HUMAN PERCEPTION AND THE BUILT ENVIRONMENT:

A Proposed Autism Life Learning Centre for Durban

By

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- To all my friends and colleagues who have believed in me and supported me throughout the years.

DEDICATION

To my parents, for all the love and support that you have given me throughout my life. Without you I would never have accomplished what I have today and I cannot express the gratitude for everything that you have helped me achieve. A special thank you to Timothy Twigg who has stood by me and supported me through this process and who never let me give up.

ABSTRACT

Buildings affect people both physically and psychologically, this study analyses this impact which the built environment has on people's lives. This interrelationship between people and the built environment is based on human perception. The study explores this relationship further in order to develop an understanding of the ways in which architecture influences peoples' moods, behaviours and experiences. By determining the importance of this interrelationship and developing a better understanding of it, a deeper analysis of the specialized needs of individuals with altered or impaired perceptions is developed. Focus is placed on individuals with autism spectrum disorders, who are known for their difficulties with perception. In addition, despite its overwhelming prevalence, they have a history of being inadequately catered for within the built environment because their wide range of complex needs are poorly understood.

The purpose of this study is to establish an understanding of the unique needs of this particular user group, to interpret the implications of these needs with regards to the built environment, to assess existing facilities in regards to these findings and to provide information which can be used to develop guidelines for creating positive environments which can enhance the daily lives of individuals with autism spectrum disorders.

The research was carried out by way of a review of existing relevant literature on the subject of perception, experience and autism spectrum disorders, a review of relevant precedent studies, a critical analysis of relevant case studies and interviews with parents, teachers and principals who have had first-hand experience with individuals with autism spectrum disorders.

The built environment, which plays a large role in people's lives, must be carefully considered and designed to ensure that the needs of its users are met and their overall well-being is maintained. In contemporary society, where human needs are often ignored, built environments have become ego-driven objects of visual seduction (Pallasmaa, 2005). This study calls for re-humanising architecture, considering human aspects in design and catering for all human needs. By focusing on responding to users particular needs, throughout the design process, buildings which make significant, positive contributions to the lives of individuals can be made.

TABLE OF CONTENTS

PART TWO

DESIGN REPORT

PART ONE:

BACKGROUND RESEARCH ON ISSUES

CHAPTER 1 INTRODUCTION

1.1 Background

People spend the majority of their time interacting with man-made environments, from the places where they live and work, to the places where they relax and socialize, in fact built environments are involved in almost all human activities and, therefore, undeniably play a large role in people's lives. The core of this mankind-environment interrelationship is rooted in perception and experience. People's immediate awareness of the environment is given through the process of perception (Norberg-Schulz, 1965). This process allows people to understand, translate and draw relationships with their surrounding environments. Environmental psychologists, such as Brebner, Rapoport and Viljoen, have explained that architecture has the ability to arouse thoughts, feelings and emotions within its users, therefore, people are affected constantly both physically and emotionally by the built environments which surround them.

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). Wilkes (2005) further explains that the aggressive, undesirable behaviours associated with ASD are often exacerbated by these negative environmental experiences and that such behaviours lead to ridicule, causing individuals to withdraw from society.

ASD represents one of the fastest growing disability categories in the world, the current statistics show that one in every 150 children is estimated to fall within the autistic spectrum (Mostafa, 2008). Despite its overwhelming prevalence, ASD is by and large ignored globally by the architectural community (Mostafa, 2008). Many factors contribute to this inadequacy; the main factor being the wide spectrum of disabilities experienced by these individuals, which presents difficulties in creating environments which cater for their varying needs. Another specific problem is that, in the past, these individuals were misdiagnosed as having mental retardations and were placed in psychiatric institutions where they were misunderstood and unable to communicate their difficulties (Beaver, 2010). The majority of current Autism-Specific facilities in South Africa were not originally designed for ASD's, but

are converted houses or adapted school facilities(Refer to Teacher - Interview 01, Appendix E). These adapted environments focus on the functional aspects of the spaces and do not consider the important psychological effects which they have on their special users.

1.2 Definition of the Problem, Aims and Objectives

1.2.1 Definition of the Problem

The lack of consideration of the psychological aspects of design has led to people's emotional disconnection from the built environment. Individuals with ASD, who battle to relate to the world as is, are further traumatised by the environments which surround them. It is essential that the specific environmental needs of this particular user group, which are currently under-catered for, begins to be recognised and considered in the design of built environments.

1.2.2 Aims

The fundamental aim of this dissertation is to explore the relationships between human perception and the built environment, in respect to both the physical and psychological aspects, in order to determine suitable architectural solutions which can be utilized to enhance the environment and lives of people with ASD.

1.2.3 Objectives

The objectives of this dissertation are to;

- Investigate and analyse the role of the built environment in people's lives and how it affects them both physically and emotionally.
- Explain the process of human perception and the sense modalities in relation to the built environment.
- Develop an understanding of the nature of ASD's and the current treatment methods available.
- Identify the specialised spatial and environmental needs of individuals with ASD.
- Interpret the architectural implications of these needs.
- Examine and evaluate existing architectural responses to these requirements by way of precedent and case studies.

1.3 Setting Out the Scope

1.3.1 Delimitation of Research Problem

This architectural study is investigating human perception and its relationship to the built environment, specifically in regards to the physical and psychological aspects. The scope of the research will not discuss the social and cultural issues relating to this topic, especially those in relation to people with ASD. As an architectural dissertation the study will not provide any medical therapies or other non-architectural treatments, recommendations or solutions for individuals with ASD. In the field of architecture the role of taste is not of much interest and is therefore not discussed in detail in the scope of this dissertation.

1.3.2 Definition of Terms

- ***Autism Disorder**:* The most common Pervasive Developmental Disorder characterized by impaired communication, challenged social interaction and repetitive behaviours.
- ***Autism Spectrum Disorder**:* An umbrella term for a group of 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.
- ***Man:*** Where the masculine gender is used in this dissertation it includes the feminine gender.
- ***Neurotypical:*** The term used among the autistic community referring to people who are not on the autism spectrum and would be considered as 'normal'.
- ***Pervasive Developmental Disorder:*** A collective term used for a group of five developmental disorders characterized by delays in the areas of social development, communication, cognition and behaviour. The term is used interchangeably with Autism Spectrum Disorder.
- ***Self-stimulation**:* The habitual, compulsive behaviour exhibited by an individual with autism indicating discomfort or sensory unbalance.

1.3.3 Stating the Assumptions

As stated previously, this dissertation is architectural therefore the conclusions and recommendations are based on therapies defined by professional therapists. The therapies

discussed in this dissertation are assumed to be the most appropriate and effective methods of therapy for individuals with ASD.

1.3.4 Hypothesis

People perceive their surrounding environments differently; this varies according to their emotions, attitudes and memories as well as age, gender, race and culture. Although there is a vast range of perceptions, by identifying a particular group of people, in this case those with ASD, commonalities can be identified and an understanding of these can be used to develop an appropriate design approach for a built environment suitable for their physical, emotional and specialised needs.

1.3.5 Key Questions

The primary research question which will be used to guide this dissertation is:

- How can the physical aspects of the built environment enhance its user's perceptual and emotional experiences?

Sub-questions for the research are:

- How do man and the environment interrelate?
- What are the psychological effects of the built environment and how do they influence the way in which people experience spaces?
- What is the relationship between perception, the sense modalities, experience and the built environment?
- How can the built environment enhance the lives of people with ASD?

1.4 Concepts and Theories

1.4.1 Perception theory

Perceptual theory looks at understanding people's observations and reactions to the world around them (Hochberg, 1964) and their totality of experiences. Walter Gropius theorized (cited in Barr, 1970) 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) expresses that one can distinguish between two aspects of perception: the first is a sensory dimension which deals with passive sense experiences; and the second is the active motor dimension which

deals with bodily actions. However, in everyday experiences these sensory and motor dimensions are never separate, they 'work together seamlessly so that awareness and action unfold as an integrated, continuous experience' (Seamon, 2010). These sensations and perceptions are studied further through the theories of phenomenology.

1.4.2 Phenomenology

Phenomenology is the interpretive study of human experience (Seamon, 2000). These experiences are derived from the response of human senses to the elements, stimuli and spaces that surround them (Horvath, 2010). Many phenomenologists have discussed the quality of people's experience in relation to place in both the built and natural environments (Vischer, 2008). For example, Norberg-Schulz (1980) identifies phenomenology's potential in architecture as the ability to make the environment meaningful through the creation of specific places. For Merleau-Ponty (1962)phenomenology describes the nature of people’s perceptual contact with the world in conjunction with their experiences.

1.4.3 Concepts of Mankind and the Environment

Norberg-Schulz (1965: 130) states that "architecture dominates our physical environment and influences us constantly."However, this relationship between mankind and environment is in fact bi-directional and is described by several theorists as dynamic and interactive. In fact, Stokols (1974) claims that the environment not only shapes people, but it is also shaped by them. This interrelationship between mankind and the environment is crucially linked back to sensual experiences and human perception (Rapoport, 1995). The features of the environment combine to form the perceived environment, which in turn affects the behaviour and responses of the people within that environment.

1.5 Research Methods and Materials

1.5.1 Research Design

The research carried out for this dissertation was aimed at exploring the relationship between human perception and the built environment and identifying ways in which the built environment can enhance the lives of people with ASD. The collection and analysis of this data was used to answer the key questions stated above. The nature of this research resulted in a qualitative approach to the data collection and analysis.

1.5.2 Research Methods

The method of research was divided into primary and secondary research. The primary data was collected using interviews and case studies and was used to develop a deeper understanding of the research problem from first-hand experience. The secondary research, collected in the form of a literature review and precedent studies, explored the current body knowledge regarding human perception, experiencing the built environment and the relationship these have on individuals with ASD.

1.5.3 Primary Methods - Case Studies

The case studies are observations and evaluations of educational facilities which cater for individuals who have various learning disabilities. A purposive selection of two specialised educational facilities within the Durban area provided the opportunity for critical analysis of the contextual and environmental factors which impact people's perceptions and experiences of these buildings. Brown's School was selected due to its Autism specific facilities which provided insight into the functioning of a learning environment for children with ASD. It also provided the opportunity to observe the activities which occur inside and outside these learning spaces. Livingstone Primary School was selected because it is designed as a short term environment in which to remediate children and return them to mainstream schools and the built environments have been adapted to facilitate this process. The case studies also provide a deeper understanding of the impact that the built environment has on individuals with emotional disabilities, such as those with ASD. The first hand observation and analysis of the case studies are supplemented with feedback from interviews.

1.5.4 Primary Methods - Interviews

Several selected, semi-structured interviews were conducted in the Durban area;

- Teachers and principals from educational institutions who teach children with various disabilities were purposively selected for semi-structured interviews due to their knowledge and experience with these children. The face-to-face interviews conducted were aimed at determining what kind of environments these children are currently exposed to and how these environments affect them.
- Four parents of children with ASD who attend Autism Specific Schools in KwaZulu-Natal were randomly selected for informal face-to-face interviews.

The aim of these interviews was to understand the specific impairments and behaviours of several individual children and to determine how their parents have adapted the home environment to suit their individual child's needs.

1.5.5 Secondary Methods - Literature Review

The literature review analyses and discusses the existing bodies of knowledge found in published references such as books and journal articles and in unpublished references such as theses and websites. The relevant literature relates to human perception, the sense modalities, psychology of the built environment, autism spectrum disorders and how these all relate to each other.

1.5.6 Secondary Methods - Precedent Studies

This involved the review of published writings on existing built environments. The buildings were specifically selected for their relevance in designing for the specific needs of individuals with ASD and their consideration of the architectural elements determined in the research. These precedent studies were used to give clarity to the ideas put forward in this dissertation and show how other architects have addressed the issues of perception, multi-sensory design, and experience within built environments designed for individuals with ASD.

1.6 Document Outline

This dissertation is divided into five parts; the literature review, precedent studies, case studies, analysis and discussion and conclusions and recommendations. The first part of the literature review, chapters two and three, analyse what authors such as Pallasmaa, Norberg-Schulz, Merleau-Ponty and Rapopport have written about the physical and psychological relationships between mankind and the built environment. The second part of the literature review, chapter four, is a background study about ASD's, analysing the specific needs of these individuals. This is translated into various architectural implications. The precedent studies, discussed in chapter five, analyse good examples of buildings catering for the specific needs of individuals with ASD and responding to the various autism-friendly architectural elements discussed in the literature review. The next section of the document, chapter six, deals with case studies, which are empirical studies of existing educational facilities catering for children with various disabilities. These case studies are critically analysed according to the architectural guidelines highlighted in the literature review section. The analysis and discussion, chapter seven, describes the findings of the research and puts the

precedent and case studies into a dialogue with the literature. The final section, the conclusions and recommendations chapter eight, concludes the research and highlight areas for future research.

CHAPTER 2 THE INTERRELATIONSHIP BETWEEN MANKIND AND THE ENVIRONMENT

2.1 The Role of the Built Environment in Human Life

In contemporary society people spend the majority of their time interacting with man-made environments in some way or another. This extends from the homes where people live to the places where they work, play and socialize, (Refer to figure 2.1) and if one takes into consideration semi-architectural elements such as roads, gardens and squares as well, (Refer to figure 2.2)one arrives at a "network" of interrelated components which are connected with practically all human activities (Norberg-Schulz, 1965). Thus, people are constantly surrounded by man-made environments indicating the crucial role that the built environment plays in people's lives. It is therefore key; to develop a deeper understanding of this relationship so that building design can better respond to human aspects.

Figure 2-1 People Spend the Majority of Their Time Within Built Environments (Whyte, 1988: 212)

This chapter analyses various aspects of the mankind-environment interrelationship as discussed by various phenomenologists, environmental psychologists, philosophers, geographers and architects. Pearson and Richards (1994) define the core of the mankind-environment relationship as having roots in perception and experience which is linked to both the symbolic and functional aspects of the built environment.

Figure 2-2 People Interacting with Semi-Architectural Elements (Whyte, 1988: 28)

2.1.1 Functionality

The role of function in the built environment is a controversial topic due to the modern functionalist movement. This movement proposed that any designed form - be it building or chair- should be determined solely by its function, and that anything designed with this concept would be inherently beautiful (Porter, 2004).Louis Sullivan's statement 'form follows function' and Le Corbusier's definition of a house as a 'machine for living in' are used to describe the functional design approach. However, this functional architectural tradition has been heavily criticised due to its mechanical, programmatic processes and lack of attention to the human experiences of the spaces created (Relph, 1976).The purely functional approach meets the basic practical needs which a space requires in order to function efficiently, but neglects the emotional connection which people have with the built environment. As Norberg-Schulz (1965: 17) explains: the "built environment influences human beings and this implies that the purpose of architecture transcends the definition given by earlier functionalism." Architecture is, at the end of the day, designed to house and facilitate the functions of mankind. Thus, functional requirements play an important role in the design of any environment but, what is key is that functionality is not the only design consideration.

Contemporary building forms and aesthetics reflect new technologies and materials. They are moulded to push the boundaries and create new and exciting architecture (Refer to figure 2.3). Yet, there is something to be said about the idea that the form and aesthetic of a building should reflect its function.

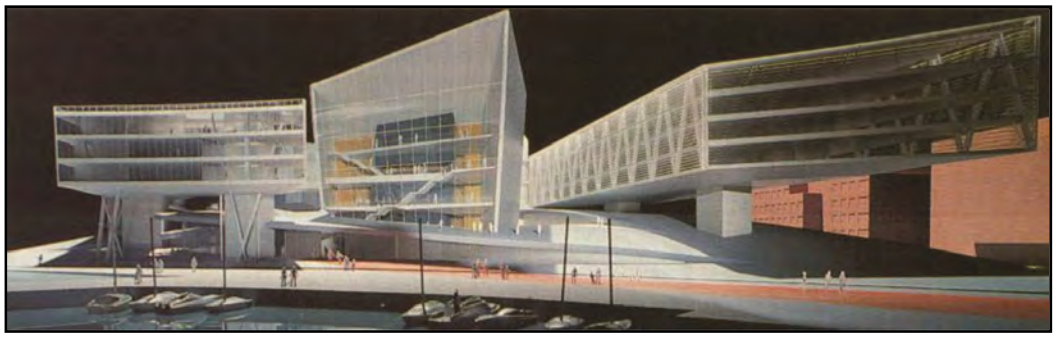


Figure 2-3 Contemporary Architectural Design for the Cardiff Bay Operah House, Wales, by Zaha Hadid (Ellis, 1996: 24)

This does not imply that a ferry terminal should look like a boat, but rather suggests that by creating ambiguous forms and aesthetics, contemporary architecture has lost its clear sense of identity and meaning. Aldo Van Eyck, one of the leading architects who opposed the

functionalist movement, introduced concepts such as 'identity' and 'place' in his designs. He redirected attention to architectures' role as a carrier of meaning (Porter, 2004).

2.1.2 Meaning and Meaningful Architecture

> "Man dwells when he can orientate himself within and identify himself with an environment, or, in short when he experiences the environment as meaningful."
> - Norberg-Schulz (1980: 5)

Places acquire meaning simply because people live in and interact with them (Relph, 1976),their individual memories, experiences and intentions automatically develop meanings and meaningful relationships with their surroundings. This in turn evokes various emotions (Hesselgren, 1975), behaviours and actions. Architecture, in addition to its functional tasks discussed in the previous section, should be designed to enhance these meanings within the built environment, making human existence more meaningful (Norberg-Schulz, 1974).

Meaning in the built environment makes use of the architectural symbol system, consisting of walls, roofs, doors, windows, steps, spires, etc. (Raskin, 1974). These architectural elements allow people to attach symbolic meanings to places and spaces (Rapoport, 1995). For example, the triangular form of the pediment and the colonnade resting on a pedestal has come to be associated with important civic or institutional buildings (Wilson, 1984). (Refer to figure 2.4) By associating meanings with all aspects of the environment people are able to move, function and behave efficiently and appropriately within the environment. This attribution of meaning to things and environments is one of the most fundamental processes of the human mind, therefore, instead of creating objects and environments of mere visual seduction, which leaves people's lives void of coherence and meaning, designers need to consider that the ultimate meaning of any building goes beyond architecture and responds to people's sense of self and being (Pallasmaa, 2005).

Figure 2-4 The Whitehouse's Pediment and Colonnade Emphasising the Buildings Importance (Unknown Author[4], Unknown Year)

In peoples' everyday lives environments are not experienced as independent, clearly defined entities that can be described simply in terms of their location or appearance (Relph,

1976). These built environments, which are involved with almost all human activities, are linked with basic human needs and experiences. Whittick (1960) expresses that architecture most successfully satisfies human needs when there is a balance between function and meaning. What is needed is not a precisely mathematical, programmatic process, as seen with functionalism, where environments are treated "like some great machine that we do not yet quite understand" (Relph, 1976: 146). It is rather through carefully designed built environments that address both the functional requirements of its users and their sense of self that moves architecture into a more meaningful existence.

2.2 Human Needs and the Built Environment

With the majority of people's activities being performed within or interacting with man-made environments, the built environment is described by Wilson (1984) as a tool with which to meet mankind's needs. Contrary to philosophers, such as Heidegger, Mearleau-Ponty and Bachelard, who describe dwelling as the basic principle of human existence (Pearson & Richards, 1994), today's society has surpassed the basic human physiological needs of shelter, food and security. Maslow (1954 cited in Wilson, 1984) proposed that there is a hierarchy of mankind's needs (Refer to figure 2.5) and that as societies develop, their needs become more complex and are no longer simply life sustaining. These complex needs tend to be psychologically, emotionally and socially based. Hence, architecture must be reconsidered in order to fulfil mankind's changing contemporary needs.

