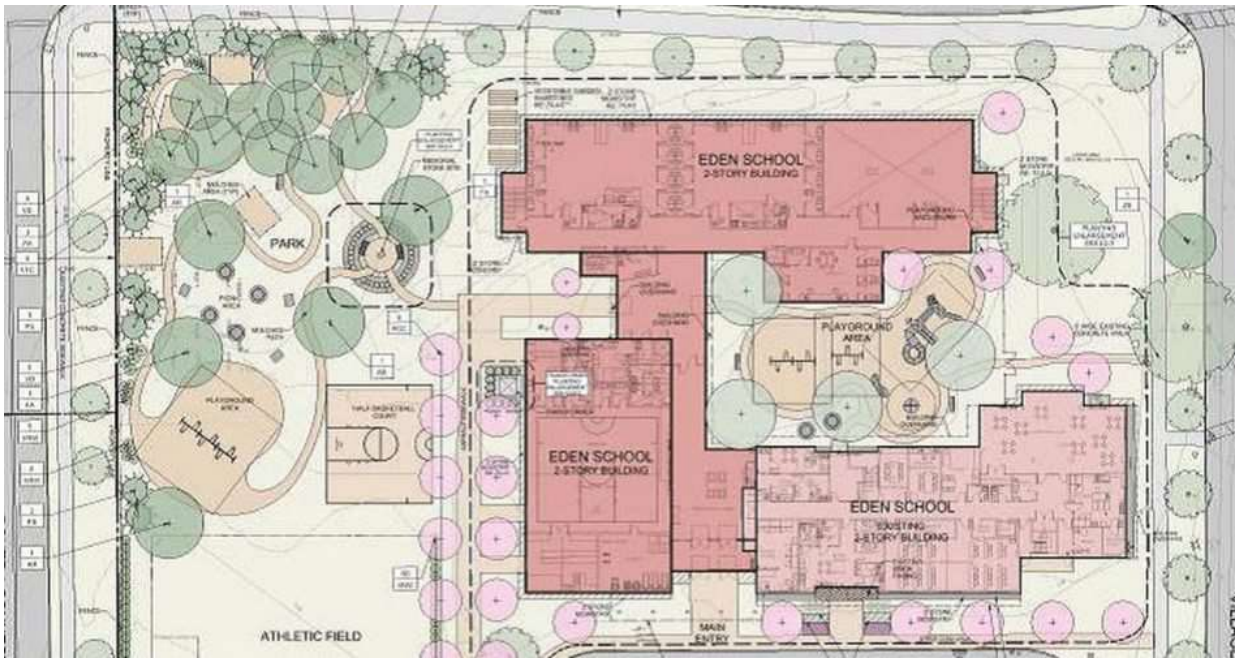


Figure 4.16. Site plan (**Source**: https://oddgraphic.com/)

The spatial sequencing of spaces includes various stimulus levels. The three major functions of the building have been separated to a different wing of the building to clearly define change in functions of the building, the administrative being positioned on the south east wing cluttered by the reception area and cafeteria. The learning rooms are positioned on the north wing connected to the therapy rooms, the sports facilities positioned on the west wing that connects to the public park and athletic field.

4.3.3. Escape Spaces

Each classroom has individual spaces for learners to work on their own when they feel over-whelmed working within groups. The classrooms open out into the courtyards space for when learners need to learn motor skills and needs to release energy when feeling over stimulated. There is a bigger playground for when learners need extra physical to further develop motor skills and social interaction skills.

4.3.4. Compartmentalisation

The facility is compartmentalised into three major functions which is the administrative, learning and outdoor. The administrative accommodates functions such as numerous staff movement as well as telephone calls throughout the day and appliance that add to the noise factor, therefore the admin block is kept separate from the learning block. The gym and cafeteria are regarded as areas of high stimulus and therefore placed the furthest away from the learning area. The central courtyard plays the role of a buffer between the separate components. The learning area is separate and designed not to be distracted from the supporting functions.

Analysis showing each component of the facility

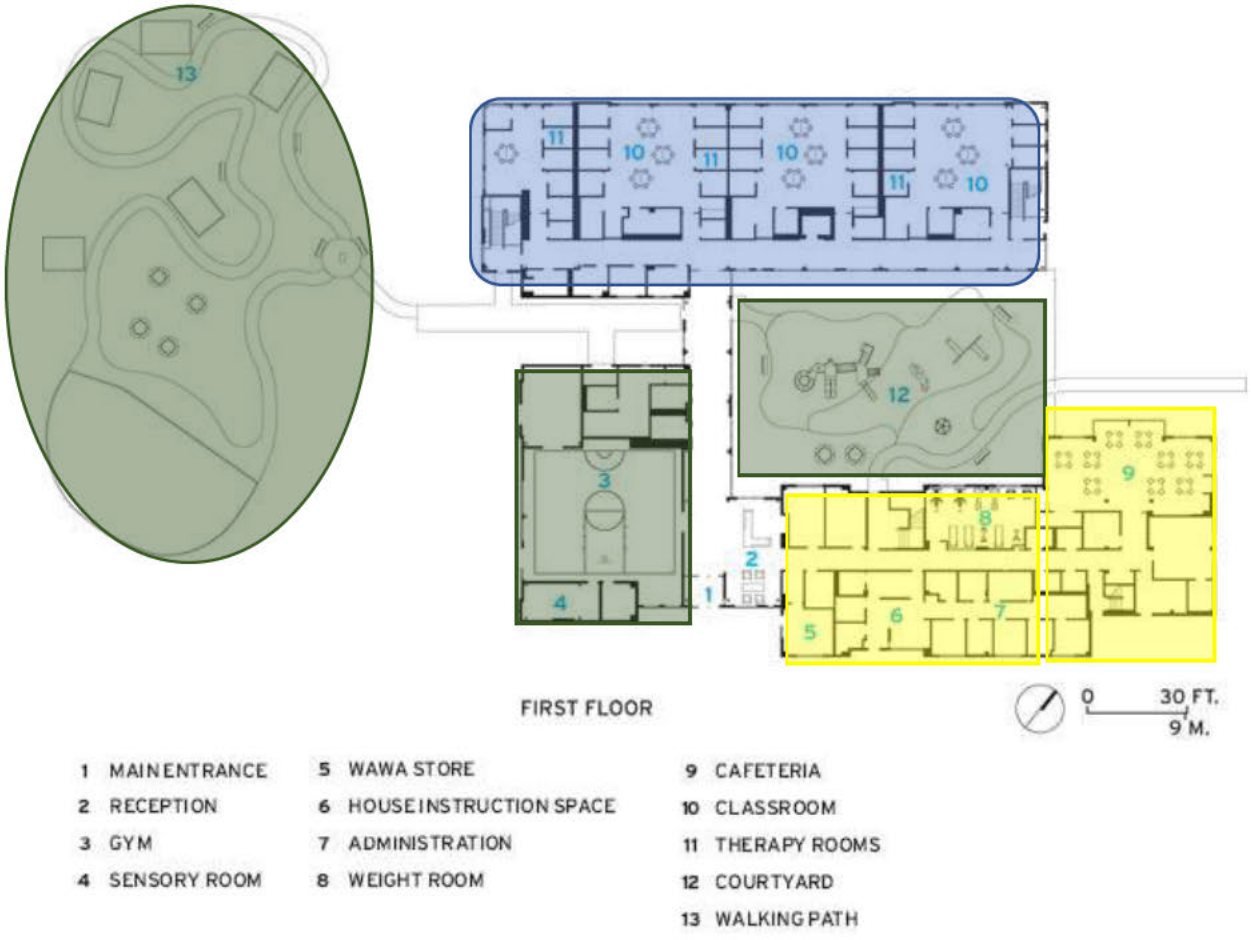


Figure 4.17. Zoning plan of facility (**Source:** https://www.architecturalrecord.com/)

4.3.5. Transition

The central courtyard defines the pathways that connects the individual components. The path is simple with clear open vision as autistic individuals need a simplified environment that will

not stress them out or cause them to go into a state of anxiety, and this is achieved through the proposal of the Eden centre.

The layout of the centre allows for a gradual transition from the administrative to the sporting and then to the learning functions along a sightline of the courtyard.

Figure below of open corridor and transtion zone.

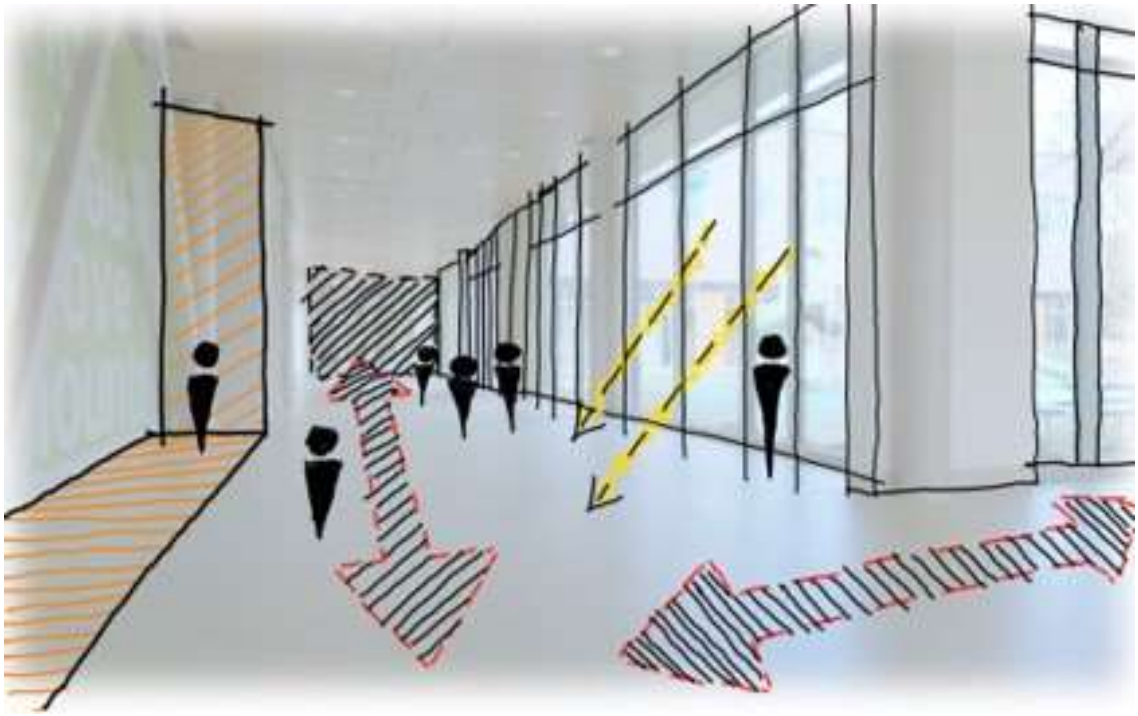


Figure 4.18. Main circulation space of the centre (**Source:** autor)

4.4. CONCLUSION

The analysis of Eden Autism services was done to explore the spatial needs of autistic individuals and how the architects responded to these key issues and successfully achieved them. The Eden Autism centre shows clearly how this have been succeeded through the compartmentalisation of each component, creating a sense of hierarchy through the spatial sequencing and finally the connection through a gradual transition from one space to the other.

The precedents studies have been conducted to inform the design of this study. The analysis will assist in developing the architectural qualities of space. The research has shown the synthesis of inclusive sensory design and theoretically driven approach to achieve a positive conducive learning environment.

CHAPTER FIVE | CASE STUDY

5.1. INTRODUCTION

The resource and facilities provided for autism within South Africa is limited and lacks awareness, never the less there are schools that provide for an ASD unit. These are where certain classroom are converted into ASD units to provide for some sort of sensory stimulated environment for Autistic individuals. The case study that has been selected in this study is located within the Durban North area. The facility itself was not initially designed to accommodate users with ASD but adapted to needs of its users. The facility will be explored and analysed through its spatial quality and according to the main theoretical framework and Autism ASPECTSS Design Index by Magda Mostafa as done in the previous chapter. The purpose of the case study will allow for insight and understanding of how individuals with sensory and perception difficulties are handled within the context of South Africa.

5.2. ACTION IN AUTISM, DURBAN NORTH, HAIG ROAD

5.2.1. Introduction

Action in Autism is a non-profit organisation that was established in 2006 by parents of autistic individuals. The facility is essentially an early childhood development but also incorporates a development program for young adults into finding appropriate skillsets for the individuals. The organisation is structured and consist of teachers, support staff, occupational therapist, speech therapist and educational psychologist. The building was not designed to cater for the needs of autistic users but has been adapted, and is still being modified to cater to the learning and sensory needs of its users.