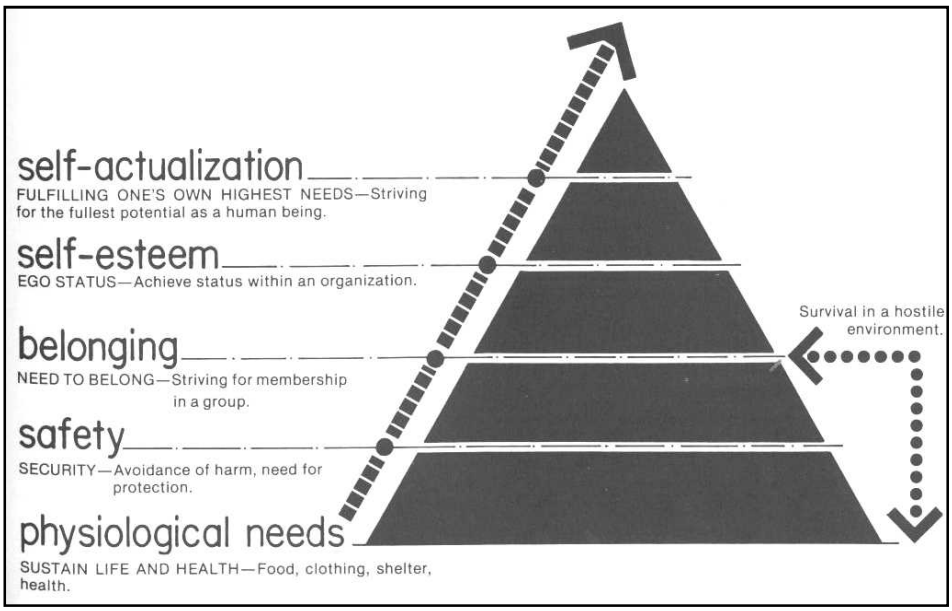


Figure 2-5 Maslow's Hierarchy of Needs (Wilson, 1984: 163)

2.2.1 Mankind-Environment

"Man is the measure of all things." - Protagoras (485 BC - 421 BC)

Norberg-Schulz (1965) describes the purpose of architecture as giving order to the environment, implying that architecture controls and regulates the relations between mankind and the environment. This relationship between mankind and environment has been established as bi-directional, that is, humans are affected by the environment and they also affect the environment. Winston Churchill (unknown date, cited in Viljoen, 1987: 7) described that: “we shape our buildings and in turn are shaped in them”. Merleau-Ponty (1962 cited in Pallasmaa, 2005: 20 & 21) defines this "osmotic relation between the self and the world" as interpenetrating and mutually defining one another. Thus, people's whole being is immersed in their surroundings and through this, a unique understanding, perception and experience of the environment is grasped.

Historically, "the view was that environments must be designed for people to be placed in, to meet their needs and to satisfy their purposes." (Stokols, 1974: 28) Thus, environments were designed for a specific purpose, allowing people only a limited amount of control over the environment. These static environments follow the functionalist approach and are devoid of any sense of place or identity which would satisfy man’s more complex psychological, emotional and social needs. With recent consciousness, environments have increasingly been designed as flexible, allowing people to manipulate, shape and alter their surroundings to suit their needs (Stokols, 1974).

> "People try to change their environments in order to satisfy their needs, wishes and dreams. The human relationship to the environment hence consists of adaptation as well as a wish for change, and the built environment should take this into consideration." - Norberg-Schulz (1974: 432)

The built environment not only houses its functions, but it also participates in people's activities. People walk on the floor, close doors to be alone, and open windows for ventilation, in other words people are active participants in their daily environments (Lang, 1974). In addition, people occupy space; therefore, the spatial features of these daily environments are important (Rapoport, 1995). Pallasmaa (2005) states that people's bodies and movements are in constant interaction with the surrounding environments,

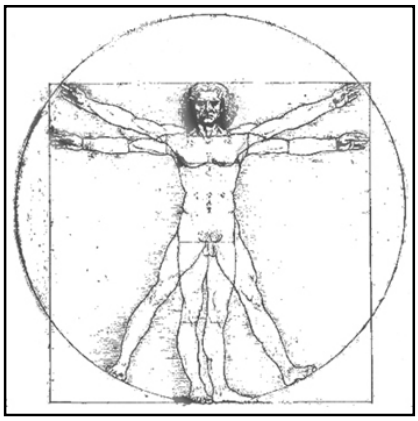


Figure 2-6 Leonardo's Vitruvian Man (Cuff & Ellis, 1989: 5)

thus the world and the self-inform and redefine each other constantly. Hence, the human body and its relationship to the environment is an important aspect in the way in which people experience space. The human being is the logical norm in terms of scale because, buildings are to be humanly inhabited and therefore, should be related to human proportions.(Refer to figure 2.6)People should belong to the building just as it should belong to them (Cuff & Ellis, 1989).

Architecture, as a human product, should order and improve people's relations with the built environment (Norberg-Schulz, 1965). Rapoport (1995) describes environmental quality as fulfilling this aspect of design. People do not perceive the environment as though it were a photograph; they are immersed in it and participate in it with all their senses. The quality of environments directly relates to the functioning of individuals within that environment, this affects their satisfaction, mood, self-esteem and personal growth (Stokols, 1974). The physical environment impacts a person's ability to stay focused (Rain, Unknown Date), in general the happier people are; the better they behave and perform (Beaver, 2010). This is true of all people, including those who suffer from ASD. Thus, the creation of positive environments enhances people's moods, behaviours and attitudes, while unpleasant experiences in buildings lead to feelings of insecurity, hostility and even rage (Lang, 1974). Wilson (1984) describes comfort as the optimum atmosphere with which mankind tries to surround themselves.

2.2.2 Behaviour, Mood, Attitude and Emotion

> "It is a truism to say that the environment influences us and determines our 'mood'. That architecture is a part of our environment is just as evident. If we take this point of departure, architecture has not only an instrumental purpose, but also has a psychological function." -Norberg-Schulz (1965: 22)

The built environment and human behaviour are closely intertwined, almost to the point of being inseparable. This ties back to the bi-directional relationship between mankind and the environment, where the concept that 'environment affects behaviour' does not adequately describe the connection (Barker, 1986). Barker (1986) explains that the very definition of behaviour must be within an environmental context. Thus, the characteristics and attributes of the physical environment need to be considered for their impact on human behaviour. For example, irritable and aggressive behaviour is observed when people are exposed to environments that are hot and humid (Anderson, 1989), therefore, buildings which require calm and quiet should have cool interiors.

Experiences of particular places also vary according to people's moods and attitudes. A person's emotional state affects the way in which they perceive places at any given time (Norberg-Schulz, 1965) thus, the same place can be experienced differently by the same person depending on their mood. This holds true for changes in people's attitudes as well, although this is experienced more dramatically over a prolonged period (Relph, 1976). For example, when a person returns to a house where they grew up, the experience of the house will be completely different from when they were younger.

2.2.3 Special Needs

Many individuals have additional specialised needs over and above those discussed in the previous sections. These individuals suffer from a variety of medical, physical and psychological impairments which prevent them from participating in 'normal' activities and environments. Their impairments result in differing experiences of built environments, for example, a positive built environment may be perceived as negative and upsetting for a person in a wheelchair who cannot use stairs. Historically, instead of catering for these individuals, they were shunned from society due to their differences and locked away in institutions (Beaver, 2010).The previous sections have discussed how architecture is a tool which satisfies people's needs, this is increasingly being applied to people's specialised needs as well. For example, the regulations for the inclusion of physically accessible elements within buildings.

There has been a slow development of a contemporary consciousness towards human factors in the design of built environments. Research shows the importance of the relationship between mankind and the environment; therefore buildings can no longer only meet the physical needs of mankind, such as shelter and thermal comfort, but must also provide for their emotional and specialised needs. Architectural elements, such as acoustics, visual character, spatial quality, colour, texture and geometry, which affect people's moods and behaviours, need to be more sensitively treated. By taking these into consideration the built environment results in spaces which are more conducive to productivity, efficiency and comfort (Mostafa, 2008). Rapoport (1995) states 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." In other words, he calls for an emphasis on the human aspects of design.

2.3 The World of Human Perception

The relationship between mankind and the environment is closely linked to the way in which people perceive the world around them. These perceptions are key in understanding the way in which people experience space and the built environment. Norberg-Schulz (1965) states that by better understanding the process of perception a deeper understanding of the experience of architecture can be attained.

2.3.1 The Process of Perception

Places are not just rooms, buildings, or outdoor spaces, but are total environments consisting of a wide variety of elements and stimuli. The phenomena of experiencing these places through the senses of sight, sound, touch, smell and taste is known as perception (Hesselgren, 1975). Each sound, taste, smell, touch and image sends sensory information to the brain, where it is processed and an appropriate response is delivered (Augustin, 2009). This process of understanding and judging phenomenon makes objects serviceable and enables people to respond appropriately to them (Norberg-Schulz, 1965). Thus, perception can be described as the way in which people relate themselves to their surroundings (Bartley, 1958) by translating, understanding and drawing relationships between objects and stimuli within their surrounding environments (Hochberg, 1964).

Figure 2-7 People See a Whole Table Instead of Individual Legs and a Table Top (Choquette, 2010: 12)

Philosopher Taylor Carmen (2008) distinguishes two aspects of perception: first a passive sensory dimension of sense experiences; and, second, an active motor dimension, which relates to bodily actions. These sensory and motor dimensions are never separate; rather they work together seamlessly "so that awareness and action unfold as an integrated, continuous experience" (Seamon, 2010: 6). This embodied perceptual process is often deficient in individuals with ASD(Joiner, 2007) and they struggle to acquire the same seamless experiences of their surroundings.

Gestalt Psychologists were the first to describe this whole unified experience of perception (Lang, 1974). They explained that, a table is perceived as a table and not as a number of legs with a top on them (Wilson, 1984). (Refer to figure 2.7) For individuals with

ASD, however, there is no gestalt or 'whole picture'. They do not experience a forest; they experience a series of single trees (Joiner, 2007).

Perception is described by Merleau-Ponty (1962) as a foundational quality of human experience, but it is not only restricted to aspects of experience, it also has certain emotional (Norberg-Schulz, 1965) and behavioural implications (Bartley, 1958). Thus, the perception of built environments not only affects people's experiences of the space but also affects their emotions and behaviours; this highlights the importance of the interrelationship between human perception and the built environment.

2.3.2 The Experiential World

Contemporary built environments have placed importance on the aesthetic experience. Relph (1976) describes the aesthetic features of the environment, both natural and built, as the most easily describable attributes of places. According to Vitruvius (cited in Horvath, 2010) a good building should satisfy the three principles of '*firmitas, utilitas* and *venustas*'. Translated, *firmitas* relates to the ability of a structure to stand up robustly and remain in good condition, *utilitas* that it should be useful and fulfil its purpose, and *venustas*, that is should delight people and raise their spirits (Horvath, 2010). This is commonly referred to as 'firmness, commodity and delight.' The first two principles relate to the functional requirements that a building should meet in order to shelter and protect its inhabitants, the basic human needs. It is the third principle of beauty which is more complex (Horvath, 2010). 'Beauty' is regarded as an attribute of perception; it is an emotion, a feeling, and hence a subjective phenomenon (Hesselgren, 1975). Vitruvius (cited in Horvath, 2010) referred to 'beauty' as the intangible, psychological and emotional effect that the built environment can have on the human spirit. Hume (1975 cited in Norberg-Schulz, 1965: 92) states that "beauty is no quality in things themselves: It merely exists in the mind which contemplates them; and each mind

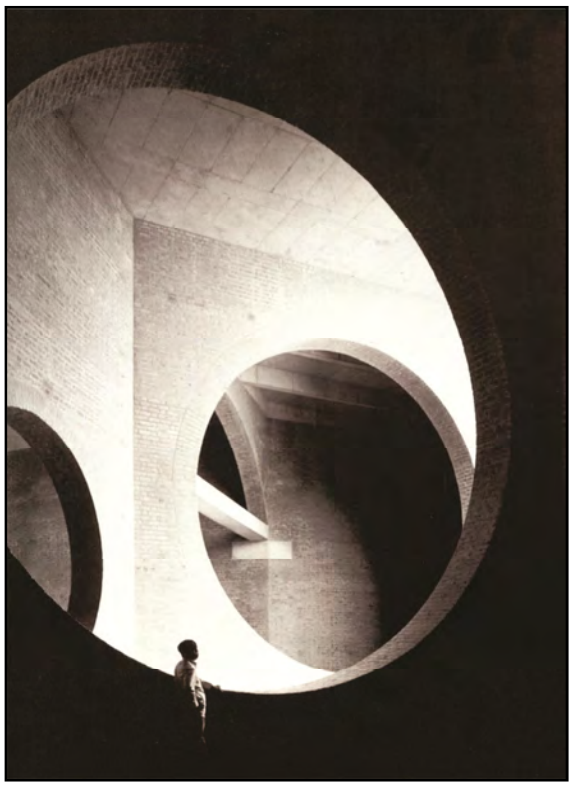


Figure 2-8 Indian Institute of Management, Louis Kahn Using the Emotive Qualities of Light to Create 'Beauty' (Futgawa & Miyake, 1994: 338)

perceives a different beauty." What people evaluate from an aesthetic point of view is a complex entity in which a number of sensations, images, expressions and emotions are connected to one another (Hesselgren, 1975). (Refer to figure 2.8) The aesthetic 'beauty' of a building, although subjective, can serve to inspire and uplift the community to which it speaks.

Contrary to this, Pallasmaa (2005) talks about the contemporary built environment being a purely aesthetic experience while ignoring aspects of the spatial experience. He (Pallasmaa, 2005) describes architecture as becoming a series of striking and memorable visual images that have adopted the psychological strategy of advertising and instant persuasion.(Refer to figure 2.9) Although the aesthetic experience is of importance, it has become too dominant in the built environment, in other words, not enough emphasis has been placed on other aspects of design which are equally, if not more, important.

Figure 2-9 The Overwhelming Visual Advertising in the Streets of China (Richardson, 2012: 39)

Hall (1966: 171) describes "virtually everything that man is and does as associated with the experience of space." People occupy, move around in and interact with space on a continuous basis, thus, their experiences and perceptions of these spaces is an important dimension within the built environment. Sensational qualities of light, sound, texture and colour (de Vega, 2009) can enhance spatial experiences. Rapoport (1977) states that space is perceived and experienced as three-dimensional and it is a person's sensual perceptions which develop their understanding of that three-dimensional space. He (Rapoport, 1977) goes on to explain that space facilitates relations and transactions between people and the physical components of the world, thus space, and the experience of it, can be seen as the heart of the built environment.

Many different kinds of space have been defined by various researchers, scientists, philosophers and geographers. One kind of space with particular relevance is that of perceptual space, as defined by Relph (1976). This is the realm of direct emotional encounters with natural or built spaces. It is the personal experiences of perceptual space that are the basis of the meanings which built environments and landscapes have for people

(Relph, 1976). "Although they are personal, perceptual spaces and places are not entirely isolated within the individual, for there are common landscapes that are experienced." (Relph, 1976: 11) This suggests that a particular group of people may share common perceptual spaces with common meanings and experiences associated with various elements.

Architects and designers are interested in how people experience space and the built environment, how they understand and organize it, how they give identity to its elements, how they classify these elements and how they behave as a result (Rapoport, 1977). Holl (2006) stated that:

> "A real architectural experience is not simply a series of retinal images; a building is encountered – it is approached, confronted, related to one's body, moved about, utilised as a condition for other things, etc."

Experiences are derived from the response of human senses to the objects and spaces that surround them (Horvath, 2010). These experiences enhance architecture's ability to arouse thoughts, feelings and emotions. Without this dimension of feeling and emotion, architecture remains an object, an artefact with no soul. Thus, the essence of architecture can be seen as the experiences which people encounter within it. By shifting attention from the object to the experience of the object, humanity is reconnected to the built environment. After all, architecture is designed to be inhabited and hence it is inevitably experienced.

> "An architectural work is not experienced as a series of isolated retinal pictures, but in its fully integrated material, embodied and spiritual essence. It offers pleasurable shapes and surfaces moulded for the touch of the eye and other senses, but also incorporates and integrates physical and mental structures giving our existential experience a strengthened coherence and significance." - Pallasmaa, 2005: 12

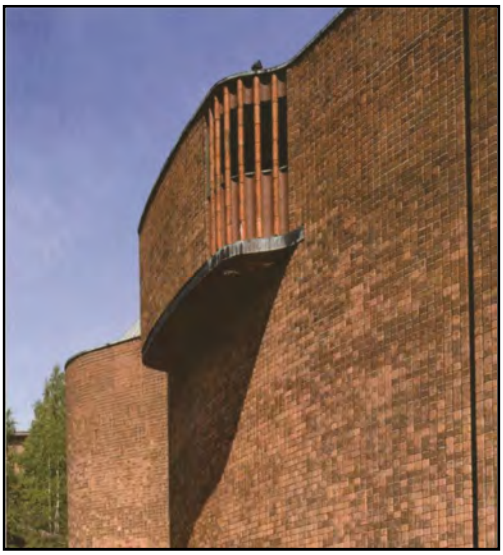


Figure 2-10 The House of Culture, Helsinki, by Alvar Aalto (Pallasmaa, 2009: 61)

The very experience of architecture lies in grasping coherence of the built environment. Often, the abstraction of design leaves users with a meaningless experience. In explaining this, Norberg-Schulz (1966, cited in Srikanth, 2010) stated that "a brick is just a brick; it becomes meaningful to the user only when used in a coherent part of an experience."(Refer to figure 2.10) Thus, it is the responsibility of the designer to transition objects to experiences, rather than creating

unconventional environments which are meaningless to the majority of the population (Norberg-Schulz, 1965).

Walter Gropius theorised (cited in Barr, 1970) that by understanding the nature of what people see and the way they perceive it, the potential influence of man-made design on human feelings and thinking can be better understood. The process of perception has been defined as the way in which people experience and relate to their surrounding environments which affects both their emotions and behaviours. With the increasing dominance of the aesthetic experience, architecture's power to stimulate the imagination and emotions (Belcher, 1907) is being undermined, resulting in a numbing of experience in contemporary built environments (Benjamin, 2000). Architecture must be recognised as a powerful tool, experienced completely by the body. These experiences are derived from the response of human senses to the objects and spaces that surround them (Horvath, 2010). Merleau-Ponty (1962) makes the human body the centre of this experiential world, Pallasmaa (2005) builds on this stating that a person experiences themselves in the city, but the city exists through their embodied experience.

> "We do not grasp space only by our senses...we live in it, we project our personality into it, we are tied to it by emotional bonds; space is not just perceived...it is lived." - Merleau-Ponty (1962: 22-23)

Thus, each person is the centre of their own experiential world; this world is created by their subjective experiences. All places and landscapes are experienced individually; each person sees them through a lens of their own attitudes, experiences and intentions and from their own unique set of circumstances (Lowenthal, 1961 cited in Pile, 1996). Therefore, it is difficult to design a specialised environment for a person if one does not fully understand that person first. Their backgrounds, needs, experiential worlds, bodily requirements and behavioural patterns need to be carefully analysed so that the environment designed adequately suits their needs and individual worlds. These considered environments will henceforth be referred to as 'positive environments' and the converse being referred to as 'negative environments'.