Figure 5.1. Central courtyard activity space (**Source:** https://www.actioninautism.org.za/about-us)

5.2.2. Spatial Sequencing

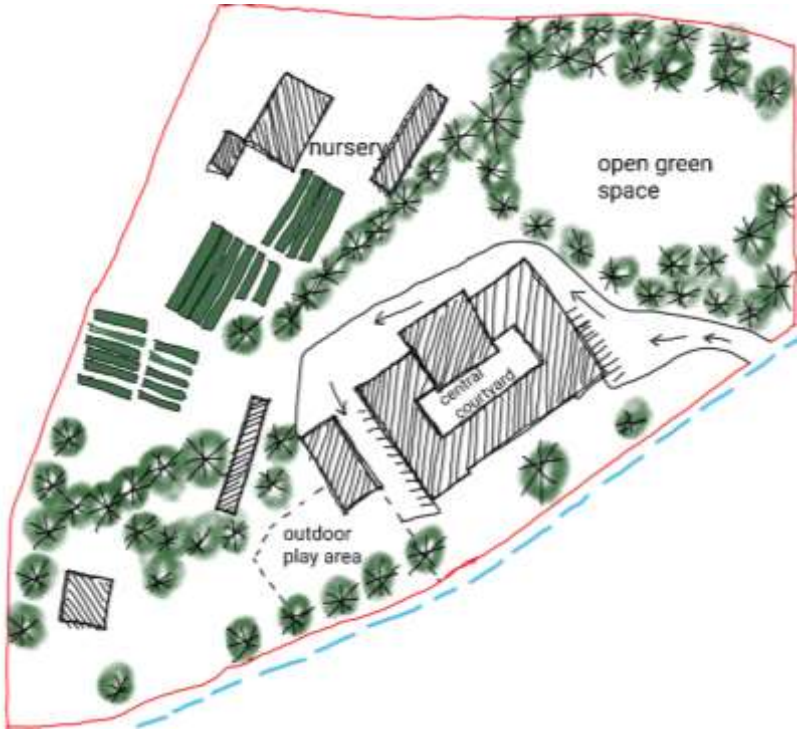


Figure 5.2. The sketch above shows a sketch layout site plan (**Source:** Author)

The building is a single storey building which has no need for stairs or ramps. The building form wraps around a central courtyard creating a simple flow of movement and easy wayfinding for young kids finding their way from one classroom to the other. The layout of the building is a central courtyard design as the building was initially designed as a school this allowed for control and safety of its users. The central courtyard has no cover and is therefore open to the sky which act as area for young autistic learner to explore the outdoors while in a safe controlled environment.

Figure 5.3. Image of the open central courtyard (**Source:** Author)

The courtyard has been modified to cater for a positive sensory environment through the playfulness of adding murals to the wall, painting the balustrades yellow and the soft green AstroTurf that covers the existing floor.

The main building consists of the administration block, learning spaces, sensory rooms and a new addition which is a kitchen. The facility also has adult learning and skills development adjacent to the outdoor play area that incorporates a computer centre. The room is an open plan layout which allows the spaces to be adjusted to the users' needs and perceptual difficulty. The spaces surrounding the site is an open green space which allows for a good natural surrounding and a nursery which assist the centre in gaining skills in planting and harvesting of crop.

5.2.3. Sensory Zoning

Sensory zoning plays a vital role in the learning spaces for those who are Autistic. Noise is a significant factor when it comes to sensory zoning in the learning environment. Unwanted noises from the outside environment needs to be buffered out through the kind of material used within the classroom such as flooring and ceiling board properties. The facility provides sensory rooms when learners feel over-whelmed and need a time out to re-establish a balance sensory stimulus.

Figure 5.4. Image of one of the sensory rooms (**Source:** Author)

The use of selected colours and textures assist in reducing over stimulation when students feel over stimulated in the natural environment. The spaces have large ceilings but still lacks the consideration for suitable acoustic properties.

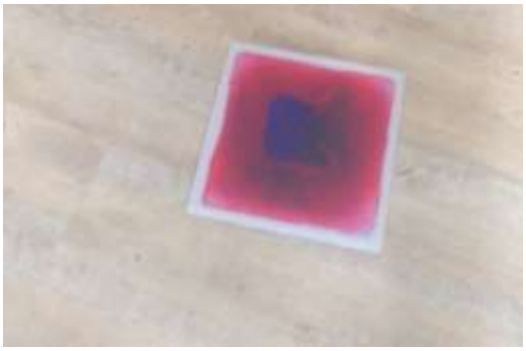


Figure 5.5. (Image above shows sensory stimulation methods and activities for learner to engage in **Source:** Author)

The room caters for various stimulation difficulties such as under stimulation. To enhance stimulation the room has multiple activity to create stimulation such as a ball pen different textures on the wall that allow learners to interact with to soothe and calm them down and various foot pad for learners to step on when feeling under stimulated.

The layout of the room can be interchangeable to cater for the wide range of sensory difficulties faced by individuals with autism. Due to the lack of awareness and funding the facility is unable to cater for each sensory impairment in individual rooms therefore this is not the most efficient and effective way dealing with various sensory zoning.

5.2.4. Connection to Nature

The connection to nature creates the experience that is relaxing and nostalgic. The exposure to nature is a natural process and can play an important role in the perceptual experience in what an individual experiences from the natural surroundings.

Action in Autism is surrounded by a natural landscape with its neighbouring site a nursery below allowing for a great visual connection within view. Along the entrance of the site dense lush green space. The admin block and some of the classes are orientated to take advantage of these views.

Images below shows nursery adjacent to site and open playground and their connection to nature

Figure 5.6. Image of garden and nursery (**Source:** Author)

Figure 5.7. Image of children's play area (**Source:** Author)

The secure playground is essential to the school as it helps autistic children experience the outdoors without feeling restricted. It is big enough for the children to run and interact with the environment while still having a sense of security. The school does not have a connection to the natural environment from its interior functions in which the school aims to achieve by integrating landscaped sensory gardens that is filled with positive sensory stimulation. The centre also aims to create a sensory playscape that is inclusive of both surrounding communities and autistic individuals to allow for social interaction and creation of awareness (Interview with senior member of the organisation)

5.2.5. Transition

The centre has one main central transition zone which is situated around the central courtyard. The walkway connects from the entrance foyer to the admin block, learning spaces, kitchen and open hall space and returns back to the admin block.