CHAPTER 3 PSYCHOLOGICAL AFFECTS OF THE BUILT ENVIRONMENT

3.1 The Body and the Senses

As discussed in the previous chapter people observe the world and the built environment through their several senses, referred to as modalities of sensation. Aristotle distinguished five distinct sensory modalities: visual, auditory, tactile, olfactory and gustatory. Today kinaesthetic is also considered (Mitchell, 1990: 2), and in the autistic world vestibular as well. These major senses can be split into three groups; distance senses (seeing and hearing), skin senses (touch, taste and smell) and deep senses (kinaesthetic and vestibular) (Hochberg, 1964). The distance senses are concerned with the examination of distant objects and the immediate senses, the skin and deep senses, decipher the close-up world (Wilson, 1984). These senses never operate in isolation, their interdependence and interplay allows people to grasp the overall impression of their environment (Hochberg, 1964). Merleau-Ponty (1964, cited in Pallasmaa, 2000) emphasizes this simultaneity of experience and sensory interaction:

> "I perceive in a total way with my whole being: I grasp a unique structure of the thing, a unique way of being, which speaks to all my senses at once."

The information people receive through their senses affects them emotionally and behaviourally because much of human behaviour is emotionally based (Augustin, 2009). Each sound, taste, smell, touch and image sends sensory information to the brain, where it is processed and an appropriate response is delivered (Augustin, 2009). These sensory inputs can take on a special meaning for individuals based on their past experiences and memories and each sense makes a particular sort of contribution to a person's experience (Augustin, 2009) and memory of a place. This chapter analyses the various sense modalities and how they impact the relationship between mankind and the built environment.

3.1.1 The Sense Modalities- Sight

Vision is the preferred channel for maintaining contact with the environment; it is considered to be the main sensory input, with the other modalities complementing it (Brebner, 1982). Thiel (1981) agrees that vision is the principal channel of sensory information for people's comprehension of the physical world. He (Thiel, 1981) states that:

> "For this reason all of our interventions in the visual environment, whether incidental, accidental, or purposeful, are means of communication with others. The environment is an ever-present slate on which, consciously or unconsciously, we are writing messages to each other."

Visual stimuli act from a distance thus, are detached from the human body. Visual perceptions allow people to judge distances and orient themselves so as to be able to move easily within spaces (Farbstein & Kantrowitz, 1978). This movement through space is essential in a person's complete experience of that space.

Humans' visual fields normally consist of diverse elements, subject matter that differs in shape, size and colour. To better comprehend the structure of this complex visual field, people organize elements into two opposing groups: positive elements that are perceived as figures and negative elements that provide a background for the figures (Ching, 1979). A figure is something to which a person directs their attention; it is perceptually bright, seeming to have more intensity than the background. The ground always seems to be under the figure, lacks a particular form and appears continuous. A figure suggests meaning, while a ground seems relatively meaningless. (Refer to figure 3.1)The differentiation of figure from ground is essential to perception and takes place within all the sense modalities (Bloomer, 1976). Thus, people's perception and understanding of an architectural composition depends on how they interpret the visual interaction between the positive and negative elements (Ching, 1979).

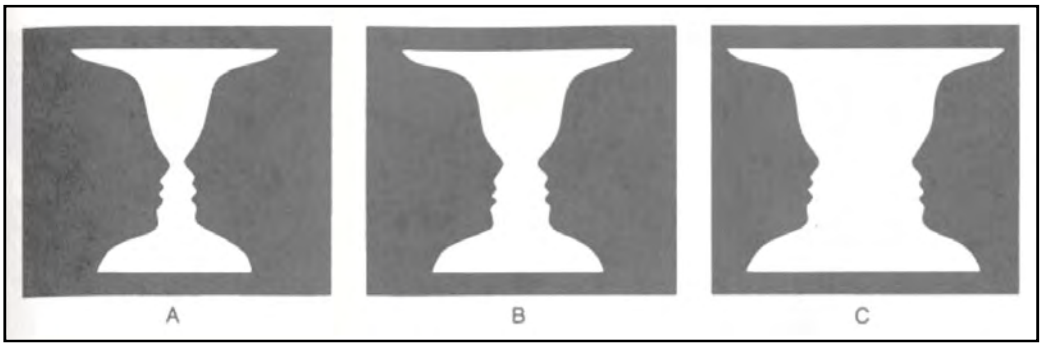


Figure 3-1 Reversible Figure and Ground Where a Pair of Black Faces is Seen Alternately with a White Vase (Coren, 1999: 297)

In addition to the distinction between figure and ground, another important aspect of sight is the differentiation between focused and peripheral vision. Pallasmaa (2005), highlighting the importance of peripheral vision, states that architecture continues to be interested on focused vision, yet the quality of an architectural environment depends fundamentally on peripheral vision which enfolds a person in space. He (Pallasmaa, 2005) explains that peripheral vision transforms retinal gestalt into spatial and bodily experiences,

in other words, peripheral vision integrates people with space, while focused vision pushes people out of space, making them mere spectators.

3.1.2 The Sense Modalities - Sound

Hearing provides a three-dimensional atmosphere which enriches people's spatial experiences and understanding of their surroundings (Chow, 2009) yet,people are not aware of this significance of hearing in their spatial experiences (Pallasmaa, 2005). Hearing is an interesting sense in relation to architecture, because of these spatial qualities. The reverberation time indicates the shape and size of a space, and the tone gives information about the softness and structure of materials (van Kreij, 2008), a space is "understood and appreciated through its echo as much as through its visual shape" (Pallasmaa, 2005: 50), however, this realm of sound remains an unconscious background to visual images.

Sounds' emotional qualities provide opportunity for designers to create 'soundscapes', which affect people's moods and guides them in the use of environments(Augustin, 2009). The sound of predictable rhythms, for example, is relaxing and will encourage people to move through a space at a slow pace, whereas unpredictable rhythms are invigorating and encourage haste (Augustin, 2009). Pallasmaa (2005) believes that the most powerful auditory experience that architecture can create is that of tranquillity.

Although sound has strong effects on the way in which people perceive and experience their surrounding environments it has been neglected in contemporary visual-dominant societies (Chow, 2009). In fact, sound is normally considered to be unwanted noise that needs to be suppressed (Wilson, 1984).

3.1.3 The Sense Modalities - Smell

The process of smelling takes the longest to reach the brain and, once it has reached the brain the smell lasts longer than any of the other sense stimuli (Lehman, 2012). The olfactory sense is regarded as the sense with the most powerful emotional effects (van Kreij, 2008) due to the processing of smells and emotions in the same part of the brain (Augustin, 2009). People respond to smells according to their 'scent memories', memory links between scents and experiences (Augustin, 2009). Thus, Pallasmaa (2005: 54) explains that "the most persistent memory of any space is often its smell." (Refer to figure 3.2)

Olfactory adaption, when people no longer consciously perceive a smell, occurs a few minutes after smelling the smell. This does not eliminate the influences that particular smells have on people, for example, various 'scent effects' have been scientifically proven to influence people, such as an improved performance on mental tasks when exposed to the scent of lemon and jasmine (Augustin, 2009). Contemporary cultures tend to 'cover up' and 'clean up' scents, rather than tapping into their vast potential (Lehman, 2012). The extensive use of deodorants and the suppression of odour in public places results in olfactory blandness and sameness. This blandness results in undifferentiated spaces, depriving people of a richness and variety in their lives, as well as obscuring deep felt memories (Hall, 1966).Hall (1966) describes olfactions as providing a sense of life to an environment; with the shifts and transitions of smells helping people locate themselves within spaces.

Figure 3-2 Scent Memories (Pugh, 2008)

3.1.4 The Sense Modalities - Touch

Touch is the sensory modality which integrates people's experiences of the world with themselves (Pallasmaa, 2009). It is these tactile experiences that determine the sensuous qualities of perceived objects and environments (Pallasmaa, 2009) and provides information regarding textures, weight, densities and temperature (Chow, 2009), all important attributes within the built environment. In his design of Saint Ignatius Chapel (1997), Steven Holl stimulates the sense of touch through materiality and form. The wall surfaces are covered with beeswax, embedded with gold-leaf prayer texts, creating a rich, textured environment (Hall, 2008; Olsen, 1997). (Refer to figure 3.3)

Figure 3-3 Beeswax Walls of the St Ignatius Chapel, Seattle, by Steven Holl (Olsen, 1997: 50)

Touch also has the potential to be a means of communication, for example, Hazelwood (2007), a school for children who have severe visual, mobility and sensory impairments, encourages their students to use touch as a means of way-finding. This is achieved by a tactile wall which children can follow with their hands, the differentiated folds and textures of the wall allow children to locate themselves and their classrooms within the greater school building (Rodger, 2007). (Refer to figure 3.4)

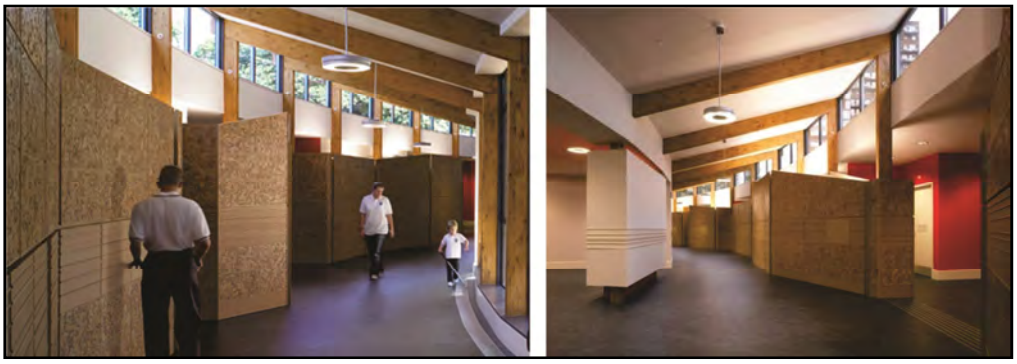


Figure 3-4 Tactile Wall at Hazelwood School (Rodger, 2007: 30)

"Touch is the sense of nearness, intimacy and affection." - Pallasmaa, 2005: 46

As with the senses of sound and smell, there is a lack of concern regarding the importance of touch within the built environment. Pallasmaa (2009) states that although architecture may entice and amuse the eye, it does not provide for the touch of peoples bodies.

3.1.5 The Sense Modalities - Kinaesthetic and Vestibular

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.” (van Kreij, 2008: 19). Strictly speaking kinaesthesia is not sensory because it does not directly give a bodily emotion; however, it does affect the senses and peoples experience of space through their positions and motions (van Kreij, 2008). Therefore, fundamentally, kinaesthesia deals with people’s positions and movements within space and this impacts directly upon the way in which people perceive the built environment. Evident in Le Corbusier's concept of the Promenade Architecturelle where he (cited in De Vega, 2009) explained that people's perception of spaces change progressively depending on their location and that by carefully planning the links between spaces and allowing a gradual exploration of these spaces the designer can control and enhance user experience. This concept was used in Le Corbusier's design of Villa Savoye (1931). Each space is designed to lead people into the next space,

providing a thought out progression through the building. For example, upon entering the 'entry vestibule' through the front doors a person is confronted with a dominant, central ramp which directs people up through the building, whereas a spiral staircase is orientated away from the entrance, discouraging its immediate use. (Refer to figure 3.5)

Figure 3-5 Le Corbusier's Concept of Promenade Architecturelle in the Design of Villa Savoye (Samuel, 2010: 115-123)

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). Thus, the vestibular system is responsible for people's balance and posture. Pallasmaa (2009) describes the sawatari-ishi, 'steps in the marsh', in the garden of the Heian Shrine in Kyoto, Japan, as directly addressing the body's vestibular system. The rhythmic organisation of the stepping stones encourages people to engage their body with its journey through space.(Refer to figure 3.6)The body is a tool for sensing space thus, the movement and orientation of it determines people's experiences and perceptions of the built environment. Hall (1966) describes contemporary urban spaces and built environments as providing little excitement or visual variation and virtually no opportunity to build this kinaesthetic repertoire of spatial experiences. This is exacerbated by comfort

Figure 3-6 'Steps in the Marsh' in the Garden of the Heian Shrine, Kyoto, Japan, address the Body's Vestibular System (Pallasmaa, 2009: 106)

devices, such as cars and elevators. People no longer feel and experience their movements and journey through space from one location to another.

3.1.6 Multi-Sensory Experience and Deprivation

Figure 3-7 Thermal Vals, Switzerland, by Peter Zumthor have a Variety of Textures, Colours and Volumes Creating a Multi-Sensory Experience (Plumer, 2009: 62)

The sense modalities, discussed individually above, are conventionally defined separately in fields such as philosophy and science. However, Merleau-Ponty (1962, cited in Seamon, 2010) emphasizes that the senses intermingle and mutually resonate. The information gained by each sensory system strengthens those obtained by the others (Wilson, 1984),making each perception more vivid and each experience more meaningful. It is through multi-sensory perceptions that people understand and navigate the built environment. Therefore, multi-sensory experiences are of prime importance in the body's engagement with the space surrounding it. As the human body moves, sees, smells, touches, hears and even tastes within a space - architecture comes to life. Thus, multi-sensory architecture can serve to move occupants - elevating their experience, connecting with them emotionally (Lehman, 2012). Peter Zumthor applies this multitude of sensory experiences in his architecture by using different textures, colours, massing, qualities of light, temperatures and materials. (Refer to figure 3.7)

Pallasmaa (2005) stated that 'life-enhancing' architecture, which addresses all the senses simultaneously, fuses people's image of self with their experience of the world, however, contemporary consciousness has developed an unrivalled dominance of the sense of vision (Pallasmaa, 2000). This increasing importance of the image and the mass production of visual imagery has resulted in the neglect of the other senses, divorcing people from emotional involvement, identification and participation within the built environment (Pallasmaa, 2005). Without multi-sensory stimulus the human body fails to feel and experience the world around it, becoming a mere ‘spectator of built objects’ (Srikanth, 2010).

Historically mankind was subject to a great variety of sensory inputs - extremes of hot and cold, light and dark, dryness and dampness (Lang, 1974). Current culture, however, tends to standardize environmental conditions and make the environment entirely predictable,

causing sensory impoverishment (Pallasmaa, 2000).The negligence of the body and the senses result in an inhumane architecture which unbalances people's sensory systems (Pallasmaa, 2005). "Buildings have lost their opacity and depth, sensory invitation and discovery, mystery and shadow." (Pallasmaa, 2000: 78) Thus, contemporary society is facing growing experiences of alienation, detachment and solitude. Mankind's perceptive capacities are shrinking due to this sensory deprivation and people now approach the world and its opportunities with narrow perspectives (Landry, 2006). Ashley Montagu (1986, cited in Pallasmaa, 2000: 79) however, sees a change taking place in Western consciousness:

> "People in the Western world are beginning to discover their neglected senses. This growing awareness represents an overdue revolution against the deprivation of sensory experiences which has been suffered in the technologized world."

The senses are a fundamental aspect of people's perceptions of the built environment and operate together to create people's entire perceived worlds. The senses affect people's emotions which, in turn, affects their behaviours, highlighting the importance of the multi-sensory dimension within the built environment. Current ocular-centric culture has left the other senses under stimulated resulting in a void in the total experiences of built environments. It is important to critically review this role which vision plays in people's understanding of architecture (Pallasmaa, 2005) because although architecture is a visual art, it also has human implications and human experiences. Pallasmaa (2009) suggests that an educational change, concerning the significance of the sensory realm, is urgently needed in order to enable people to rediscover themselves and to eliminate alien environments.

3.2 Environmental Alienation

Contemporary architecture, in its 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). Thus, people are experiencing complete alienation from the environments which they inhabit. Pallasmaa (2009) stated that this experience of alienation and weakening of the sense of self results in mental and physical illness, which is concerning due to the fact that people spend the majority of their time within built environments.

Individual buildings are conceived and constructed in isolation, ignoring their context, and exposing people to unconsidered urban experiences (Relph, 1976). The spaces between individual buildings are left over spaces, unconsidered and undesigned.(Refer to figure 3.8)

This is exacerbated by the urban realm becoming what Pallasmaa (2005: 29) refers to as "the city of the eye". People's bodies are being removed and disconnected from the urban city by rapid motorised movement such as trains and cars, so that the experience of the journey between places is lost (Pallasmaa, 2005). Hall (1966: 59) emphasises that the car is aggravating this "process of alienation from both the body and the environment."

Figure 3-8 Urban Left Over Spaces (Relph, 1976: 106; Pallasmaa, 2005: 43)

Relph (1976) claims that man's alienation from his environment is directly related to the universal character of contemporary buildings. There is no evident distinction between cultures, countries and climates within these designs, buildings are instead being characterised and differentiated by their function alone. This results in a lack of a sense of place, with people losing their connection, experiences, meanings and memories of the environments that surround them. People are now exposed to interchangeable locations that have a sameness to them all. C.W. Moore (cited in Relph, 1976: 79) has written that "the richly varied places of the world...are rapidly being obliterated under a meaningless pattern of buildings, monotonous and chaotic."

CHAPTER 4 INTERPRETING THE ARCHITECTURAL IMPLICATIONS OF AUSTICNEEDS

4.1 Background

The built environment, as discussed in the previous chapters, plays a large role in the lives of all people and affects their perceptions, moods, feelings, experiences and behaviours. Typical perception is described as the understanding of and relevant response to, the sensory input from the surrounding environments. People with ASD, who have impaired perceptions, experience these built environments differently from neurotypical individuals but are still influenced by them. The previous chapters are used as a background with which to develop a deeper understanding of the role of the built environment in regards to autistic needs and behaviours (Mostafa, 2008). This chapter provides a background of these specialised needs and analyses the various architectural implications of them.

Recent research indicates that ASD is growing at epidemic proportions (Hill and Firth, 2003 cited in Mostafa, 2008), in fact, the current statistics show that one in every 150 children is estimated to fall within the autistic spectrum, regardless of socio-cultural and economic aspects (Mostafa, 2008).Increased public awareness and improved diagnostic tools may be aiding this increase (Taylor, 2006 cited in Simons, 2008), but this does not deny the fact that ASD represents one of the fastest growing disability categories in the world (Wilkinson, 2010). Despite its overwhelming prevalence, ASD is by and large ignored by the architectural community (Mostafa, 2008). In fact, until relatively recently people displaying symptoms of ASD were admitted into psychiatric institutions where they were misunderstood and unable to communicate their difficulties (Beaver, 2010). These establishments paid no heed to the quality of 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).By exposing individuals with ASD to these negative built environments they experience distress and frustration, resulting in the common challenging behaviours associated with ASD (Beaver, 2010).

When people think of treatments for ASD's, they envision behavioural interventions, biomedical treatments, or play therapies. Rarely do they think about the built environment that accommodates these people on the spectrum (Rain, Unknown Date). Architecture is

about people and should be designed to respond to the needs of the individuals who come into contact with it. The complex needs of people with ASD are poorly understood, therefore, in order to design appropriate treatment environments for them the nature of the disability, its treatment models and their specialised needs must be understood.

4.1.1 Understanding Autism Spectrum Disorder

> "In 1911, a psychiatrist, Eugen Bleuler, coined the words 'autism' and 'autistic' from the Greek word *autos* which means self, that is to be self-absorbed." - de Nysschen(2008: 1)

Autism Disorder (AD) is a term associated with a range of conditions collectively referred to as Pervasive Developmental Disorders (PDD's). A developmental disability is defined as a severe, chronic, lifelong disability attributed to mental and / or physical impairments with limited functioning in areas such as self-care, social interaction, language, learning and mobility (Whitman & DeWitt, 2011). PDD's are broken down into five diagnostic categories: Autistic Disorder (AD), Asperger's Disorder, Rett's Disorder, Childhood Disintegrative Disorder (CDD) and Pervasive Developmental Disorder Not Otherwise Specified (PDDNOS) (Wilkinson, 2010). Many professional organisations prefer to use the collective term 'Autism Spectrum Disorder' to describe these five categories, suggesting that instead of distinct and separate diagnoses, the disorders all lie somewhere along the spectrum of autistic behaviours (Simons, 2008). Essentially, ASD and PDD refer to the same five disorders. AD and PDDNOS are the most common of the five disorders, Asperger's represents a small fraction of cases and Rett's and CDD's are very rare (Lathe, 2006). (Refer to figure 4.1) Appendix A lists the diagnostic criteria associated with each PDD.