Figure 5.8. View of main circulation space (**Source:** Author)

The walkway acts as the only pause space and the in-between of the open (the outdoor) and the enclosed (the inside) before learners' step into the classroom. Along the walkway there are elements such cubicles for bags playful features, murals on the wall, these elements suggest sense of playfulness or a sense of learning to prepare the learners on what to perceive before entering into a space.

5.2.6. Conclusion

The case study shows attributes and a connection to the literature in the previous chapters. The facility has successfully integrated the sensory and learning needs of Autistic individuals. Though the facility was not designed for autistic users, the organisation has made it suitable through changes in floor finishes, wall colours, the control of daylight, acoustic properties and spatial sequencing has made it possible for a productive and sensory stimulated environment for autistic learners with different sensory needs towards their journey of facing life while being on the spectrum.

CHAPTER SIX | ANALYSIS AND DISCUSSION

6.1 INTRODUCTION

This chapter will look at the data collected and analyse the primary data collected through semi-structured interviews that has been sourced from participants of the case study in the previous chapter. The online interviews were conducted with participants based on their position held at the facility and their experience working with autistic individuals.

The semi structured interviews were answered by qualified professions at the Action in Autism centre. The interviews were answered by a director of the facility, a manager, educators, caregivers and psychologist. These members have an extensive background in understanding the neurological and physical needs of autistic individuals.

Roles and responsibilities of participants that Interviews was conducted with:

Action in Autism (AIA) Participant	Roles and Responsibilities
Director	Oversee program of the facility, organise and conduct events, create and promote public awareness of Autism and facility
Psychologist	Educational psychologist. Responsible for staff and children therapy Implement sensory calming techniques.
Educator 1	Plan and prepare lessons. Develop creative learning opportunities for children with Autism. Interact with parents about children development.
Educator 2	Early intervention class. Structuring activities, overseeing development progress as well as implementing components of therapist suggestion.
Educator 3	Running class and planning daily class program

The interview schedule was composed in response to the key questions stated in chapter 1 and translated into the following format to structure the schedule:

1. The background information to the participants in their relation to the organisation.
2. The background information of the organisation.

3. The spatial experience autistic individuals and the impact of the built environment on the individual.
4. The specialised needs of indoor and outdoor facilities.
5. The connection to nature.

The primary questions focused in the interview schedule is on the sensory and spatial experience of the users as follows:

- *One of my main focus in this research is the various senses. Through my study I found that individuals with autism often experience sensory issues. Through first-hand experience what can you say are the major sensory issues in your class?*

- *There are couple key buildings design consideration that my research has led me to thus far. Please could you explain from your experience how the natural elements such as the sun, wind and noise has impacted on children with autism, could you elaborate on the positive and negatives and how these issues are addressed in your classroom.*

- *From my research it has led me to believe that an organized classroom/space spatial layout is important, does your classroom have a specific layout for the needs of the condition?*

The secondary questions focused on the supporting outdoor spaces and their impact of autistic individuals. The questions were listed as follows:

- *What would you say are suitable outdoor activities for autistic individuals?*

- *How are the outside spaces beneficial for them?*

- *Is there a need for more autism specific facilities within the context of Durban and where would you suggest a suitable place be?*

The information collected from the interviews were studied using the qualitative analysis method and the information was extensively studied and reviewed in relation to the research questions of this study to formulate the following themes that emerged from the analysis of the data:

1. Sensory saturated environment.
2. Sense of calm and order.
3. Natural setting and outdoor interface.
4. Sense of awareness through an integrated public sphere.

6.2. OUTLINING THEMES OF PRIMARY DATA ANALYSIS

6.2.1. Theme 1- Sensory saturated environments: the data gathered from the case study and interviews indicate the response of the environment to the sensory needs of Autistic individuals. There was strong response to the auditory, visuals and tactile senses and the environments response to these senses.

At Action in Autism there was a common concern with the impact of overwhelming sounds and noises that can cause individuals to become anxious and have sensory breakdowns.

AIA – Educator 1: *"In my class the major sensory issue is sound, most of the children block their ears when there is loud music or when other students scream or cry"*

AIA- Educator 2: *"Noise is one of the major factors, our children are particularly sensitive to high levels of noise and it is important to have a break out space within the classroom which the kid could go to and regain a sense of sensory balance and feel much less anxious and to calm down. Sometimes some of the kids feel anxious when they see a lot of movement outside through the window".*

AIA- Director: "*while each child can have their own sensory profile, one of the major stimulations that tends to aggravate those with ASD is when certain sounds are overwhelming. These could range from the crying of another child or the sound of a grass cutting machine. This leaves most of the class upset and the class routine is disturbed.*

The third educator participant and psychologist explained the experience of individuals being either being over or under stimulated and finding ways of creating a sensory balance for themselves and often need to be surrounded by suitable stimulus.

AIA- Educator 3: "*The major sensory issue in my class is hyper activity, this is noticed by children biting toys, being socially withdrawn or disrupting class activity. If a child experiences hyperactivity they can go into the sensory where there is various different touch stimulation that can help calm them down.*

AIA- Psychologist: *"it impacts on children response and ability to focus etc, if the environment is not friendly to their sensory needs it does not facilitate communication".*

The above responses express the importance of sensory integration within the built environment and the major role that it plays on an individual with ASD and their ability to understand and communicate in a learning environment.

6.2.2. Theme 2- Sense of calm and order: the second theme that was prominent in the interviews conducted was a sense of organisation and program. A daily routine allowed the individuals to be calm and identify what was needed of them through daily repetition. Such things as; sudden noises and disruption as discussed in the previous theme cause a break in the order therefore causes individuals with ASD to become uneasy and confused which can lead to sudden break downs.

At Action in Autism there are daily routines that children engage in to allow the activation and training of all their senses and as well as communication skills. A simple environment with a sense of order and layout allows for greater understanding of the engagement and interaction needed.

AIA- Educator 1: "*We have a daily routine which includes visual pictures of anything that will be focused on so that they will know what to expect for the day, and what activities they are doing next. This helps them understand when it is time to finish and when it is my turn and your turn during activities".*

AIA- Educator 2: *"In my classroom they tables are set on one side of the classroom as a specified workplace area. We have allocated visual communication pictures that are strategically placed around the class to allow for opportunities for communication, an example of this is; a wait symbol at the door.*

AIA- Educator 3:*" Having structured spaces are essential has it promotes understanding of schedule, activities and expectations. Having a structure in place promotes independency.*

The classroom layout in Action in Autism all have their own structured layout that allow for the students to understand what is expected. Visual communication assist learner in understanding specific task and routines without aid from educators and this establishes a sense on independency among the students.