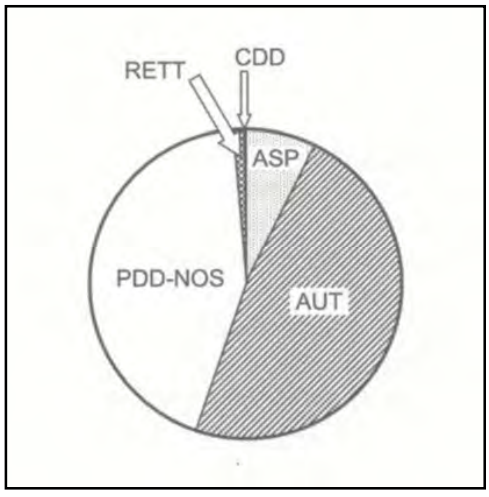


Figure 4-1 Approximate Proportions of the Different PDD's (Lathe, 2006: 21)

The exact origins and causes of AD have yet to be found despite extensive research addressing the neurological; neuro-chemical and genetic abnormalities present (Herbert, 2003). Typically, children with AD show improvements while older individuals indicate regression (Paron-Wildes, 2008). There are no cures for ASD's (Wilkinson, 2010) only methods of management. Thus, this lifelong disorder has serious implications on individual's personal, social and educational experiences and often prevents them from leading self-sufficient, independent lives. Several of these methods of management and therapies are discussed in the next section.

People with ASD suffer with difficulties in three main areas, known as the 'triad of impairments': these are social interaction, social communication and imagination (Deudney, 2006). Appendix B lists the behavioural characteristics of these three impairments. In addition many people with ASD experience symptoms relating to unusual sensory perceptions (Southerington, 2007). There is, however, a marked variability in the severity of impairments, and symptoms differ from one person to another and may change over time (Wilkinson, 2010). The terms 'low functioning and high functioning' are used in reference to this spectrum (Southerington, 2007), where 'low functioning' refers to individuals who are severely impaired in virtually all areas of development and 'high functioning' refers to individuals who need minimal support in daily life and experience no intellectual or learning disabilities (Wilkinson, 2010).

4.1.2 Current Methods of Education and Therapy

Research indicates that outcomes for children with ASD are significantly enhanced when early intervention strategies are employed (Wilkinson, 2010). The complexity and variability of ASD has resulted in a broad range of intervention approaches (Whitman & DeWitt, 2011) which are based on three main theories; perceptual theory, developmental theory and behavioural theory.

Perceptual theory is based on the principle that individuals with ASD have differences in the way they receive sensory input and in their thinking abilities (Herbert, 2003). This theory sees the child with ASD as over stimulated by sensory stimuli (Herbert, 2003) and the child, overwhelmed by the overload of sensory input, withdraws. The treatment methods based on this theory are aimed at helping these children make sense of the chaotic world (Herbert, 2003). Environments should be designed to be uncluttered and should be organised so as to give children visual cues and directions. Highly organised and predictable visual schedules keep children on task and directions are given in brief short steps (Herbert, 2003).

The main example of an intervention based on this type of theory is the Treatment and Education of Autistic and Communication Handicapped Children (TEACCH) program.

Developmental theory addresses children with ASD as having failed to meet the developmental milestones in language, social, cognitive and motor domains which their peers have already mastered (Herbert, 2003). Therapists or special educators follow children's' interests and encourage play and interaction based on these interests, following a sequence of experiences in order for the children to acquire necessary skills (Herbert, 2003). Stimulating toys, objects and people are placed in the children's environments to encourage interaction and growth as well as providing gross motor opportunities and sensory stimulation (Herbert, 2003). Examples of interventions based on this type of theory are play therapy and sensory integration therapy.

Behavioural theory suggests that the ASD prevents normal learning from occurring, resulting in behavioural deficits and excesses (Herbert, 2003). Behavioural deficits are the lack of socially accepted skills and behaviours experienced by individuals with ASD, and behavioural excesses are the negative and undesirable behaviours exhibited by these individuals, such as aggression, tantrums and self-abuse. It is believed that through identification of the deficits and excesses present, and through direct skills training, appropriate behaviour can be taught (Herbert, 2003). The main example of an intervention based on this type of theory is applied behaviour analysis (ABA).

4.1.3 TEACCH Method

TEACCH is a widely accepted strategy for teaching children with ASD (Southerington, 2007). The intervention emphasises the physical structure of the curriculum and the layout of the learning environment (Herbert, 2003).The most important goal is to facilitate independence at all levels of functioning (Herbert, 2003) and help children with ASD grow up to maximum autonomy at adult age. By designing the learning environment to suit the specialised needs of ASD's, the independent functioning of each child is gradually increased and many frustrations and behaviour problems are avoided (Lord & Schopler, 1994).(Refer to figure 4.2)

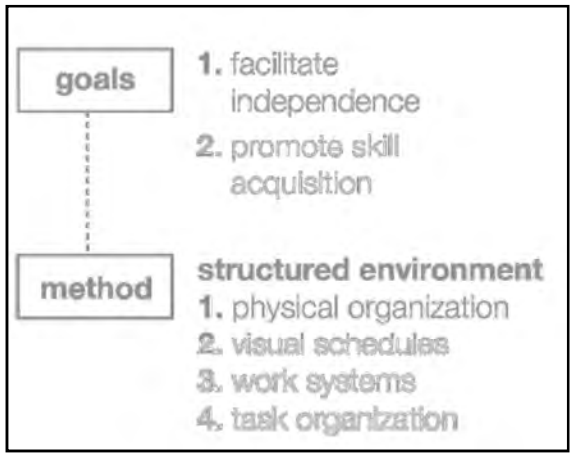


Figure 4-2 The Goals and Methods of TEACCH (Southerington, 2007 :17)

Structured classrooms allow for predictable routines to be established. At first a basic routine is set up, teaching children skills on a one-on-one basis within a specific environment. Once this skill is established, the child is taught the same skill in a different environment. This process gradually decreases the amount of assistance children need in order to perform tasks and they gain higher levels of independence. The main components of this classroom structure are; physical organization, visual schedules, work systems, and task organization (Southerington, 2007).

Physical organization refers to the physical layout of the classroom or teaching area. Boundaries, both physical and visual, are used to define different areas in which specific activities occur.(Refer to figure 4.3)These areas remain consistent so that students can "understand their environment, identify and remember activities that occur in specific places as well as understand relationships between activities." (Southerington, 2007: 17) Physical organization helps children's independent functioning by providing visual information which directs their activities in a predictable manner (Texas Statewide Leadership for Autism, 2010).

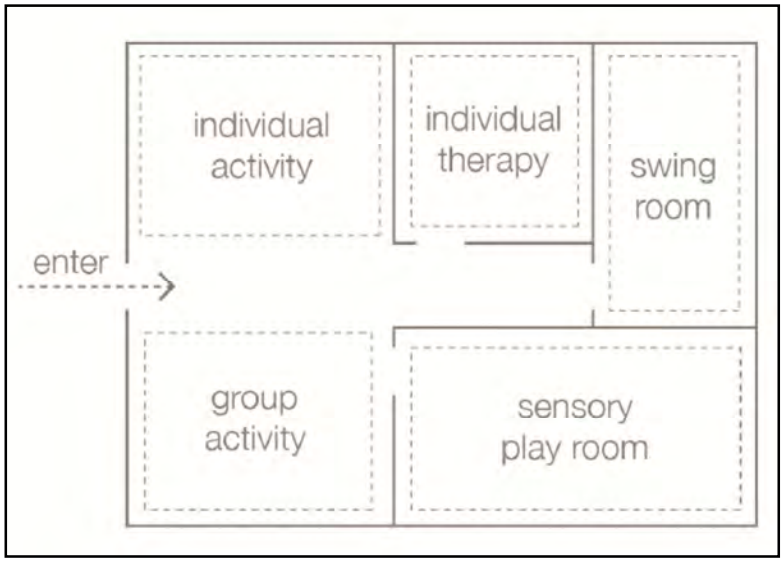


Figure 4-3 Physical Organization in Accordance with the TEACCH Method (Southerington, 2007: 17)

Children with ASD have problems with sequential memory and organization of time; thus, visual schedules are used to direct children in performing activities in a routine order; "they teach the student to follow a sequence of steps, events, activities or routines." (Southerington, 2007: 18) Schedules show pictures of tasks which a child has completed and, shows, in order, tasks that still need to be done. These visual schedules give children a focal point to their routines and helps them anticipate and predict activities that will occur (Southerington, 2007), reducing the stress of the unforeseen.

Individual workstations are set up within the classroom to encourage independent work. Each work system uses visual schedules guiding the child as to what activities are to be completed in that work area (Texas Statewide Leadership for Autism, 2010). Southerington (2007) explains that each work system consists of two work boxes one on the right and one on the left side of the desk.(Refer to figure 4.4) The work which needs to be done is in the left hand boxes and once finished is moved to the right hand boxes. This system enables children to easily comprehend how much work there is to do, the order it needs to be done in and when it is finished.

Figure 4-4 Individual Workstation (Southerington, 2007: 19)

Task organization is the thoughtful organization of each component of the work system, organized in such a way that teaches children to look for instructions on what to do rather than to do whatever they want with the objects in front of them (Southerington, 2007).

TEACCH highlights the importance of defined, structured spaces and routine activities for children with ASD (Southerington, 2007). Structure and routine is crucial for them because they are easily stressed when confronted with environments that are in flux (Whitman & DeWitt, 2011). Children with ASD have fewer cognitive, language and social resources for coping with change compared to neurotypical children, these mechanisms reduce experiences of stress and anxiety (Whitman & DeWitt, 2011).Change, when it needs to occur, should be introduced slowly and in an orderly fashion (Whitman & DeWitt, 2011). The principles of TEACCH support children with ASD and helps them understand their environment, enabling them to become more independent and productive.

4.1.4 Play Therapy

Play is an activity vital in the development of children from infancy to adulthood (Whitman & DeWitt, 2011). It is the vehicle through which children explore the environment and learn how to interact with it, aiding their sensory-motor, cognitive and socio-emotional development (Whitman & DeWitt, 2011). It is through play that children learn how the physical and social environments operate, including what environments look, sound, feel, smell and taste like (Whitman & DeWitt, 2011). From these experiences children begin to organize meanings, develop memories and thinking processes (Whitman & DeWitt, 2011).

Thus, play is important in the development of people's perceptions and enables interaction with and learning from the environment.

An inability to engage in appropriate play activities is considered to be one of the early distinguishing characteristics of ASD (Whitman & DeWitt, 2011). Although children with ASD do play, their play is characterised by its stereotyped and repetitive nature, self-stimulation, preoccupation with specific toys, lack of imagination and non-social qualities (Whitman & DeWitt, 2011). Researchers suggest that these play difficulties, experienced by children with ASD, are related to their problems with sensory processing (Whitman & DeWitt, 2011), therefore, although play can be frustrating and challenging for them, it is invaluable for helping them develop (Whitman & DeWitt, 2011).

Herbert (2003) explains that play therapy refers to a number of treatment methods which employ the therapeutic benefits of play. It differs from regular play in that it is designed to encourage each child to address the specific difficulties and impairments which they experience. Play therapies are designed to encourage children with ASD to communicate and interact with others, express their feelings, modify their behaviour and develop problem-solving skills (Herbert, 2003).

Floor time is a play-based method which uses individual children's interests or obsessions in order to develop relationships and communication skills (Herbert, 2003). The play therapist joins the child on the floor and engages with them through the medium of play (Herbert, 2003). (Refer to figure 4.5)For example, a number of toys, which a child finds interesting, may be placed in front of them, if the child chooses a toy train, running it back and forth, the therapist picks up another train and places it in front of the child's train, blocking its path. This encourages the child to respond and interact with the therapist (Herbert, 2003), developing a relationship between them.

Figure 4-5 Floor Time Play-Based Therapy (Miami University, 2012)

Specific environments can be designed to encourage play, these spaces should be structured, as discussed in the TEACCH method, and have "clearly defined boundaries, and explicit organization with materials accessible, visible, clearly labelled, and logically arranged around activities and themes." (Wolfberg, 1999 cited in Herbert, 2003: 49)Play therapies are developed around children's specific interests in order to facilitate positive

developmental progress in areas of social interaction, communication and imagination. Play reduces anxiety, promotes self-confidence and a sense of competence, develops a sense of trust in others and enhances creativity and playfulness (Whitman & DeWitt, 2011);these are all steps towards independent functioning.

4.1.5 Applied Behaviour Analysis

The behavioural characteristics of ASD's are categorized as either behavioural excesses or behavioural deficits. Children with ASD do not have the essential skills for living, such as talking, dressing and playing. Without these abilities, the child is severely handicapped. These characteristics are referred to as behavioural deficits and often result in behavioural excesses (Scheuermann & Webber, 2002). In other words, the more skills or abilities a child lacks the more likely it is that they will resort to behavioural excesses in an attempt to communicate their frustrations (Herbert, 2003). These excesses are the challenging behaviours which people associate with ASD. Behavioural excesses affect children's ability to learn and when misunderstood, cause them to be frequently punished (Scheuermann & Webber, 2002).

Applied behavioural analysis (ABA) is one of the most popular treatment approaches for ASD's (Wilkinson, 2010). This method is based on the idea that all behaviours have a source and a consequence, and that by manipulating the consequences it is possible to change people's behaviours (Simons, 2008). ABA attempts to change problematic behaviour of children with ASD by positive reinforcement, repetition and prompting (Wilkinson, 2010). These various methods encourage positive development in the areas of language, play and social skills.

As mentioned previously, outcomes for children with ASD are enhanced when early intervention strategies are employed; therefore, the Early Intensive Behavioural Intervention (EIBI) program was developed based on ABA (Wilkinson, 2010). EIBI has proven to be an effective intervention program for many children, although not all children respond to it (Stone, 2006, cited in Wilkinson, 2010). EIBI involves the breaking down of behaviours into sub-categories and teaching each sub-category through the same methods mentioned for ABA; positive reinforcement, repetition and prompting. These methods are gradually removed from the program enabling positive social behaviour and increased language and daily living skills to be carried out independently (Wilkinson, 2010).

ABA examines the functional relationships between different behaviours and develops programs based on these (Southerington, 2007). As with play therapies, ABA is an

individual curriculum developed for each child's specific behavioural needs. Whitman and DeWitt (2011) highlight that for ABA to be effective it is important to consider the role that the environment plays in the various behaviours experienced by children with ASD.

Numerous other therapies and treatment methods for various aspects of ASD have not been discussed. For example; to address specific communication difficulties, a speech pathologist may suggest sign language or the picture exchange communication system (PECS), a communication system where children express their needs or wants using pictures instead of words. For specific auditory problems a therapist may suggest auditory integration training. Medical interventions by physicians may be vitamin therapy or Ritalin (Herbert, 2003). However, as expressed in the delimitation of this research, to address all the treatments methods is beyond the scope of this dissertation, but it is important to know that these and others treatments do exist.

Amanda Tipkemper (2006, cited in Southerington, 2007) suggested that choosing one specific method as the focus for a centre for autism is unwise because each child has different needs and it is more effective to craft a specific program for each child based on their needs. Thus, classrooms and teaching spaces should be able to adapt for different approaches, without compromising on the need for order (Scott, 2009).

Given the right care and management, sufferers of ASD can make tremendous progress towards an improved way of life (Beaver, 2010). An important aspect of this is the environment in which they live and learn. Young (2004, cited in Scott, 2009) explains that when teachers use the built environment as a teaching tool and adapt it to suit the specialised needs of individual children, improvements can be seen in the children's communication skills, social interactions and imaginations, leading them towards higher levels of independence and autonomy.

4.2 Sensory Integration

Sensory integration theory was developed by occupational therapist Dr. A. Jean Ayres (Herbert, 2003). She (Ayres, 1979 cited in Wilkes, 2005) defines sensory integration as the 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). During sensory integration, stimuli are received, organised, interpreted, and used to guide behaviour (Whitman, 2009), thus, sensory integration is directly involved with human perception.

A common characteristic of AD is difficulty with sensory processing and the inability to integrate and make sense of sensory experiences (Larkey, 2007). "There is enough evidence to suggest that sensory processing impairment is as central to autism as the impairments of social interaction, communication and imagination." (Larkey, 2007: 11) Thus, children with AD often display problems in "orienting responses, filtering incoming stimulation, habituating to stimulation, and processing and interpreting sensory information - particularly information that is complex and requires integration from multiple modalities." (Whitman & DeWitt, 2011: 156-157)Sensory integration theory explores the deficits in interpreting sensory information and has three components; normal sensory integration functioning, sensory integrative dysfunction, and intervention programmes that use sensory integration techniques (Herbert, 2003).

4.2.1 Sensory Integrative Dysfunction

Paron-Wildes (2008) explains that children with AD, who experience difficulties with sensory integration, may experience a sensory deficit associated with one of their senses and experience no problems with their other senses. However, problems in one sensory modality often influence the functioning of other sensory modalities creating sensory dysfunction (Whitman & DeWitt, 2011). Harrison and Hare (2008) suggest that sensory integration dysfunction occurs in 70 to 80 percent of children with AD, while Baker (2008) claims that studies indicate that as many as 95 percent of people with AD display sensory difficulties.

An individual with AD may experience one, or more, of the following sensory related problems; hypersensitivity (over-stimulation), sensory overload, hyposensitivity (under-stimulation), sensory fixations, unusual sensory attractions and sensory tune-outs (Whitman & DeWitt, 2011). One of the most common is hypersensitivity (Cascio, 2008). Sensory difficulties impact the way in which people with AD experience the built environment (Nguyen, 2011), everyday experiences, which neurotypical individuals take for granted, for individuals with AD are negative and upsetting experiences (Wilkes, 2005) accompanied by feelings of pain, anxiety, stress and fear (Wetherby & Prizant, 2000). Many individuals develop a range of behavioural excesses and coping strategies in order to avoid these negative sensory experiences (Larkey, 2007). Appendix C provides a comprehensive list of sensory difficulties and the related coping strategies.

4.2.2 Sensory Integration Techniques

According to Govender (cited in Simons, 2008), the primary goal of sensory integration therapy is to facilitate adaptive behaviour by providing appropriate, graded sensory experiences. Sensory integration techniques work with the senses calming or arousing the individual, bringing them to the optimum level of arousal for attending specific tasks (Herbert, 2003). The therapy involves gentle exposure to various stimuli (Wilkes, 2005) over a gradual period of time. The aim is to strengthen, balance and improve fine and gross motor skills, co-ordination, production of language, behaviour and other skills (Herbert, 2003; Wilkes, 2005).

Wilkinson (2010) explains that best practise guidelines indicate that programs for children with ASD should allow for an appropriately structured physical and sensory environment which accommodates their unique sensory processing patterns. Environmentally focused sensory integration techniques utilize simplified learning environments that are devoid of distractions which could divert a child's attention (Whitman & DeWitt, 2011). These simple and predictable environments provide children with a sense of comfort (Whitman & DeWitt, 2011) and can be gradually increased in complexity without causing too much stress or anxiety. (Discussed in more detail in section 4.3) By slowly introducing sensory inputs, which a child finds overwhelming, a desensitization towards that stimulus develops (Larkey, 2007) allowing the child to act in a more adaptive manner (Wilkinson, 2010). In addition sensory rooms and gardens are used to stimulate, develop and balance the sensory systems of individuals with sensory problems (Refer to figure 4.6) and have shown great strides in the development of certain individuals (Beaver, 2010). These sensory rooms and gardens are structured according to sensory zones (Mostafa, 2008) because individuals with ASD find it difficult to focus on more than one sense at a time.