AIA- Psychologist: *"Space should be sensory sensitive, things such as light, sound and texture impacts the senses of individuals within the spectrum. Spaces that are required are calm down rooms, connection to outdoor movement spaces, spacious classrooms and green spaces that facilitate learning. Also, safety is an important part to these spaces".*

Structured space for autistic individuals is an important part of the design. Simple spaces with visualisation and applied wayfinding techniques assist in smooth transition through spaces for the individuals with ASD.

6.2.3. Theme 3- Natural setting and outdoor interface: from the review of the literature, precedent and case studies, there has been an importance towards inclusive design of the natural elements and outdoor interface. The following participants have also advised the importance of implementing the natural elements and outdoor interface.

AIA- Director: "*Spending time in the natural environment and outdoor helps the children to be imaginative and improves their social skills and concentration. Negative impact of could be hypersensitive reaction from the child due to the noises and over populated spaces.*

AIA- Educator 1: *"Outdoor learning helps to manage difficult behaviour therefore the children are in a much better, happier and calmer place. By releasing all their energy or anger by jumping, running, etc. It is also sensory relaxing for them. They are able to explore new things and be exposed to new learning opportunities".*

AIA – Educator 2: "*Many of our children spend the vast majority of their time indoors at home. They do not get the opportunity to move around freely and develop their gross motor skills through play/ interacting with the environment. Our outdoors spaces are able to provide them with that in a safe environment".*

AIA – Educator 3: *"Outdoor spaces are beneficial to those with ASD as it can be therapeutic, it helps calm down individuals who become anxious in confined spaces. Outdoor spaces such as sensory gardens or swinging on a hammock helps calm down frustrated children and help distract them from having a meltdown".*

The natural surrounding plays an important role on the human senses, it is important when designing for individuals with ASD that these elements can be controlled and adjusted to suit the users. These elements can be a positive or negative factor for those with ASD, therefore it is important to understand how to implement these elements of design. The above responses have provided an understanding of the impact of the natural elements in the context of Durban.

Outdoor spaces from the theoretical analysis to the primary research has been a prominent and important element when designing for individuals with ASD. Therefore, there is strong link needed between indoor and outdoor activity with emphasis on open spaces with natural landscape and public interface.

6.2.4. Theme 4- Sense of awareness through an integrated public sphere: Autism awareness is slowly increasing in South Africa, but is currently not enough due to the lack of public facilities. The few facilities that are within Durban are either non- profit organisations or do not deal with the specialised needs of Autistic individuals (Interview with director of AIA).

Due to previous stigma of exclusion of non neuro-typical individuals from society, many of the older facilities are isolated from the public sphere and have very little connection to the public sphere. Therefore, this has left for little integration of people living in spectrum to engage with the public world and be accepted as part of society.

AIA- Director: *"I think it would be nice for townships/peri urban areas to have more facilities for the needs of Autism, because some children have to travel far to get intervention of receive a diagnosis. Most people in the township areas still lack knowledge about autism".*

AIA- Educator 1: *"I think there should be more opportunities available for Autism specific facilities within the public realm of awareness. A main centre that is centrally based will be ideal as there are children that are still on waiting list to get into a school because schools are full or there are not enough facilities".*

AIA – Educator 2: *"There is a great need for a public presence and a sense of awareness!*

An appropriate place should be easily accessible (central area), a place that is largely residentially populated. Lower socio- economic family households need these kinds of facilities".

AIA- Psychologist: *"Action in Autism currently holds workshops, clinics, social media groups, outreach and training programs to create awareness. School for Autistic individuals needs to be purpose built. Most of the facilities are old schools that has been repurposed and isolated from the school population. Awareness should be created in how to support autistic people in schools, workplaces and socials spaces. There should be more intake of autistic children in schools".*

The lack of social awareness has been a major issue for people living within the spectrum and caused a separation in society. Creating an environment that promotes inclusivity will not only cater for the needs of autistic individuals, but boost their self-esteem as being a part of society and build their ability to communicate break the social barrier.

6.3. CONCLUSION

The information collected from the interviews has outlined important consideration and requirement of the learning spaces needed for Autistic individuals. External factors from the built environment can impact on the sensory difficulties experienced by the learners. Loud noises have been outlined has one of the biggest factors that cause sensory break out by the learners. To reduce this from happening it has been recommended that the acoustic properties of the environment is essential such as use of soft materials that absorbs sound within the classrooms, padded walls to reduce noise generated.

Light has been considered as part of another important factor that impacts on the sensory perception of the learners. When children have breakdowns, they need a dark space to calm down, this is generally in a calm room that is incorporated as part of the classroom that learners can escape to re-establish a sense of sensory balance. Therefore, small high openings with adjustable blinds is suitable for this kind of environment. Another element of design consideration is close contact with green spaces helps learners feel calm and relaxed and allows for social interaction therefore, sliding stacks doors that allow for an open environment to nature and control of natural light will aids in a controlled learning environment. Amongst these considerations other factors such as noisy HVAC systems and florescent lighting can impact on individuals learning capabilities.

CHAPTER SEVEN | CONCLUSION AND RECOMMENDATIONS

7.1. INTRODUCTION

Through research it has been indicated that there is a lack of spatial consideration, sensory inclusivity and public integration towards the needs of those with ASD. The study has created a structure that will be implemented towards a design response to the research problem and confirmed hypothesis of this dissertation.

The key theories and concepts of this dissertation encourages the relationship between the users senses as communication tools within the built environment. Architecture has a dominance of the visible and physical environment, which its presence and impact on people's daily lives cannot be ignored. Architecture can be believed to create the pace for everyday living, the spaces created co-exist with the people that experience them daily. The spaces created affects the movement, activities, interactions, communication and views of its users. Architecture acts as an instrument to express emotions, social and environmental interaction.

The core aim of this research is to: "implement the study and understanding of spatial needs of individuals with Autism into a learning centre that caters for the Autistic individuals and explore the impact, benefits and understand the concept of perceptual architecture and its relationship with the built environment". The following being the objectives:

To explore the spatial needs of individuals with ASD - The research conducted in chapter 2 shows the understanding of the social and neurological impairments of ASD and its relationship to the built environment to specific detail.