Figure 4-6 Sensory Room (Unknown Author[2], 2009)

Children with sensory difficulties do not explore their environments in the same way as neurotypical children. Consequently, children with ASD have limited environmental experiences and are fearful of change (Larkey, 2007). Sensory programs encourage children

with ASD to interact with their environment thus, reducing the fear associated with it (Larkey, 2007).

Sensory integration therapy is a child-directed, sensory enriched therapy that depends upon a specialised environment (Herbert, 2003). Designers have control over the physical and sensory environments; therefore, they play an important role in what sensory inputs people experience. Spaces that have too much stimulus on the walls, doors and furniture can create havoc in an autistic mind. Thus, designing low sensory-stimulus environments can reduce sensory overload, stress and anxiety(Scott, 2009), rather creating positive environments conducive to skill development and learning (Mostafa, 2008).

4.3 Autism Friendly Architectural Elements

It is clear that built environments are inadequate for the specialised needs of individuals with ASD, calling for a reconsideration of the design of these environments. Environments designed to reduce levels of stress and discomfort allow the autistic user to focus and concentrate on developing skills which enable them to experience higher levels of independence with the possibility of functioning within the everyday world. The creation of successful environments for children with ASD relies on the consideration of their specialised needs by addressing the following aspects;

4.3.1 Sense of Calm, Order and Simplicity

Humphreys (2008) explains that complexity within the built environment causes stress to children with ASD because they are unable to filter or differentiate between separate stimuli such as noises, shapes and colours. Thus, complex environments with a lot of stimuli are experienced by them as confusing and deeply troubling. By keeping spaces clear, calm and ordered the confusion experienced by children with ASD is reduced (Southerington, 2007). Humphreys (2008) emphasizes that a sense of clarity in the layout and organisation of spaces allows children with ASD to easily navigate a building without experiencing high levels of stress. New Struan Centre for Autism, Aitken and Turnbull Architects, is designed around a central hallway (Refer to figure 4.7)which runs the entire length of the school building allowing for clear views of the whole school and promoting order and independent movement from one area to the next (Scottish Society for Autism, 2011). This clarity of layout and organisation of space reduces feelings of confusion and stress within the children.

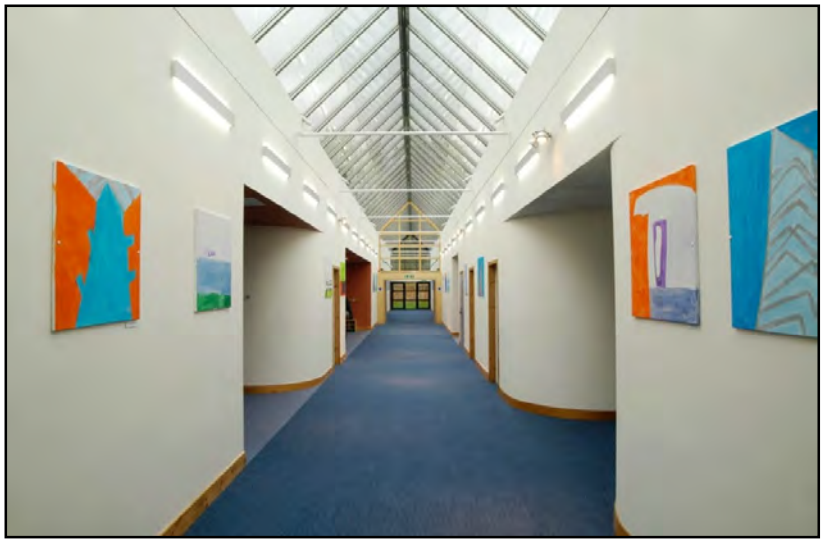


Figure 4-7 Simple Central Hallway, New Struan Centre for Autism, Alloa, Scotland, by Aitken and Turnbull Architects (Henry, 2011)

Calm and order are not only confined to the building plan and sections, it can also be employed in the choice of materials, for example, a limited palette of materials assists in creating clarity within spaces (Humphreys, 2008). Busy patterns and bold colours in building materials distract and disturb children (Scott, 2009), exposing them to negative spatial experiences.

Complexity in the details of a building can cause visual distractions and some children with ASD develop obsessions with these details (Humphreys, 2008). For example, patterned floors are often confusing and cause anxiety when children with ASD walk on them. Some children may become fixated when looking at the floor patterns and will stop and stare at them for extended periods of time (Nguyen, 2011).A reduction in detail provides less stimulation which enables children to be more focused. It is easier to provide a simple environment with minimal stimulation, to which stimulation can be added as necessary for the particular user's needs. Paron-Wildes (2008) describes simplifying the environment as the most difficult yet important goal for individuals with ASD.

Herbert (2003) describes order, structure and clarity of intent as important elements in the design of autism-friendly environments; in that they reduce sensory demands, promote independence and reduce inappropriate behaviour. Once the level of sensory demands has decreased, the level of stress experienced by the child is reduced as well (Herbert, 2003). Therefore, buildings should have a simple layout that reflects order, calm, clarity and has good signage and way-finding (Scott, 2009).

4.3.2 Legibility and Way-Finding

Children with ASD battle with vestibular and kinaesthetic integration, tending to be uncoordinated, and they struggle to relate their bodies and their bodies' movements to their surrounding environments (Henry, 2011). This movement through space, as previously discussed, is important in people's perception, understanding and experience of the environment. Children with ASD also have difficulty following environmental cues; many cannot distinguish normal visual cues such as exit or restroom signage. Thus, legibility and way-finding is crucial to these children's successful use of environments (Paron-Wildes, 2008).

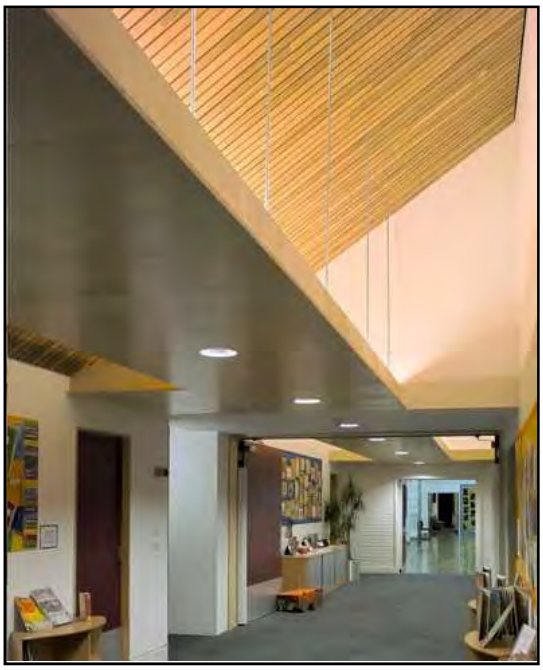


Figure 4-8 Bulkhead Provides a Visual Assisting Children in Navigating the Building, Kentish Town School Autistic Resource Base, Haverstock Associates (Henry, 2011)

Mostafa (2008) states that visually distinctive landmarks can be used to demarcate particular zones within the built environment. These landmarks serve two purposes; firstly they comfort children by providing them with a sense of orientation and secondly allows them to navigate the environment independently (Mostafa, 2008). The application of sensory zoning, mentioned in the previous section of sensory integration, further allows children to successfully navigate their environments. For example, the use of visual cues such as; colour schemes (Refer to figure 4.8) and texture changes can create a clear, ordered spatial hierarchy which the children can easily understand (Scott, 2009).

Simple, legible routes are important for children with ASD, an environment with too much stimuli is often distracting and prevents the children from reaching their destination (Mostafa, 2008). This ties back to the idea that a building should have a simple layout that reflects calm, order and clarity (Scott, 2009).A well designed circulation space not only provides the functional means to get from A to B, but also provides an overlap between circulation and social space (Scott, 2009). Assirelli (2011) remarked that circulation spaces designed for children with ASD should provide sufficient space for various types of play, story-telling and socialising. Aitken and Turnbull Architects, in their design of the New Struan Centre for Autism, transformed the traditional corridor into the main social space and 'heart' of the building (Scott, 2009). This spacious, well lit, community space is a powerful

orientation device because the classrooms, the library and the dining room can all be accessed directly off it, making it easy for children to navigate(Scott, 2009). Children with ASD battle to grasp the concept of personal space, thus, circulation spaces need to be generous so that children are not forced too close together so as to invade each other's personal space (Beaver, 2010). The New Struan circulation space is wide, allowing children to pass each other comfortably without fear of collision, confusion (Scottish Society for Autism, 2011) or invasion of their personal space. (Refer to figure 4.7)

4.3.3 Sense of Openness and Closure

The sense of openness and closure needs to be carefully monitored for children with ASD. Small spatial volumes make certain children on the autistic spectrum feel cramped and threatened while larger spatial volumes make other children feel anxious and exposed (Henry, 2011). Many architects try to resolve these conflicting spatial needs with flexibility (Henry, 2011). However, flexibility, while good in concept, often results in generic spaces that accommodates many functions but does not serve any one function well (Henry, 2011). At Netley School ASD Resource Base, Haverstock Associates purposely did not include permanent workstations in the classrooms, with the belief that this would allow the teachers greater flexibility (Henry, 2011). (Refer to figure 4.9)The teachers however, found that this high level of flexibility created a lack of order within the teaching environment. Individuals with ASD, also exhibit a strong aversion to change, they need structure and routine within their lives and need to be able to predict what is coming. If an environment is too flexible a child will live in constant fear that the environment will suddenly be changed (Henry, 2011), this is far from the calm, positive environments that are required.

Figure 4-9 Unsuccessful Flexible Environment, Netley School ASD Resource Base, London, Haverstock Associates (Henry, 2011)

With these children having different sensitivities to spaces, providing a mixture of larger and smaller spaces allows children to choose which space to occupy. This provides children with the confidence to explore spaces in which they are uncomfortable because they

have the security of knowing that they can withdraw to more comfortable spaces whenever they become overwhelmed or anxious. This can be achieved by the compartmentalization of spaces and activities by confining the limits of the sensory environment which the child interacts with (Mostafa, 2008).

Children with ASD do not understand the concept of personal space and feel threatened when they have a lack of personal space, therefore Young (2004 cited in Scott, 2009), suggests that generous space standards are used when designing for children with ASD. Humphreys (2005) suggests 40 square metres per child. In addition to creating spacious classrooms, withdrawal areas (Refer to figure 4.10) are also of extreme importance. These areas allow children to remove themselves from an over-stimulating or stressful situation and place themselves in a calming environment with as little stimulation as possible (Southerington, 2007).

Figure 4-10 Withdrawal Space Separated from the rest of the Classroom Space, Langagerskolen, Denmark, by 3 x N Architects (Henry, 2011)

4.3.4 Borders and Transitional Zones

Children with ASD experience difficulties when moving and transitioning from one space to another or from one activity to another. Tipkepmer (2006, cited Southerington, 2007) explains that for activity transitions, visual cues and schedules help keep children on track, and for spatial transitions sensory cues are used, such as; paths between rooms formed by stripes of colour on the floor or a timber rail on the wall which children can run their hands along feeling their way through different spaces. The primary goal is to keep some form of consistency from one place to another or from one activity to another (Southerington, 2007). (Refer to figure 4.11)

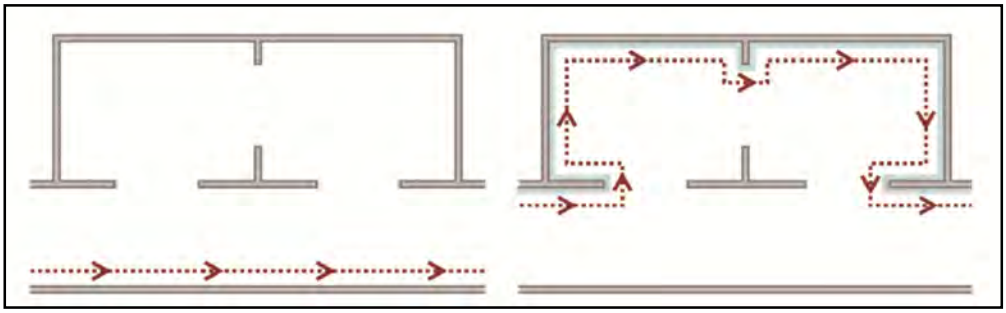


Figure 4-11 Methods of Assisting Transition Through Spaces (Southerington, 2007: 28)

The need for repetition is evident in the repetitive behaviours seen in children with ASD. Thus, smooth transitions and repetition should be reinforced in the environment in order to avoid stress and provide predictable surroundings that can be easily understood (Southerington, 2007).

Boswell, Decker and Schultheis (2000 cited in Southerington, 2007: 26) explain that children with ASD "are more able to identify and carry out assigned tasks when visually clear boundaries designate the exact space that is available for specific activities." These boundaries create a sense of emotional security in children who would normally be otherwise overwhelmed in large, empty spaces (Southerington, 2007). Again, the idea of compartmentalization of spaces and activities is beneficial to children with ASD.

4.3.5 Lighting and Ventilation

Human comfort is an important factor in the design of any environment and lighting and ventilation are two aspects that affects peoples comfort and well-being. Natural ventilation is best achieved through cross ventilation, however, the size and position of windows in a facility for children with ASD needs to be carefully considered for safety reasons. Some children with ASD enjoy the sound of hitting or breaking glass which may cause harm to themselves or others (Nguyen, 2011), while other children may decide to climb out of windows (Beaver, 2010), either injuring themselves or disappearing altogether.

Natural light has the ability to uplift the spirit and enhance people's well-being (Henry, 2011) however, for children with ASD too much variety of light or glare may distract them and too much contrast and shadow may create over stimulation (Humphreys, 2008). Low level windows with exterior views also provide additional unwanted distractions for children with ASD (Henry, 2011) With this in mind, the design of Langagerskolen (1998) only has a few windows which children can look out of, none of these windows are found in the classrooms (Henry, 2011). Instead, high level windows and skylights provide bright natural light into the building (Henry, 2011) without providing any visual distractions. To maximize daylight but avoid contrast, glare, and distracting views, James Vance and Associate Architects, in their design of River Street School (1989), used

Figure 4-12 Large Overhangs at River Street School, Windsor, by James Vance and Associates, Eliminates Contrast and Glare (Henry, 2011)

high level windows protected by large roof overhangs (Henry, 2011). (Refer to figure 4.12) In their design of Netley School ASD Resource Base, Haverstock Associates took a completely different approach to natural light. They incorporated floor to ceiling windows that span almost one entire wall of the school (Henry, 2011), the idea behind this was that natural light is important for people's health and well-being. The extensive windows have since been covered with paper, (Refer to figure 4.13) because the staff found that the windows provided too much daylight and distractions (Scott, 2009), the building, as a result, looks rundown.

Figure 4-13 Paper Hung on the Windows of Netley School in order to Block Out Distracting Views (Henry, 2012)

Artificial light has a dramatic effect on children with ASD. Fluorescent or harsh lighting hurts their sensitive eyes, while the flickering and hum of the lights, which is less apparent to neurotypical individuals, is distracting, sometimes even painful (Nguyen, 2011). Thus, glare, noise control and flicker need to be carefully considered in the selection of light fittings. Artificial lighting does provide the opportunity to add different colours to a space and the ability to dim or brighten a room. This allows the mood of an environment to be adapted to suit the needs of the users at any particular time. It also enables children to have control of their environment so that they can adapt the lighting levels if they become too overwhelmed by the brightness.

4.3.6 Acoustics

Mostafa (2008) conducted a survey showing acoustics as the most influential architectural factor affecting autistic behaviour. This is due to the fact that many individuals with ASD find it difficult to filter out noises which neurotypical individuals simply block out or ignore (Nguyen, 2011), resulting in children with ASD being easily distracted and affected by noise (Villegas, 2009).

Internally, acoustic ceilings, soft flooring and furnishings can be used to reduce noise levels, echo and reverberation, creating cosier environments. Generally, shiny reflective surfaces should be avoided as they create noisy, uncomfortable spaces (Beaver, 2010).

Externally, urban noise such as traffic, machinery, air-conditioning and loud voices can disrupt internal environments (Herbert, 2003), thus filtering methods such as trees or

vegetation screens and masking elements such as running water can be utilized to reduce noise levels.

4.3.7 Colour

Colour theorists believe that the colour of a person's surroundings play a large role in influencing their mood and behaviours (Southerington, 2007). People with ASD are often even more sensitive to the psychological and physical effects of colour (Rain, Unknown Date). Paron-Wildes (2008) states that 85% of children with ASD see colours with greater intensity than neurotypical children and 5% see muted tones. For children who see colours with a greater intensity red appears fluorescent, and children who experience muted tones perceive everything as grey (Paron-Wildes, 2008). Since children with ASD either experience heightened or minimal response to the sensory stimulation of colour, it is an important aspect to consider.

Figure 4-14 Low Arousal Cream Colours are Used in Lagagerskolen, Denmark, by 3 x N Architects (Henry, 2011)

It is generally accepted that low arousal colours such as cream should be used (Nguyen, 2011) and the use of primary colours should be limited.(Refer to figure 4.14) Paron-Wildes (2008) states that muted pink has been shown to be a favourable colour for people with learning disabilities. The colours used should create a warm but not over-stimulating environment (Beaver, 2010), furthermore, the use of a variety of colours is stimulating (Humphreys, 2008), hence a simple palette of colours should be selected to prevent overstimulation and distraction. Plain, bare walls decorated in muted, soft colours are seen to be the best compromise, so that stimulus (such as displays of art work) can be introduced gradually, as needed, to suit the individuals' needs (Scott, 2009).

4.3.8 Contact with Nature

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) In contemporary times natural elements and settings are still incorporated for their healing and calming properties. Outdoor spaces and gardens can be useful outlets for children with ASD as spaces where they can safely reduce stress (Nguyen, 2011). These outdoor environments are more conducive than indoor

environments for motor activities such as balancing, jumping on a trampoline and climbing (Herbert, 2003). They are also more suited for certain sensory integration activities, such as tactile activities that involve sand and water (Herbert, 2003). In addition outdoor environments are natural settings in which to engage play therapies (Herbert, 2003).

The opportunity exists for outdoor environments to be designed as learning tools, as much as the indoor environments are (Scott, 2009). By designing a variety of clearly demarcated external play and learning spaces, that are easily accessible, children have the opportunity to learn new skills or practise existing skills in a new environment. Pitmore Special School in Hampshire, a school for children with behavioural and emotional problems, has a garden area that is used as an alternative to the classroom (Refer to figure 4.15) and is a therapeutic method of releasing stress and frustration in the children (Scott, 2009).

Figure 4-15 Therapeutic Garden at the Pitmore Special School, Hampshire (Unknown Author[3], 2011)

4.3.9 Security, Safety and Supervision

The safety and security of children with ASD is crucial because often they do not understand the danger of the situations or environments in which they find themselves. Thus, it is important that they are 'contained' for their own safety, but they must still be able to wander freely within their immediate environment or at least feel that they can (Humphreys, 2008). It is important to monitor the children, but not to the extent that they feel uncomfortable or stressed by feeling constantly watched. A level of confidence and independence needs to be instilled in the child. Good lines of observation within a building are paramount for the wellbeing of both staff and children (Scott, 2009). The Sunfield Rowan and Oak houses are designed specifically so that the staff can easily monitor the children. The centrally located courtyard has high levels of visibility so that staff can constantly monitor student activity within it, even from a distance (Whitehurst, 2007) and the staff rooms have high level windows which allow for good views of the circulation and bedroom wings (Whitehurst, 2006) so that the entire space can be constantly monitored wherever the staff members are.

Outside space can provide a stimulating alternative environment; however, any external space needs to be sufficiently enclosed so that children who become curious or confused cannot just wander off (Herbert, 2003). In addition to this passer-by's may stare or mock children with ASD, making them feel more isolated and different. Thus, it is also important to ensure that unwanted intrusions from passer-by's are avoided (Herbert, 2003).

4.3.10 Implications

The first thing apparent in children with ASD is that each individual experiences spaces differently and exerts their frustrations in different ways. When designing a building for their specialised needs a designer does not know from the outset who the occupants are going to be and even if they did, the occupants would change as time went on. Thus, a building should be designed for the average resident so that it can be tweaked along the way to suit the particular characteristics and behavioural patterns of the individuals (Beaver, 2010). As mentioned previously, people adapt their environments to suit their needs and it is easier to add stimulation from an external temporary source, than to remove stimulation from an existing environment (Mostafa, 2008). The architectural implications discussed in this section are based on common characteristics and needs of children with ASD.

A final important aspect that needs to be addressed is that any building designed for individuals with ASD will also be occupied by their carers or teachers (Beaver, 2010). Therefore, any design approach needs to consider and cater for their needs, comfort and well-being as well.

4.4 Independence and the Built Environment

Self-regulation is considered to be an essential skill that regulates arousal, sensory input, cognitive activity, motor behaviour and social interaction (Whitman & DeWitt, 2011). Due to their difficulties in self-regulating, discussed in previous sections, children with ASD depend on others for guidance (Whitman & DeWitt, 2011). Therefore, teaching children with ASD to self-regulate helps them achieve higher levels of independence. Through self-regulation children with ASD are able to act without external social direction, maintain skills they have learned and generalize learned responses to new situations, this means that they are more likely to be able to cope in normalized settings (Whitman & DeWitt, 2011).

Environments designed with an autism-friendly approach encourages better behaviour, fosters a happy relationship between child and teacher and results in a reduction of challenging behaviour. (Beaver, 2010: 4) This creates a window of opportunity where

children with ASD will achieve a more efficient skill development in a shorter period of time (Mostafa, 2008). As discussed in previous sections, therapies, treatment methods, educational programs and specialized environments can be designed to enhance this efficient skill development and help children learn self-regulation, working towards independence (Whitman & DeWitt, 2011).

It is this idea of independence that is pivotal for facilitating and improving the quality of life for all special needs individuals, especially those with ASD (Mostafa, 2008). Independence represents an important goal in all autistic interventions as it is the first step towards inclusion and acceptance in the greater community (Mostafa, 2008).

But where does a person draw the line between environments that prepare individuals for the outside world and specialised, protected environments? (Beaver, 2010) Some educators and carers of individuals with ASD claim that specialized environments, which over-provide and over-protect these individuals, leaves them exposed and unprepared for the dangers of the outside world (Assirelli, 2011; Beaver, 2010).

> "The challenge is to organise a school that allows these children to become involved members of their society, giving them an identity and purpose, while also giving them the space and attention required for a natural and healthy development." -Villegas(2009: 9)

CHAPTER 5 PRECEDENT STUDIES

5.1 Introduction

The selected precedent studies discussed in this chapter are specifically chosen for their relevance to the key issues established in the previous sections. They have been deemed to be relevant because they serve as appropriate examples of architectural responses to the special needs of individuals with ASD. The analysis of these two precedent studies explores how the considered relationship between the built environment and the specialised needs of individuals with ASD creates positive environments. The buildings are not discussed in their entirety; their purpose is rather to identify other architects' recognition of, and response to, these specialised needs. The analysis is based on the following criteria, where applicable:

- Sense of calm, order and Simplicity
- Legibility and Way-finding
- Sense of Openness and Closure
- Borders and Transitional Spaces
- Light and Ventilation
- Acoustics
- Colour
- Contact with Nature
- Security, Safety and Supervision

5.2 Towards Independence and Autonomy:

New Struan Centre for Autism, Alloa, Scotland

Architects: Aitken and Turnbull Architecture

Figure 5-1 Entrance to New Struan Centre for Autism (Henry, 2011)

The New Struan Centre for Autism is a school for children suffering from ASD. (Refer to figure 5.1) The school is run by the Scottish Society for Autism and also functions nationally as an Autism Centre, with facilities for autism advisory, education and training in autism, education outreach services and a research, diagnosis and assessment centre (Scott, 2009).

The building is situated in a forested residential

area and is carefully designed to enable its users, who experience complex and intensive needs, to achieve their maximum potential (Scottish Society for Autism, 2011).The environment provides purpose, meaning and understanding for each individual child and encourages them towards independence and autonomy (Scottish Society for Autism, 2011). Andrew Lester, from Aitken and Turnbull Architecture, explains that their aim was to create an autism-friendly environment that was influenced by the priorities of people with ASD (Scottish Society for Autism, 2011).

The building plan is a 'T' shape, with the horizontal section of the 'T' facing the street. This section accommodates the public front-of-house activities of the Scottish Society for Autism. The classrooms, diagnosis and assessment rooms are located in the spine of the 'T' and are separated from the public facilities by a set of secure doors. (Refer to figure 5.2)

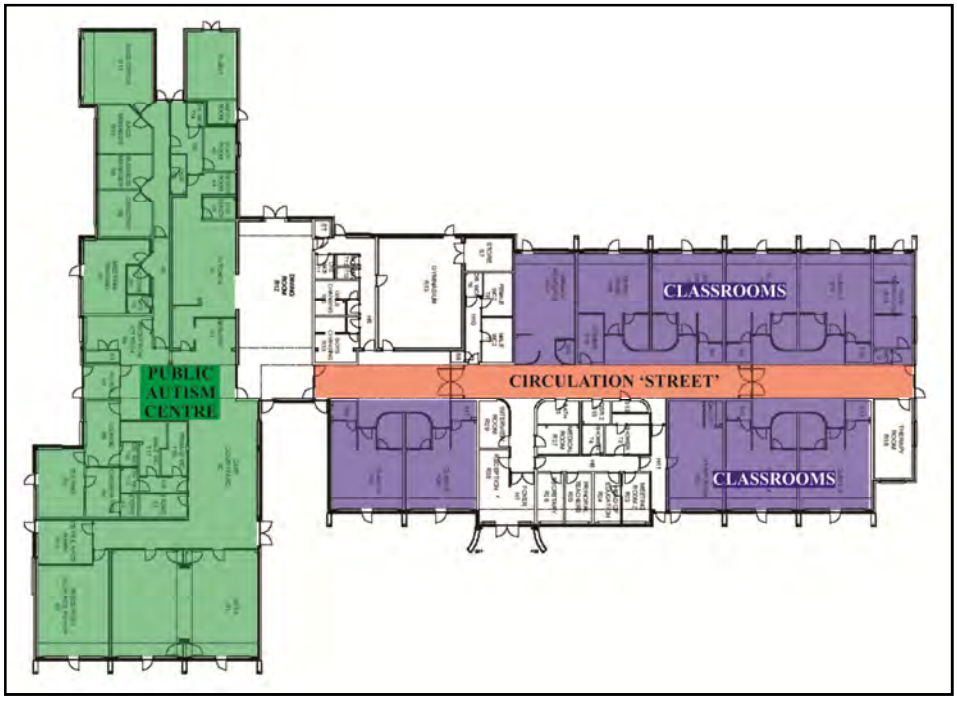


Figure 5-2 New Struan Centre For Autism Floor Plan (Courtesy of Aitken and Turnbull Architects)

5.2.1 Sense of Calm, Order and Simplicity

The single storey spine is designed around a central hallway, referred to as 'the Street'. The street is effectively a glass atrium which runs the entire length of the building, providing natural light and ventilation into the interior spaces. The Street allows for a clear view of the whole school, thus promoting order and independent movement from one area to the next (Scottish Society for Autism, 2011). This clarity of layout and organisation of space reduces feelings of confusion and stress within the children.

The limited palette of materials, which have no detail or patterns, add to the sense of calm and simplicity.(Refer to figure 4.7) The classrooms, themselves are structured around the individual child. Each child has their own structured workstation (Scott, 2009). These structured classrooms create a sense of order and routine, enhancing the sense of calm.

5.2.2 Legibility and Way-finding

The street acts as the circulation spine of the building with the classrooms accessed off either side of it. Scott (2009) describes the street as a powerful orientation device which forms the 'social heart' of the school. The street enables a clear view of the whole school, as well as views out to the outdoor play areas; this allows children to easily orientate themselves within the building and encourages them to move independently from one area to the next. By providing this opportunity children develop confidence in their navigation abilities. The wide circulation space allows children to pass each other comfortably without fear of collision, confusion (Scottish Society for Autism, 2011) or invasion of their personal space.

Semi-public communal areas, such as the dining room and library, are also accessed off the length of the street. These areas are open to the street and are designed so that their purpose is clearly indicated before a child enters the space (Scottish Society for Autism, 2011). This enhances their ease of way-finding and reduces stress by them knowing what to expect before entering a space.

The finishes and colour scheme of the walls and floors support the spatial hierarchy (Scott, 2009). The atrium is painted white, which with the bright natural light enhances its spaciousness; the dark blue flooring runs the length of the street and clearly separates it from the threshold spaces. The threshold spaces are an earthy red-brown colour, and the flooring is a light blue, this visually separates the spaces and emphasizes the importance of the street. (Refer to figure 5.3) The creation of this visual hierarchy further assists children in their independent navigation of the building. Each classroom has a door accessing the outdoor play areas. In order for the children to distinguish which classroom is

Figure 5-3 Colour and Materials used to Emphasize the Spatial Hierarchy (Scott, 2009)

theirs each door is painted a different colour. (Refer to figure 5.4) Thus, children can play outdoors freely, comforted by the knowledge that they can easily find their way back to their specific classroom.

Figure 5-4 Different Coloured Doors Assist Children in Finding their Classrooms (Scott, 2009)

5.2.3Borders and Transitional Spaces

As discussed in chapter four, many children with ASD have a fear of 'difference', this includes spatial or environmental differences thus, thresholds can often be threatening and intimidating to them. Andrew Lester (Scott, 2009) explains that, in the New Struan School, threshold spaces form transitional zones between the street and the classrooms, allowing for a smooth and independent transition between the play and circulation space of the street and the teaching zone in the classrooms. (Refer to figure 5.3)The threshold spaces have clear visual boundaries created by the use of finishes and colours, discussed above. The ceiling height of these spaces are lowered, reducing the scale and creating more intimate areas (Scott, 2009). These threshold spaces are often used for small group activities so that the classrooms start outside, helping the children transition smoothly into the classrooms. These threshold spaces are structured, with everything organised into a specific place, assisting with maintaining a sense of order and simplicity. (Refer to figure 5.5)

Figure 5-5 Spaces are Structured and Organised (Scott, 2009)

Glass panels in the classroom doors allow children to see into the classrooms before entering and allows views of the street before leaving the classroom. This provides children with the opportunity to process and assimilate important details of an environment before they enter (Scottish Society for Autism, 2011), allowing them to prepare themselves thus, reducing stressful situations.

5.2.4 Light and Ventilation

Aitken and Turnbull Architects have provided an innovative solution for the incorporation of natural light in the New Struan School. High level windows allow for natural light to enter the classrooms, a light shelf and a specifically angled ceiling diffuses the direct sunlight, while still maximising its effects (Scott, 2009; Scottish Society for Autism, 2011). This eliminates distracting shadows and glare. The high level windows also provide natural ventilation and their position prevents children from climbing out the windows (Scottish Society for Autism, 2011). The lower level windows and doors have opaque blinds which are operated manually. This allows for filtered light to enter the classrooms without distracting views of the exterior (Scott, 2009). The blinds are simply designed, preventing them from becoming a distraction in themselves.

The atrium space has ample natural light and ventilation provided by the roof structure, constructed from operable glazed panels. (Refer to figure 5.6) This extensive skylight provides children with a calming view of the sky. The system of artificial light is subtle, unobtrusive and mimics the patterns of natural light thrown up onto the ceiling. These up lighters, used instead of overhead florescent lights, are controlled by dimmer switches, allowing the light levels to be adjusted to suit the occupants needs (Scottish Society for Autism, 2011).

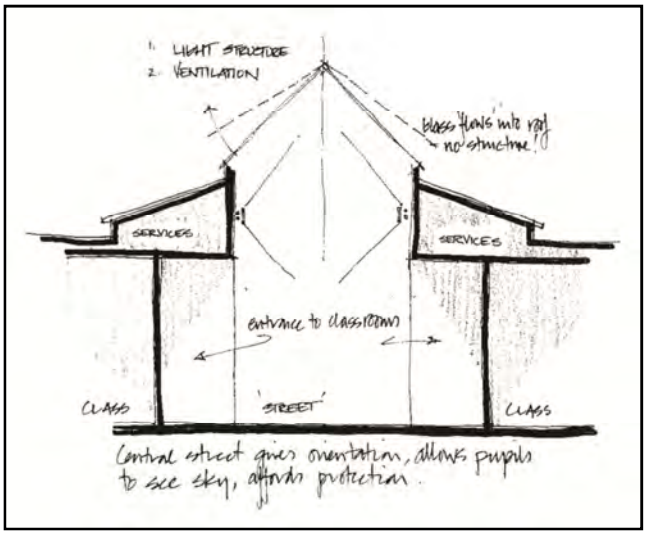


Figure 5-6 Sketch Section Through Atrium Indicating the Operable Skylights (Henry, 2011)

5.2.5 Acoustics

The street and the classrooms are carpeted to reduce noise and soften the environment (Scottish Society for Autism, 2011) The classrooms were built using thick masonry walls to provide additional sound insulation (Scott, 2009). The consideration of the acoustic qualities provide cosier and less stressful environments for the children.

5.2.6 Colour

The colour scheme for New Struan School was chosen for its positive impacts on the moods of children with ASD and to promote a sense of calm throughout the building (Scottish Society for Autism, 2011). Both the classrooms and the street's muted neutral colours allow for stimulation to be added as necessary. In the street this addition comes from children's paintings, personalizing the space and making it less institutional (Scott, 2009). (Refer to figure 5.3)As discussed, the colours are also coded to support the spatial hierarchy.

5.2.7 Contact with Nature

Each classroom has an external door leading to the outdoor play area. This allows learning to easily extend into the outside space (Scottish Society for Autism, 2011). The outdoor area includes a cycle track, play equipment, a ball park and sensory garden(Refer to figure 5.7) and is designed to encourage children to play; either together or independently (Scottish Society for Autism, 2011). In this way the outdoor area caters for a wide range of social and motor skill development.

Figure 5-7 Play Equipment in the Outdoor Area (Courtesy of Aitken and Turnbull Architects)

A low perimeter fence encloses the outdoor space and provides a clear visual boundary that the children can understand without it being restrictive or overbearing (Scottish

Society for Autism, 2011). Therefore, this safe and secure outdoor environment can be explored freely and independently.

The building as a whole is designed to create a calm and structured environment in which children with ASD can focus and learn important life skills. The building takes cognisance of the specialised needs of these children by incorporating them into the details of the built environment. The wide street enables children to move independently without confusion or the need of supervision, indicating how the sense of autonomy and independence influenced the design. Andrew Lester (Scottish Society for Autism, 2011) explains that each detail of the building offers a statement of respect to the pupils, acknowledging the difficulties which they experience.

5.3 Environments of Calm and Safety:

Sunfield's Rowan and Oak House, England

Architects: GA Architects

Sunfield is a special educational needs (SEN) school which provides education and residential care for children with severe learning disabilities, autism spectrum disorders and associated complexities. The school has ten residential houses on its premises, two of which, the Rowan and Oak houses, are specifically designed to meet the needs of children with ASD (Whitehurst, 2006).(Refer to figure 5.8)

Figure 5-8 Sunfield's Rowan and Oak House (Whitehurst, 2007:1)

The single storey building comprises of two semi-detached houses with a central shared courtyard space. Both houses operate independently, accommodating six children in each house (Whitehurst, 2006), however, they allow for the sharing of certain facilities where

needed. For example, both houses have sensory rooms, but one house has a sensory room for children with hypo-sensitivities and the other house has a sensory room for children with hypersensitivities.

An important aspect of the design was to move away from the conventional corridor with an 'institutionalised' feeling (Scott 2009); this was achieved by adding a wide circulation space that incorporates low level seating (Whitehurst, 2007) and provides ample space for play and social interactions to occur. Each single bedroom, accessed off this circulation space, is adapted to meet the needs of the individual child, in order to create a 'home away from home' (Whitehurst, 2007).

Sunfield uses the TEACCH structured teaching method to help children develop skills and coping strategies in the classroom and residential settings. The TEACCH approach allows for the wide variety of communication levels experienced by the children and is based on each individual's abilities, interests and needs. GA Architects addressed these communication difficulties within the fabric of the building by wall mounting carpet tiles in each bedroom (Whitehurst, 2007). This allows children to place photographs or symbols of what they wish to express on these boards, providing them with an easy means of communication. Similar attention to detail is seen throughout the rest of the building.

5.3.1 Legibility and Way-finding

Each wing of the building has a wide circulation space, off which the bedrooms are accessed. This space incorporates low level seating and storage while providing ample space for play and social interactions (Whitehurst, 2007). (Refer to figure 5.9) The circulation space runs the entire length of the building so that children can easily locate themselves and identify various spaces. This makes navigation simple so that children can confidently move around by themselves.

Figure 5-9 Spacious Circulation and Play Space (Henry, 2011)

Harsh right angles and corners are visually difficult for children with ASD to navigate because of their difficulties in visio-spatial processing (Whitehurst, 2006). Thus, curves were incorporated into the circulation spaces. (Refer to figure 5.10) These curved walls assist children in moving easily and safely

through the building (Whitehurst, 2006), becoming an important orientation and way-finding device. Children often place their hands on the walls and follow the contours along the corridors (Whitehurst, 2007). The curved walls have a humanising effect ensuring that the building is not institutional (Whitehurst, 2006).

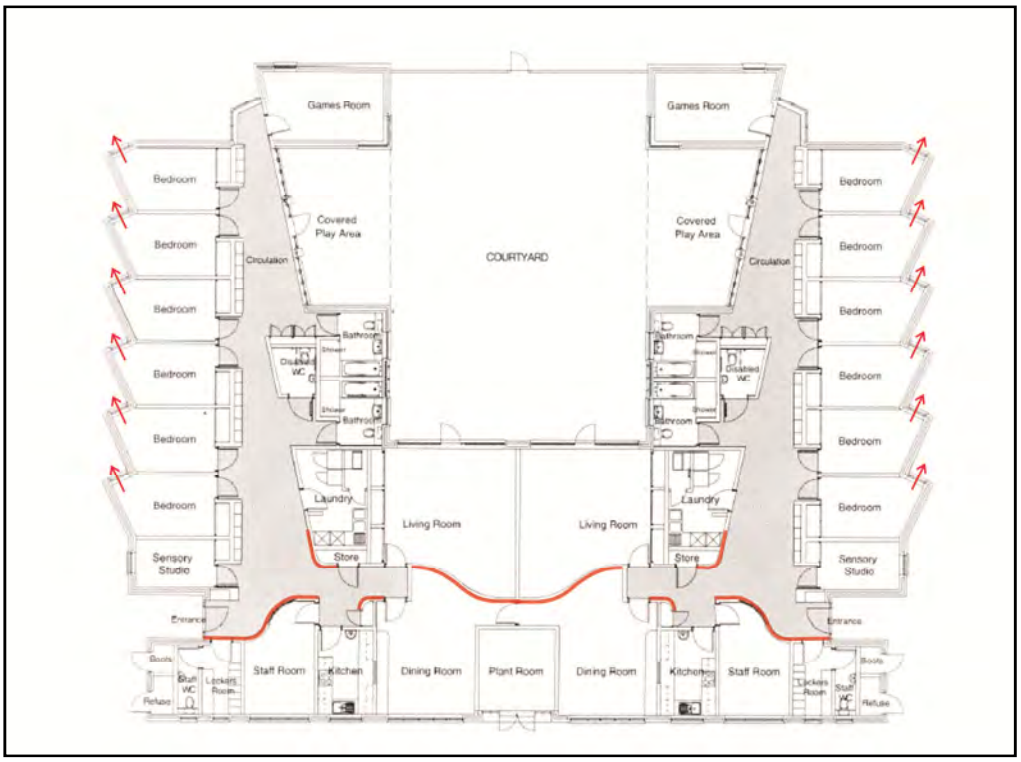


Figure 5-10 Floor Plan of Sunfield's Rowan and Oak House Indicating the Curved Walls and Staggered Bedrooms (Whitehurst, 2007: 3)

5.3.2 Light and Ventilation

As this is a residential building, as opposed to an educational facility, like New Struan School, both high and low level windows are provided because distracting views do not affect the functioning of the building. The low level windows provide children a view of the outdoor surroundings (Whitehurst, 2006) (Refer to figure 5.11) rather than it being screened off. Operable high level windows provide natural ventilation and additional natural light without the risk of children climbing out them(Whitehurst, 2006). Whitehurst (2006) explains that natural ventilation reduces the negative adrenalin produced when stressful events occur. Thus, the incorporation of natural ventilation enhances the building's calm environment.