To explore the influence that the built environment has on autistic users – Chapter 3 applies architectural theories and concept that has shown relevance to the key social and neurological issues that has been outlined in chapter 2. The chapter also forms the theoretical framework and structure to the dissertation to achieve this objective.

Understand the nature of ASD and the current response to facilities provided for those who suffer from ASD – The precedent and case study conducted has shown the current response of facilities that cater for ASD. It has indicated the importance of public and social interaction. It has indicated the impact through example of the implication of architectural sensory design and the negative impact without considered sensory design. It

has also added the lack of response towards the condition and importance of specialized centers towards ASD.

To apply architectural theory and sensory design principles to cater for those with impaired perception- This objective has been partially achieved, has it only explored the architectural theory and sensory design thus far, and will be applied through part two of the dissertation.

Main key questions that this study and research answered through its analysis and discussion

- *What are the spatial needs and quality of the environment needed for those suffering from ASD?*

  The spatial needs and quality of an environment for autistic users should implement the principles of sensory design. It should meet suitable acoustic properties that would absorb loud and unwanted sound. Provide a spatial sequencing pattern that is simple and not confusing to autistic users. Provide escape spaces when users experience sensory overload. Classrooms and activity spaces needs to be compartmentalized into zones for its users' specific needs. There is a need for pause spaces and transition zones to allow individuals to re-establish their senses before entering new spaces.

- *How can spatial needs of people with ASD inform an architectural design process/typology?*

  The spatial needs of autistic individuals are guided by the paradigm of phenomenology, perception theory and sensory stimulation. This informs a typology that responds to human perception and senses. Therefore, the design process will look to enhance the well-being of its users through human centered design and sensory integrated spaces such as; saturated spaces, controlled environments and a public interface.

- *What are the current conditions of the learning spaces provided for children and people diagnosed with Autism?*

  The current conditions of learning spaces provided are very limited and are not designed specifically to the spatial needs of autistic individuals. The case study investigated in this study shows evidence of that. It was an old military base that was converted into a school for autistic users and therefore does not follow and guidelines of spatial sequencing or integrative sensory architecture but rather converted standard

environments to meet the major generalized needs of autistic users. This is not the best solution and still restricts individuals from achieving and unlocking their skill and potentials due to trying to cope with sensory difficulties experienced through the built environment.

- *What can architects do to change how the built environment is perceived by people living with ASD?*

  Though the implementation of architectural sensory principles and design guidelines for ASD developed by researchers done within the architectural field such as the ASPECTSSTM Design Index by architectural professor Magda Mostafa. Through design that is inclusive to the sensory and spatial needs of its users.

- *What relation or role does the physical built environment play on the perception and emotion of people's experience?*

  Human spend a majority of their time within the built environment. If spaces are designed without the consideration to their emotional and psychological needs it can cause mental and physical illness. Without sensory integrated people are left lost and lack self-confidence which leaves them to withdraw from society.

- *How does perception relate to the sense modalities and experience of space?*

  Each sense modality has its own specific perception such as sight through visuals perception of color being bright or dark stimulates different parts of the brain to formulate a response. This response creates a sense of emotion or trigger that will allow a user to react to the space in which they have perceived through its visual communication and characteristics of that space. If the perception conceived is a positive one the user will feel comfortable and relaxed, but if it triggers negative response it will cause the user stress and anxiety.

The presence of the built environment on lives of those with ASD is experienced with a greater sense of emotion and interaction. The senses of those within the spectrum are heightened and therefore experience every little detail of the built environment around them. It is vital that special consideration is taken in the spatial planning of movement, connection and transition of spaces in great detail with a strong consideration of natural elements on the users' sense.

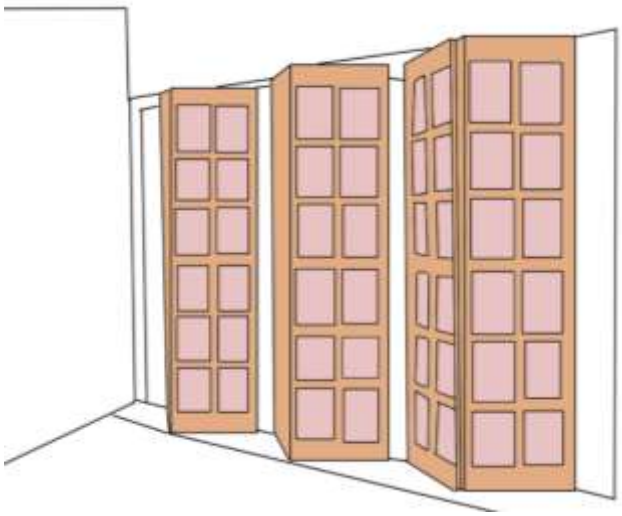
7.2. RECOMMENDATIONS

The secondary and primary data collected and analysed through theories, concepts, literature, interviews, precedents, case study and observations have directed this study towards a spatial and sensory inclusive design for a learning and skills centres. This includes analysing spatial planning sequences and creating controlled saturated spaces for autistic individuals across the spectrum with a connection to the public interface.

The two main theories in relation to design for Autistic individuals are Socio-spatial theory and Sensory design theory. These theories have proven most relevant to the research problem, and also what have been identified the lack of when responding to the impairments and condition of ASD.

The study has suggested the best approach when designing for autism is one that is neutral based, this means the space created can be used by autistic individuals of different sensory profiles. This has potential for sensory integration but also inclusive of sensory stimulation. It is important to create that allows individuals to adapt to the various sensory stimulus. The follow design proposals have been made:

7.2.1. Controlled spaces – due to the multiple senses of perception the environment created must be able to adapt to various perception difficulties. The background should be neutral and the consist of elements of adaptability, one of these elements are folding stack doors:



Elements that can adjust the environment according to the users needs. The doors allow for controlling natural light in a space and controls connection and movement between spaces.

Figure 7.1. Simple sketch of typical folding stacks doors (**Source**: Author)

Sliding timber panels allows for interchangeable environments of colour texture and relief, strategic positioning can allow for integration with the natural surroundings.

Figure 7.2. Sketch of sliding panels (**Source:** Autor)

Acoustic ceiling panels to absorb sound generated within in the classroom and noise of others children.

Figure 7.3. Image of typical classroom with acoustic ceiling panels

(**Source:** https://resonics.co.uk/school-acoustics/)

7.2.2. Balance between hypo and hyper sensitive environments- in order to design for a condition involving sensory difficulties is to separate zones according to the different stimulus. Individuals diagnosed ASD can experience hyper or hypo sensitivity. The following elements can help separate the zones and aid individual's perception in controlling these stimuli through purposed aided design:

- Visual connection between hypersensitive and hypo sensitive zones.
- The use of volume and light and a change in spatial configuration.
- A play in complexity but still user friendly.
- Defined boundaries.