Figure 5-11 Children are able to look out of the Windows Instead of them Being Blocked Off (Whitehurst, 2007: 7)

The layout of the bedroom wings follow a zigzag pattern, allowing each bedroom to have windows with an exterior view without compromising privacy (Whitehurst, 2006). (Refer to figure 5.10) The roof design incorporates clerestory windows in the bedrooms (Refer to figure 5.12), providing a soft indirect light which washes down the angled ceilings. This results in brightly lit bedrooms, rather than dark institutional rooms.

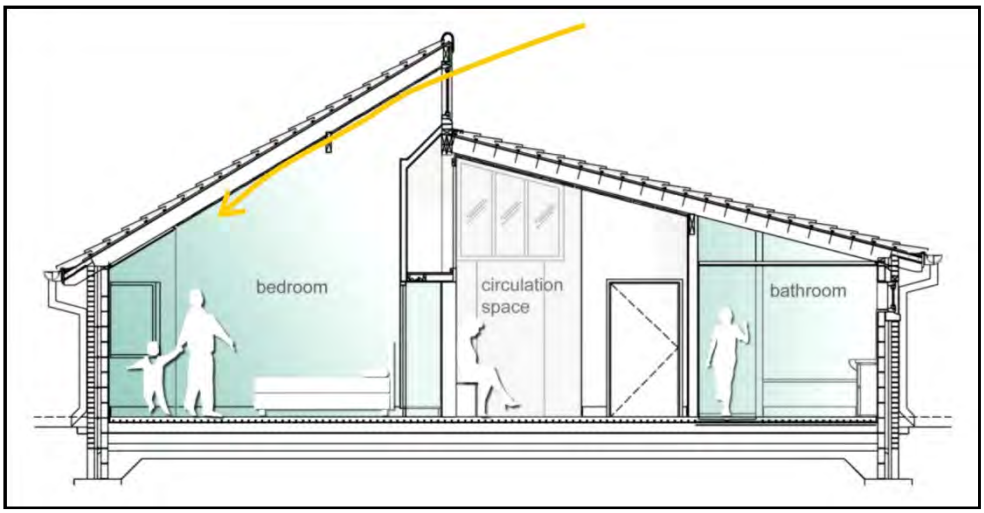


Figure 5-12 Section Through One Wing of the Rowan and Oak House Indicating the Clerestorey Window and Angled Ceiling (Henry, 2011)

5.3.3 Acoustics

GA Architects paid careful consideration to the acoustic quality of the houses. The ceiling design consists of slatted timber with ten millimetre gaps between each board and an acoustic sound-absorbent backing (Whitehurst, 2006). (Refer to figure 5.13) The sound travels between the gaps and is absorbed by the backing, reducing reverberated sound (Whitehurst, 2007). The walls in the circulation spaces are facebrick with deeply raked joints. This breaks up sound waves when they hit the wall rather than reflecting them back, as is the case when using plaster or shiny surface finishes (Whitehurst, 2007). The combined effect of these noise reduction techniques creates a calmer experience for both students and staff (Whitehurst, 2007).

Figure 5-13 Circulation Space With Various Noise Reducing Elements (Henry, 2011)

5.3.4 Colour

Whitehurst (2007) explains that the colour scheme for the Rowan and Oak houses was selected based on research conducted by Dr Di Pauli (Pauli, Egerton & Carpenter, 2000).The research suggests that some colours disturb or alter the moods of children with ASD, whilst others have a calming effect. Pauli (2000, cited in Whitehurst, 2007) found shades of pink and purple to be the most positive colours, thus, these colours are used extensively on the walls of the Rowan and Oak houses. Grey was found to be a neutral and non-reflective colour, provoking neither a positive nor negative reaction, therefore is used extensively in the houses (Whitehurst, 2007). (Refer to figures 5.9 and 5.13) The colour palette is minimal and free of any detail or patterns, enhancing the sense of simplicity and keeping visual stimulus to a minimum.

5.3.5 Contact with Nature

The adjoining houses are built around a central courtyard, providing a safe outdoor environment where children can play. Its central location allows children to play independently while being observed from a distance by the staff (Scott, 2009; Whitehurst, 2007). Doors and windows in the circulation spaces open out onto the courtyard allowing the children unlimited access to this outdoor space. This has a positive effects on the children because it increases their levels of autonomy and eliminates frustrations of having an outdoor space which they cannot access (Scott, 2009; Whitehurst, 2007). The courtyard space, shared by both houses, encourages children to intermingle (Whitehurst, 2007). Thus, the outdoor space not only provides the opportunity for children to develop their motor skills by playing, running and cycling but also their social skills. (Refer to figure 5.14)

Figure 5-14 One of the Children Enjoying the Freedom of the Outdoor Courtyard (Whitehurst, 2007: 6)

5.3.6 Security, Safety and Supervision

The building is specifically designed so that staff can easily monitor the children. The centrally located courtyard has high levels of visibility so that staff are able to constantly

monitor student activity within it, even from a distance (Whitehurst, 2007). The staff rooms have high level windows allowing for good views of the circulation and bedroom wings (Whitehurst, 2006) so that the entire space can be constantly monitored wherever the staff members are.

An additional security feature are the window openers in the bedrooms. All bedroom windows are fitted with special security fittings and opening restrictors, this allows staff to control which children are allowed to open their windows and which require their windows to be locked (Whitehurst, 2006). This security measure prevents children escaping out of the windows.

The design of the Rowan and Oak houses has taken careful consideration of the needs of both the residents and the staff. The design and layout of the building provides the children with freedom, choice and autonomy, allowing them to wander around and mix with other children in a safe environment (Whitehurst, 2006). The children have the option not to interact with other children, escaping instead into their own bedroom spaces. This element of choice is important, enabling the children to remove themselves from stressful situation before they become overwhelmed. Thus, reducing challenging behaviours. The curved walls, neutral colours, high ceilings, noise-reducing components and natural light add to the feelings of calm, comfort and security within the building (Whitehurst, 2006). In addition to these features which are designed specifically with the children in mind, staff spaces were created to cater for the staffs specific needs. These staff rooms, whilst being enclosed and providing privacy, allow the staff to monitor the children's activities through high-level windows (Whitehurst, 2007). This easy monitoring system allows staff to have a private space where they can withdraw and relax, not having to worry about the children.

5.4 Conclusion

The two selected precedent studies indicate how the focus on specific user needs can be interpreted and applied in various ways to the built environment. Both examples represent built environments which have been designed specifically for the unique needs of children with ASD. They show how considered design can greatly enhance the lives of these children and indicates successful design approaches to buildings of this nature.

CHAPTER 6CASE STUDIES OF SPECIALIZED ENVIRONMENTS

6.1 Introduction

The case studies are used to conduct empirical research in the form of an evaluation of existing educational facilities in terms of the key issues established in the previous sections. The two case studies were deemed to be relevant because they serve as examples of educational buildings which cater for the specialized individual needs of their users. The selected case studies provided the opportunity to identify and critically analyse specific contextual and environmental factors which have been discussed in the previous chapters.

The assessment of the case studies were carried out as first hand observations and analyses of the built environments, which were supplemented with feedback from the educators and principals who teach in the various facilities (Refer to Appendices E-G). The analysis of the case studies are based on the following criteria, where applicable:

- Sense of calm, order and Simplicity
- Legibility and Way-finding
- Sense of Openness and Closure
- Borders and Transitional Spaces
- Light and Ventilation
- Acoustics
- Colour
- Contact with Nature
- Security, Safety and Supervision

6.2 Responding to Special Needs in a Caring Nurturing Environment: Brown's School, Pinetown

Brown's School is a ELSEN (Education for Learners with Special Educational Needs) public school catering for children with a range of disabilities, such as cerebral palsy, specific learning disabilities and autism spectrum disorders, whose aim is to provide specialised help to these children in a nurturing, caring environment (Brown's School, 2011). The classes are kept small in order to provide specialised support and teaching programs are modified to suit each individual child's particular needs (Brown's School, 2011).

The school is situated in a quiet residential area that is easily accessible off a major highway. The proximity of the school to the highway allows the building to take on students

from across the greater Durban area, from Amanzimtoti to Durban North, and from the beach front to Hillcrest (Brown's School, 2011). Thus, the facilities are available to a wider group of people. The building is also situated in a natural setting, with a large number of trees around the site and the surrounding areas. (Refer to figure 6.1) This natural setting provides a tranquil environment which is conducive for learning.

Figure 6-1 Entrance to Brown's School Indicating its Natural Setting (Google Street Maps)

There are seven separate classes for children with ASD which make up the autism unit within the bigger school. (Refer to figure 6.2) These children have been separated because their learning needs are unique. The classes are grouped according to age and level of progress (Brown's School, 2011). A teacher explained that "the focus with the children is teaching them life skills and developing their abilities to take care of themselves." (Refer to Teacher - Interview 02, Appendix F)

Figure 6-2 Brown's School Floor Plan Indicating the Autism Unit and the Complex Circulation (Courtesy of Brown's School)

6.2.1 Sense of Calm, Order and Simplicity

Brown's School has designed the classroom spaces with the understanding that the difficulties experienced by each child vary across a wide spectrum. Thus, the classrooms have a limited palette of materials and colours with no patterns. This creates a simple base environment to which teachers add various objects and stimuli responding to the specific needs of the individual children who are using that specific classroom. For example, an extremely different set of environments have been created in two of the classrooms for the younger children. One classroom has minimal objects and stimuli added to it, (Refer to figure 6.3a) whereas the other classroom has a variety of different colours, shapes, objects and paintings which creates a busier environment. (Refer to figure 6.3b) The teacher from the second classroom commented that "I like art so my classroom is very busy, the children are proud of their pictures so we pin them up on the walls. The children don't seem to mind it." (Refer to Teacher - Interview 02, Appendix F)

Figure 6-3 a) Classroom with Minimal Stimulus Added, b) Classroom with Added Colours and Stimuli

All the classrooms are arranged to instil a sense of routine and structure. The furniture is arranged so that each child has a specific workstation within the classroom and different areas are designated for different activities such as; group activities, ring time and play time. A teacher explained that the chairs set up for ring time (Refer to figure 6.3b) are never moved creating a constant environment (Refer to Teacher - Interview 02, Appendix F) Shelves and storage trays are used extensively to ensure that

Figure 6-4 Extensive Use of Storage Units in the Classrooms

everything within the classrooms have designated places (Refer to figure 6.4) resulting in the classrooms being ordered and uncluttered.

The TEACCH method is used extensively; this can be seen in the use of structured workstations and visual schedules. Each workstation has visual aids, such as photographs of the child; this assists the children in identifying the workstation as their own. The work stations each have a system of trays in which the work they need to complete is placed. (Refer to figure 6.5) This creates routine and a clear understanding of what they are expected to do so that stress of the unknown is reduced.

Figure 6-5 Individual Workstation set up for the TEACCH method

6.2.2 Legibility and Way-finding

Brown's School is a large school catering for a wide variety of special needs children, thus orientation within the building can be confusing. (Refer to figure 6.2) The autism facilities are contained within a small section of the overall school and are connected by means of conventional corridors; long passageways with doors leading directly off. One of the teachers explained that the children generally stay within their area of the school (Refer to Teacher - Interview 02, Appendix F). Otherwise the children are accompanied by a teacher, assistant or therapist when moving from place to place. Thus, children are able to navigate their area of the school independently, but require assistance when moving through the other areas of the school. To assist the children with way-finding pictures which they have drawn are hung outside their classrooms, so that they are able to identify which classroom is theirs. (Refer to figure 6.6) There are no steps in the school allowing accessibility for children in wheelchairs, this is not a crucial aspect for children with ASD, however, it does make navigation easier.

Figure 6-6 Children's Artwork Hung in the Corridors Outside their Classroom

6.2.3 Sense of Openness and Closure

The classrooms are small and contained, the principal Mr Dave Smyth explained that these classrooms are the ideal size, if they were any bigger the management of the children would become challenging. The classrooms have high ceilings so that the small spaces do not feel cramped or enclosed. Some of the classrooms, especially those for the lower functioning children, have small breakaway rooms. These tight spaces provide an area where children can escape when they feel overwhelmed in the larger classroom spaces. The sense of enclosure in the breakaway spaces reduces the children's stress levels and calms them down.

6.2.4 Light and Ventilation

One of the teachers explained that "natural light is very important for children with ASD because they have a tendency to go into depression." (Refer to Teacher - Interview 01, Appendix E) Therefore, all the classrooms have large windows to allow for high levels of natural light. Some of the classrooms also have clerestory windows; these windows cause high levels of contrast and glare during certain times of the day. (Refer to figure 6.7) In one class this does not bother the children, but in another the windows are covered by curtains to block out the glare. The windows for each classroom overlook one of the schools various courtyards, these courtyards have minimal visual stimuli so as not to distract the children.

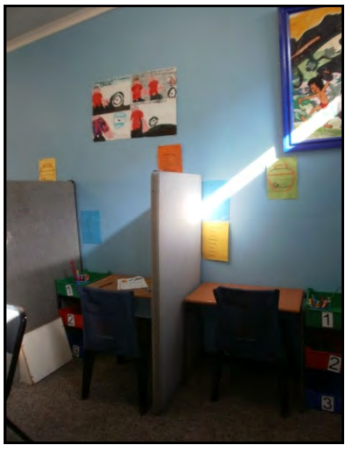


Figure 6-7 High Contrast and Glare Created by Clerestorey Lighting

All classrooms have florescent lighting. (Refer to figure 6.8) One teacher explained that although it is not ideal and affects some of the children, most of them have adapted to the lights. The classrooms have poor cross ventilation and, according to one teacher, get very hot during summer; this affects the children's moods, behaviours and attention spans. Some of the classrooms have ceiling fans to help with ventilation, however a teacher explained that "some children become obsessed with the fans movements and will stop and stare at it rotating." (Refer to Teacher - Interview 02, Appendix F)

Figure 6-8 Florescent Lighting

6.2.5 Acoustics

One of the major acoustic concerns in the building is the corridors. The corridors are enclosed and consist of hard surfaces. The floors are tiled, the walls are brick and the ceiling is plaster and paint. (Refer to figure 6.9) This means that any sounds in the corridor reverberate and the corridor becomes extremely noisy. With the classrooms opening directly off the corridors this noise filters into the classrooms and distracts the children inside. One of the teachers has incorporated a sound system into her classroom; she plays instrumental music in the background to calm the children.

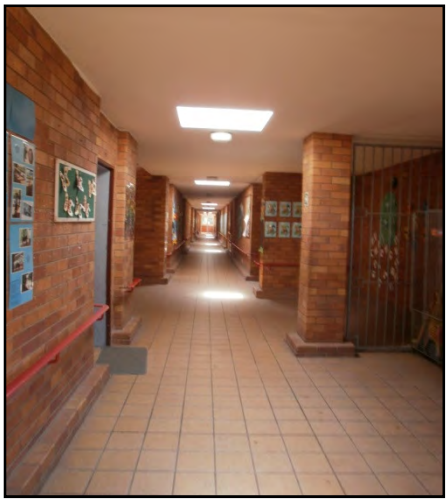


Figure 6-9 Corridor with Hard Reflective Surfaces

6.2.6 Colour

The majority of the classrooms are a neutral cream colour to which teachers have added various colours that suit the children. For example, in one classroom the teacher has added yellow chairs, curtains, screens and storage units. By adding one colour, of uniform hue, the sense of simplicity is maintained but the class is more cheerful. A second classroom has light blue walls.(Refer to figure 6.10) The teacher explained that the walls were originally white, but used to get dirty. She repainted the walls light blue and discovered that the children were noticeably calmer (Refer to Teacher - Interview 01, Appendix E). The partition screens in this classroom have also been covered with blues and greys keeping the colour scheme uniform. The classroom doors are painted uniformly with the colour scheme of the classrooms, for example the classroom with blue walls has a blue door of the same shade and the classroom with yellow furniture has a yellow door in the same shade. In most of the classrooms the carpeted floors are neutral grey colours. This is important in terms of maintenance, as it does not show up dirt, and it allows colour to be added from temporary items such as the furniture and paintings. (Refer to figure 6.5)

Figure 6-10 Classroom Using Shades of Blue and Grey

6.2.7 Contact with Nature

The school has two outdoor courtyards specifically for the autism division; this ensures that children with ASD do not interact with children from the rest of the school who may cause stress to the children with ASD. The two different playgrounds cater for the younger and the older age groups. A teacher explained that "the garden area gives the children a space to 'be autistic', a space where they can run, jump and release all their pent up frustrations, and behaviours which are normally controlled within the classroom environment." (Refer to Teacher - Interview 01, Appendix E)The playground for the younger children has a variety of climbing equipment, swings, a place to cycle and a sand pit. One of the more popular items is a hut (Refer to figure 6.11)which children enjoy sitting in when they need time out, the enclosed space calms them down. The playground for the older children does not have play equipment; instead it has two hammocks which the children use, much to the same effect as the hut for the younger children. (Refer to figure 6.12)

Figure 6-11 Young Children's Playground

Figure 6-12 Teenagers Playground

All the classrooms have direct access to an outdoor veranda area. (Refer to figure 6.13)This provides children with a release space from the main classroom, as well as providing a place for group activities such as eating lunch and painting. Only some of the verandas open directly onto the playgrounds which, according to one of the teachers, would be ideal for all the verandas.

Figure 6-13 Outdoor Veranda

6.2.8 Security, Safety and Supervision

Mr Dave Smyth explained that the school has residential flats on the corners of the building. These flats are occupied by staff members and provide the dual function of accommodation for staff and security for the school. The principal also lives alongside the

school for additional safety and security measures. Due to the large scale of the school the staff need to constantly monitor the movements and whereabouts of the children. However, the internalised nature of the building does reduce the risk of one of the children wandering out of the school building accidentally. In addition, some of the classrooms have gates on the doors in order to contain specific children. (Refer to figure 6.14)

Figure 6-14 Security Gate on a Classroom Door

Brown's School, although catering for children with a wide range of disabilities, has developed a section of the school specifically designed for the unique needs of children with ASD. By separating them from the rest of the school the environments and teaching methods are able to be moulded to suit the specific difficulties experienced by these children. The simple base classroom environments allow teachers the freedom to add and remove stimuli as is necessary. This adaptation of the environment ensures that the specialized individual needs of each child can be accommodated for.