Interactive sensory playscape. With various activities and sensory stimulation exercises, such as sand box, various colour through paintings and multiple textures to stimulate different touch qualities.

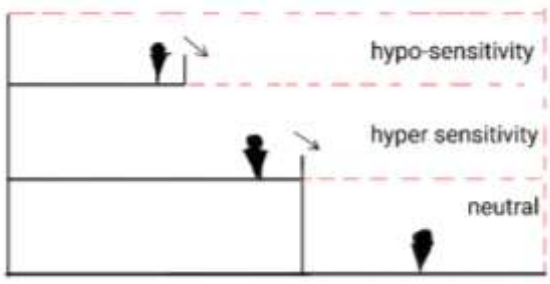
Figure 7.4. Image of typical interactive outdoor space for autistic individuals.

(**Source:** http://autismrocksfife.org/new-gallery)

Spaces with different textures to encourage interaction with the environment and create interest for its users.

Figure 7.5. Image showing a seat textured with grass and colour palette depicting different emotions. (**Source:** http://autismrocksfife.org/new-gallery)

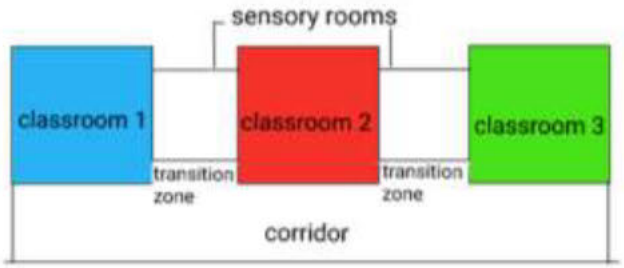
Spatial zoning may also occur vertically through split levels and mezzanine floors. The change in level can create the definition between the different stimulus. An example of this is within a classroom if a student feels over-whelmed by the main space, he or she may retreat to the mezzanine floor and overlook the teaching space until they re-centre themselves to return.



Vertical zoning of sensory stimulus while maintaining visual connection.

Figure 7.6. Sketch showing interactive levels
(**Source:** Author)

7.2.3. Modulation- This methods helps individuals idetifity different spaces through organisation and wayfinding. A clear wide walkway allows for central movement axis. Transition zones before entering classrooms helps the individual to pause before entering a new environment. Each classroom will need to have a sensory time out space for when students are over stimulated and need a calm down space.



Each classroom/ space should be easily identified through a unique element either through colour or texture.

Figure 7.7. Typical example of modulation (**Source:** Author)

7.2.4. Site Selection Guidelines

The research has suggested a specific criterion for selecting the most suitable site to meet the requirements and needs for people with ASD. According to the research the facility should create a sense of calm, comfortable home like environment. It should be within or close to a residential context with a strong public presence. Due to the lack of facilities and awareness this facility should be located close to Durban central area within a close neighbourhood surrounding. Its needs to be easily accessed by transport routes public and private and connect to walkable routes. The study has shown that access to outdoor spaces has a great benefit on the senses of autistic individuals.

The following table listing site selection factors and its guidelines:

Site Selection Factors	Recommended Guidelines
Access	Outer edge of the city centre. Close to public and private transport routes. Strong walkability node.
Natural Setting	Strong natural setting surrounded by large amount of vegetation and trees and open to public space.
Topography	Land with a natural slope or flat would be ideal. Autistic people do have problem with depth perception therefore to many changes should be avoided.

Community	There is a need for a strong sense of community and an environment and community that will support individuals with ASD and not ridicule them.
Public Sphere	The surrounding community should connect to existing retail, commercial and public amenities that attract people.
Sound Barrier	The site should not be near any fast-vehicular movement or construction. A site that has an abundance of vegetation will act as sound barriers from its surrounding.

7.3. CONCLUSION

To conclude the findings of this study evidence has shown that universal design responds only to physical disabilities, but neglects the non-visible impairments. These impairments are such sensory difficulties which autistic people experience daily within the built environment. These characteristics of space include; colour, lighting, volume, depth, order and textures which undoubtably need to be sensory inclusive to achieve an environment that is conducive to autistic individuals. if the environment created is comfortable to the user's needs, it will promote positive interaction and better concentration to its users.

The study began by understanding the overlooked problem in the research, and then progressed to form a theoretical and conceptual understanding. Which allowed for the creation of an architectural response. The response of this study will look to create innovative strategies in applying the proper spatial and sensory needs that are sensitive of autism while allowing for autistic individuals to achieve their underlying potential uniqueness and creating the stepping stone to a positive and inclusive life.

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APPENDICES

APPENDIX A:

Information Sheet and Consent to Participate in Research

February 2020

To whom it may concern:

This information consent letter (a copy of which has been given to you) outlines the details of my master's thesis research and what your participation entails. This project is part of my requirements for the course, Arch807: Architectural Design Dissertation Proposal, Department of Architecture, University of KwaZulu-Natal, and supervised by Lawrence Ogunsanya.

This study focuses on the spatial needs of those who fall under the ASD spectrum. The study looks into how the built environment has catered for those currently living with ASD, and how it can create awareness through architecture to make the lives of those in the spectrum comfortable. The study is expected to enrol approximately ten participants in total, in the Durban and surrounding areas. Participation in this project is voluntary and there are no known or anticipated risks to you as a participant in this study. The interview will be approximately 30min-45min in length and consists of general questions and answers. The aim of this study is to create awareness within the built environment of the severity ASD and the impact the built environment can have on those living with Autism.

You can decline to answer any of the interview questions if you so wish and, for that matter, terminate the interview at any time and that in the event of refusal/withdrawal of participation the participants will not incur penalty or loss of treatment. No costs will be incurred by participants as a result of participation in the study. Any information you provide is kept completely confidential. Your name will not appear in any written report from this study and your information will be deidentified prior to storage, however, with your permission anonymous quotations may be used. With your permission also, data collected for this project will be retained for five years in my supervisors locked office at Howard College. Only my supervisor at Howard College and I will have access to the data.

In the event of any complications or concerns/questions, you may contact the researcher at 084 3355 671, or email at roman.naidoo5@gmail.com. Alternatively, you may contact the UKZN Humanities & Social Sciences Research Ethics Committee, contact details as follows:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus Govan Mbeki Building Private Bag X 54001 Durban 4000

KwaZulu-Natal, SOUTH AFRICA Tel: 27 31 2604557- Fax: 27 31 2604609 Email: HSSREC@ukzn.ac.za

Please indicate below your willingness to participate in this study. Thank you in advance for your co-operation in this research.

Yours sincerely

Roman Naidoo Master of Architecture University of KwaZulu-Natal Howard College Campus Department of Architecture

APPENDIX B:

Consent Form

I have recited the information accessible in the information letter about a research study entitled "Exploring the spatial needs of Autistic individuals in the built environment: towards a learning centre for Durban", being led by Roman Naidoo of the department of Architecture at Howard College, Ukzn, under the supervision of Mr. Lawrence Ogunsanya. I have had the opportunity to ask any questions related to this study, to receive satisfactory answers to my questions, and additional details that I wanted.

I understand the purpose and procedures of the study.

I am aware that I have the option of allowing my interview to be taped to ensure accurate recordings of my responses.

I am aware that my citations will be unnamed.

I declare that my input in this study is entirely charitable and may withdraw my consent at any time without penalty by advising the researcher.

I was informed that if I have any comments or concerns resulting from my participation in this study, that I may contact the researcher at 084 3355617, or email at roman.naidoo5@gmail.com

With full knowledge of all foregoing, I agree, of my own free will, to participate in this study.

Yes No

I agree to the use of anonymous quotations in the final research project report that comes of this research.

Yes No

I agree to the use of my photographs for research purposes

Yes No

If I have any questions or concerns about my rights as a study participant, or if I am concerned about an aspect of the study or the researchers then I may contact:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus Govan Mbeki Building Private Bag X 54001 Durban 4000 KwaZulu-Natal, SOUTH AFRICA Tel: 27 31 2604557 - Fax: 27 31 2604609 Email: HSSREC@ukzn.ac.za Participant name :…….(please print)

Participant signature……..

Witness name: :…….(please print)

Witness signature……

Translator Signature (where applicable)…… (please print)

Date……..

APPENDIX C:

Exploring the spatial needs of Autistic individuals in the built environment:

towards a learning centre for Durban

Interview Schedule for Organization Officials

Date:…… Interview
Location……

Interviewee Name:……Contact details:……

1. **Introductory questions**
   - What is your job role, i.e. what are you responsible for? And how long have you been in your current position?
   - Could you please elaborate on the functions of this Facility with respect to individuals with ASD and how it caters for the needs of those in the spectrum and the public?
2. **Primary Questions**
   - What are the main challenges of managing this kind of environment or its user?
   - My main interest is on the effects of the built environment/ spaces on individuals with ASD and how does it play a role on those people/children and their perception of the spaces they in?
   - What efforts does the facility make to create awareness to mainstream schools and does the public at large know about the facility?
   - What are the basic living conditions of a person or child that falls in the spectrum?
   - Describe what changes in surrounding and in their environment can do to improve a person's daily life with ASD.

- Has there been any change in the built environment over the last 10 years to accommodate and create awareness to this growing condition?

- How has the facility created or made changes to its current space to accommodate the growing number of people falling within the spectrum of ASD?

3. Secondary Questions

- Do you consider the existing learning facilities in Durban as suitable for those who have special needs in the spectrum?

- How would you describe a learning centre for individuals with ASD compared to the current facilities provided?

- Does the facility only cater for those who are diagnosed with ASD or does it also include other children and individuals who are not in the spectrum?

- Do you see any long-term goals the facility has in creating national awareness to ASD?

- Do you have any personal views regarding the current facilities or relationship with someone in the spectrum?

APPENDIX D:

Exploring the spatial needs of Autistic individuals in the built environment:

towards a learning centre for Durban

Interview Schedule for Teacher

Date:…… Interview
Location……

Interviewee Name:……Contact details:……

The research my study focuses on is the impact the built environment has on people both emotionally and physical, in particular individuals with specific needs, such as individuals with ASD. Due to ASD being such a wide spectrum of disorders there has been very slight architectural research done to create a constructive impact on their behavior, education and lives of those with autism. This study hopes to create a bond in that gap.

1. **Introductory questions**
   - What is your job role, i.e. what are you responsible for? And how long have you been in your current position?

   - Could you please elaborate on the background of this Facility with respect to those who are diagnosed with ASD and how it caters for the needs of those in the spectrum and public?

2. **Primary Questions**

   - One of my main focus in this research is the various senses. Through my study I found that individuals with autism often experience sensory issues. Through first-hand experience what can you say are the major sensory issues in your class?

   - There are couple key buildings design consideration that my research has led me to thus far. Please could you explain from your experience how the natural

elements such as the sun, wind and noise has impacted on children with autism, could you elaborate on the positive and negatives and how these issues are addressed in your classroom.

- From my research it has led me to believe that an organized classroom/space spatial layout is important, does your classroom have a specific layout for the needs of the condition?

3. Secondary Questions

- What would you say are suitable outdoor activities for autistic individuals?

- How are the outdoor spaces beneficial for them?

- Is there a need for more autism specific facilities within the context of Durban and where would you suggest a suitable place be?

- Is there anything else you would like to add? What improvements with you like to make to your classroom?

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

08 September 2020

Mr Roman Naidoo (213523799)
School of Built Environment & Develop Studies
Howard College Campus

Dear Mr Naidoo,

Protocol reference number: HSSREC/00001805/2020
Project title: Exploring the spatial needs of Autistic individuals in the built environment: Towards a learning centre for Durban
Degree: Masters

Approval Notification – Expedited Application

This letter serves to notify you that your application received on 23 July 2020 in connection with the above, was reviewed by the Humanities and Social Sciences Research Ethics Committee (HSSREC) and the protocol has been granted **FULL APPROVAL** on the following condition:

1. The use of personal photographs of participants is not permitted

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

This approval is valid until 10 September 2021.
To ensure uninterrupted approval of this study beyond the approval expiry date, a progress report must be submitted to the Research Office on the appropriate form 2 - 3 months before the expiry date. A close-out report to be submitted when study is finished.

All research conducted during the COVID-19 period must adhere to the national and UKZN guidelines.

HSSREC is registered with the South African National Research Ethics Council (REC-040414-040).

Yours sincerely,

[redacted]

Professor Dipane Hlalele (Chair)
/ms