In addition to the classroom environments, a sensory/relaxation room is provided for the children. (Refer to figure 6.15) The room is divided into defined areas which have different textures, colours and lighting, designed to stimulate the children's senses. The teachers have noticed that the room calms the children.

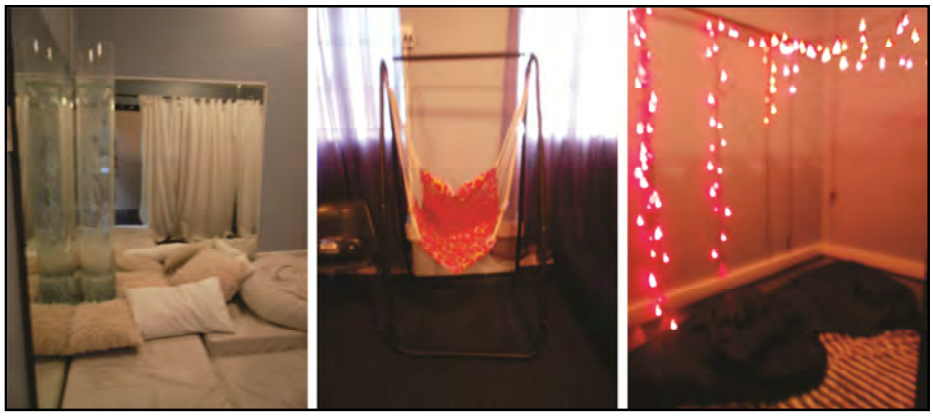


Figure 6-15 Brown's School Sensory Room

Due to the classrooms having been adapted from an existing building, several aspects of the built environment are not ideal for children with ASD, however, the careful consideration and adaption of these environments have allowed for the creation of nurturing and caring environments which suit the needs of each individual child. These environments are designed to reduce the children's stress, creating environments of calmness which allows for productive life skill development.

6.3 Remediating Children With Learning Disabilities: Livingstone Primary School, Morningside, Durban

Livingstone Primary school is a short term remedial school which caters for children with disabilities such as; learning disabilities, dyslexia, emotional difficulties and hearing impairments. These disabilities also result in perceptual, language, memory and concentration problems. Mainstream schools do not understand or cater for this groups specific needs and this results in the children experiencing low self-esteem and anxiety issues. The principal of Livingstone Primary, Mrs C. Butt (Daradagan, 2012), explained that many children arrive at Livingstone as broken people. The school is designed as a short term environment in which to remediate the children within a two year period and return them to the mainstream school system, having given them the confidence, strategies and coping mechanisms to succeed (Livingstone Primary School, 2012). Mrs C. Butt (Daradagan, 2012) explained that in preparing them for re-entering the mainstream school system, independence, responsibility, manners and team work are encouraged.

The school building, itself, is over 100 years old and has catered for several different types of schools over the years. (Refer to figure 6.16) The building was originally grey and institutional with red concrete corridors off which the classrooms were all accessed. Mrs C. Butt (Refer to Principal - Interview 01, Appendix G) questioned why parents would take their children out of mainstream schools, which have positive built environments, in order to bring their children to an unfriendly institutional building. Thus, the school has been adapted to suit the specialised and specific needs of these children, providing a calm, stress free environment in which to learn the essentials skills they need in order to return and cope within mainstream schools.

Figure 6-16 View of the Original School Building (Livingstone Primary School, 2012)

The school is situated in a semi-urban residential area within Morningside, Durban. Despite its urban setting the school has ensured that the grounds are well planted with trees

and other plants providing the school with a natural setting. Due to its specialized teaching and its considered built environment children come to the school for all over the Durban area, from Ballito in the North to Amanzimtoti in the South. The inland areas have access to two remedial schools, therefore, not as many children come from these areas (Refer to Principal - Interview 01, Appendix G). The schools location, although central, is difficult to access from major vehicle routes which is challenging for parents who come from outlying areas.

6.3.1 Sense of calm, order and Simplicity

The disabilities experienced by these children result in them battling to concentrate and they are easily distracted. Thus, these children's specialised needs require environments which are calm, simple and ordered so that they are able to focus. This is addressed by the entire school building, the classrooms in particular, having a limited palette of materials and colours which have no complex details or patterns. (Refer to figure 6.17) In addition the classrooms have only the required furniture and storage spaces so that the classrooms are organised and uncluttered, reducing unwanted distractions. (Refer to figure 6.18) By ensuring that the school environment has minimal stimuli and a clear sense of order; positive, calm environments are create where children are able to focus on the task at hand without the pressures and stress of a typical cluttered mainstream classroom.

Figure 6-17 The School has a Limited Palette of Colours and Materials

Figure 6-18 Simple, Structured Classrooms

6.3.2 Legibility and Way-finding

The original school building has been extended and added to over the years in order to meet the growing demands of the school. Due to the school's semi-urban location the surrounding sites were also developed, resulting in the school having minimal horizontal expansion opportunities. The school is therefore a compact cluster of buildings which

interlink and are complex to navigate. In addition the school has various different levels accessed by stairs, increasing the complex layout. The children have become accustomed to the schools layout and independently navigate the buildings with confidence. "The children come and go throughout the school building because they go to various different therapies during the day." (Refer to Principal - Interview 01, Appendix G) External walkways have been covered by cloth roof structures clearly defining external circulation spaces and keeping them dry. (Refer to figure 6.19) The definition of these circulation spaces provides some visual legibility to an otherwise complicated building.

Figure 6-19 External Walkways with Cloth Roof Structures

6.3.3 Sense of Openness and Closure

The classrooms are small and contained catering for a maximum of 13 children. The small classes allow for higher levels of individual attention for each child, providing them with the support they need in order to develop the confidence and coping mechanisms needed for their return to the mainstream school system. These small classrooms feel cosy and safe creating positive environments. They have high ceilings so that they don't feel too cramped or enclosed. (Refer to figure 6.20) Thus the classroom environments are designed to create a calm and relaxed atmosphere in which children can focus and feel less anxious.

Figure 6-20 Small Classrooms with High Ceilings Ensuring the Space does not Feel Cramped

6.3.4 Light and Ventilation

Ventilation is crucial for the users of this building. As mentioned, their disabilities result in them battling to concentrate and in order for them to acquire the coping mechanisms and life skills needed in order to return to the mainstream school system they require as much focus as possible. Big openable windows and doors provide high levels of natural cross ventilation within the classrooms, enhancing well-being and the ability to concentrate.

However, during the hot summer months this natural ventilation is not adequate and the heat and humidity affects the children to the extent that they become easily distracted and irritable. Therefore, additional air-con units have been added, maintaining a constant cool temperature within the classrooms throughout the year. This enables the children to focus and creates positive, calmer environment conducive to learning.

The large windows also ensure high levels of natural light which is beneficial for the health, well-being and focus of the children. Florescent lighting is used to supplement the natural, ensuring that the classrooms are continuously bright enough for their purpose.

6.3.5 Acoustics

The school caters for children who have hearing impairments, especially those with sensory processing auditory disorder who battle with the reverberation of sounds and distorted sounds, therefore acoustic quality is a major concern. The building was originally not designed for these specialized needs therefore, has a poor acoustic quality; in light of this the built environment has been adapted to provide for the specialized needs of these children. The small classrooms make sound easier to manage and classrooms which cater for children with specific hearing impairments have FM systems installed. These FM system prevent distorted sound and equalises the sound quality within the classroom. These classrooms also have carpeted floors to further increase the acoustic quality and reduce reverberated sound. These noise reduction techniques ensure that the classrooms meet the specialised needs of these children and provides them with an environment in which they can focus.

Figure 6-21 School Hall with High Level Sound Absorbent Boards to Increase Acoustic Quality

In addition to the classrooms, acoustics have been considered throughout the entire building. All enclosed corridors have been carpeted reducing reverberation of sound, and reducing the institutional qualities of the environment. The school hall has sound absorbing panels on the side walls to ensure good sound quality within it. (Refer to figure 6.21)

6.3.6 Colour

As mentioned, the school was previously a grey institutional colour which created a negative, depressing environment. This has since been replaced with warm, neutral, earthy, pastel shades. (Refer to figure 6.17)These neutral colours are non-stimulating in order to increase children's ability to focus and concentrate while also creating a sense of calm. The minimal palette adds to the simplicity of the environment and the soft colours create a positive, friendly environment which improves the moods and attitudes of the children, their parents and the teachers.

6.3.7 Contact with Nature

Every available space within the school grounds is used for the planting of trees, shrubs and flowers. Mrs C. Butt (Refer to Principal - Interview 01, Appendix G) believes that nature is fundamental to the well-being of the children and creates a positive environment for them. Therefore, various different indigenous plants are planted around the school property, with a variety of textures, colours and smells, creating multi-sensory gardens and experiences throughout the school. (Refer to figure 6.22) Mrs C. Butt (Refer to Principal - Interview 01, Appendix G) describes the planting as a softening element that makes the built environment calmer, friendlier and less institutional.

Figure 6-22 Indigenous Multi-sensory Garden

Certain areas of planting also serve an additional purpose, for example, the planting between the main road and the school buildings provides a buffer and protects the school from unwanted noise and passers-by. (Refer to figure 6.23) It disconnects the school from the busy city street to create a safe and calm internalised environment.

Figure 6-23 Vegetation Creating a Buffer Between the School and the Street

6.3.8 Security, Safety and Supervision

A single entry point into the school grounds is monitored by a security guard. This ensures that no child leaves the school grounds unattended and also ensures that no strangers enter the school grounds without permission. By monitoring this single access point children

are able to wander around the school grounds with confidence and do not need to be constantly supervised.

In the same way that Brown's School has adapted its facilities to suit the specialised needs of children with ASD, so too has Livingstone Primary School been adapted to suit the specialised needs of children with various learning disabilities. The old school building provided a negative institutional environment for these children, affecting their abilities to focus and develop the necessary skills they required. However, the building has been adapted, by the use of colour, materials and nature, to create a positive, peaceful environment where the children feel comfortable. These adapted environments provide for the specialised needs of these children, enhancing their learning and enabling rapid skill development and return to the mainstream school system.

CHAPTER 7 ANALYSIS AND DISCUSSION

The literature has described the important role that the built environment plays in people's lives. People spend the majority of their time within and interacting with man-made environments, they are the places where people live, the places where they work and the places where they play. These built environments, which are involved in almost all human activities, affect people both physically and emotionally. Therefore, the relationship between the way in which people experience their surrounding environments and the affects which the environment has on them is crucial in the design of architecture which responds to human aspects and needs.

Mankind's needs in the past were the basic physiological needs of shelter and security, however, in contemporary societies these needs have become complex and tend to be psychologically and emotionally based, for example people need to feel comfortable and happy within their surrounding environments. This is evident in the adaptation of Livingstone Primary School, where the previously negative, institutional atmosphere was adapted to create a calming, peaceful environment. The research has determined that architecture is a tool with which to fulfil people's range of needs and that creating built environments which respond to user's specific needs, results in positive spatial experiences, enhancing people's moods, behaviours, attitudes and overall wellbeing.

These environmental influences are related to the way in which people perceive the world around them. In fact, human perception is key to understanding people's relationship with the built environment. Perception is the process by which people experience their surroundings. These perceptual experiences, based on individual attitudes, memory, age, gender, race and culture, arouse thoughts, feelings, behaviours and emotions within people. The senses, having roots in perception, are what arouses these emotional responses and architecture which ignores people's emotional encounters become meaningless objects. Therefore, building's sensational qualities of light, sound, texture and colour must be carefully considered for their multi-sensory impact on people's experiences of the built environment. All the sights, sounds, smells, textures and tastes of a building must be addressed so that architecture moves its occupants, elevating their experiences, connecting with them emotionally and fulfilling all their needs.

With the built environment being a tool with which to satisfy people's physical and emotional needs, the research describes that some people have additional specialized needs.

An increasing awareness of the specialised needs of individuals with physical impairments has resulted in the mandatory incorporation of physically accessible elements within built environments. However, people with emotional and developmental impairments, such as individuals with ASD, are still uncatered for. The study shows that individuals with ASD are influenced by the built environment as much as, if not more than, neurotypical individuals, and that when the built environment is considered and designed for their specialized needs, positive effects can be seen. For example, GA Architects design for the Sunfield Rowan and Oak Autism Residential Units takes careful consideration of the specialised needs of the residents. The building layout provides the children with freedom and autonomy to wander around unaided while the curved walls, neutral colours, high ceilings, noise-reducing components and natural light are all designed specifically to enhance children's feelings of calm, comfort and security (Whitehurst, 2006). These design considerations have created a positive environment in which these children show improved behaviours and skill development. Such environmental aspects are often not considered because treatments for ASD's are considered to be behavioural interventions, biomedical treatments, or play therapies. Rarely are the effects of the built environment included. However, this research has identified several key architectural design considerations which address the specialised needs of individuals with ASD and their careful consideration leads to the design of positive environments.

Children with ASD experience a wide spectrum of sensory difficulties affecting their experiences of the built environment. For example, complex environments with a lot of sensory stimuli cause stress to children with ASD because they are unable to filter or differentiate between separate stimuli. These stimuli such as shapes, noises and colours form negative environments which are confusing and deeply troubling. Hence, environments for children with ASD should be designed with a sense of simplicity and order, with low-sensory stimulus so as to reduce stress, sensory overload and anxiety. This can be achieved by the use of a limited palette of materials and colours, as in the New Struan Centre for Autism, with patterned materials and bold colours being eliminated from the environment. This reduction in detail and stimuli provides children with clear, calm spaces. These simple environments with minimal stimulation provide the best opportunities for adaption, so that stimuli can be added to the environment as and when needed. Brown's School uses this concept, providing neutral base classrooms to which various colours and textures are added for specific children's needs.

From observations made during this study it was determined that the idea of simplicity and order should be carried through to the circulation spaces within buildings for children with ASD. Their difficulties in vestibular and kinaesthetic integration, their difficulties in following environmental cues and their difficulties in transitioning between spaces makes navigating complicated buildings impossible without guidance. Therefore, by providing simple, legible routes within a building, children with ASD are able to navigate the building independently, increasing their confidence. New Struan Centre for Autism is designed around a central circulation spine enabling a clear view of the whole school so that children can easily orientate themselves within the building, in addition a system of threshold spaces separate the main circulation space and the classrooms. These clearly defined threshold spaces help children transition between the circulation space and the classrooms.

Brown's School incorporated small breakaway spaces accessible from the main classroom areas. It was observed that this variety of larger and smaller spaces caters for children's varying sensitivities to spaces. Some children feel cramped and threatened within small spatial volumes while others feel anxious and exposed in large spatial volumes. The enclosed breakaway spaces provide an area where children can escape when feeling overwhelmed in the larger classroom space, allowing the children control over their experiences. Natural light and ventilation are crucial components in the comfort and well-being of all people. Children with ASD have a tendency towards depression and dark spaces exacerbate this. Therefore natural light and ventilations' uplifting qualities need to be incorporated in any building for ASD. However, excessive glare, contrast, shadow and exterior views are distracting to children with ASD. Aitken and Turnbull Architects provided an innovative solution to the natural lighting issues in the design of New Struan Centre for Autism. High level windows allow for natural light to penetrate the classrooms and a light shelf and angled ceiling diffuses the direct sunlight, eliminating distracting shadows and glare. Low level windows have opaque blinds allowing filtered light into the classrooms while blocking distracting views. The result is well illuminated classrooms with none of the negative implications.

Children with ASD's inabilities to filter stimuli means that they are easily distracted and affected by noise. Internally, acoustic ceilings, soft flooring and furnishings can be used to reduce noise levels, echo and reverberation, creating cosier environments; while shiny reflective surfaces should be avoided as they create noisy, uncomfortable spaces. Externally filtering devices such as trees or vegetation screens and masking elements such as running water can be utilized to reduce unwanted urban noise. Livingstone Primary School caters for

individuals with sensory processing auditory disorder who battle with the reverberation of sounds and distorted sounds. Carpeted floors and mechanical FM systems are incorporated into the small classrooms increasing the acoustic quality of these environments. The school building is buffered from the noisy semi-urban street by large areas of planting and trees. The research indicates that people's emotions, moods and behaviours are strongly influenced by the colour of their surroundings, and that warm, low arousal colours, such as muted pinks, are optimal for people with learning disabilities while the use of a wide variety of colours and the use of primary colours should be limited or avoided altogether. Plain bare walls provide the opportunity for stimulus to be added as needed to suit individual needs. For example, the circulation space at New Struan Centre for Autism is a neutral colour with stimulation being added in the form of children's paintings, personalising the space.

Outdoor spaces and gardens are useful outlets for children with ASD where they can safely reduce stress and frustration. Brown's School provides two outdoor play areas where children can engage in behaviours which are controlled within the classroom environment, eliminating pent up frustrations. Safety and security for children with ASD is crucial because they do not understand the dangers of the situations and environments in which they find themselves. It is important for a building to have good lines of observation so that children can monitored at a distance without them being uncomfortable or stressed, feeling constantly watched. Although they need to be monitored a level of confidence and independence also needs to be instilled in them. Sunfield's Rowan and Oak houses were designed so that staff can easily monitor the children wherever they are. The central courtyard, circulation spaces and bedroom wings are all designed to create good view lines so that the staff can unobtrusively monitor the children with ease.

The research has highlighted the following architectural elements for their influence on the design of positive environments for children with ASD; a sense of calm, order and simplicity, legibility and way-finding, sense of openness and closure, borders and transitional spaces, light and ventilation, acoustics, colour, contact with nature and security, safety and supervision. These elements do not act in isolation; instead they collectively create positive built environments for individuals with ASD, encouraging independence and self-sufficiency. It is this idea of independence that is pivotal for facilitating and improving the quality of life for all special needs individuals, especially those with ASD. Specialised environments need to ensure that they are designed in such a way as to prepare individuals for the outside world rather than just creating protected environments which leave individuals ill-equipped for the dangers and extremes of the outside world.

CHAPTER 8 CONCLUSIONS AND RECOMMENDATIONS

This dissertation investigates the relationships between human perception and the built environment by analysing the various aspects of functionality, meaning, human experience, the sense modalities and mankind's physical and emotional needs. The investigation of typical perception and its relationship with the built environment develops an understanding of the importance of the built environment in almost all aspects of people's lives. This knowledge was used to analyse the differing perceptual experiences of individuals who have impaired perceptions, in particular, those with ASD. These individuals, who are currently under-catered for within the built environment, experience typical environments as harsh and stressful places. The study explored the specialised environmental needs of this particular user group and analyses various architectural elements which respond positively to the differing perceptual experiences of these individuals.

The most important conclusion that can be drawn from the study is that architecture is a tool which can be used to fulfil people's physical, emotional and specialized needs through careful consideration and design. Buildings have the potential to enhance the lives of its inhabitants, and for individuals with ASD, who experience extreme difficulties in many areas of their lives, the positive affects which a specialized built environment can provide are numerous. Architectural design is not just a matter of selecting universally accepted colours, forms and textures, but is also about understanding the specialised needs of the people who will use the environment. It is about the consideration of the human aspect in design.

The research highlights various architectural elements which can be used to develop design guidelines for designing facilities for individuals with ASD, which forms Part Two of the dissertation. Paron-Wildes (2008) theorized that by designing environments according to such guidelines everyone, not only individuals with ASD, can perceive an improved environmental experience. By responding to these guidelines and remaining focused on responding to the user’s particular needs throughout the design process, the result will be a building which makes a significant, positive contribution to the lives of individuals with ASD.

The research has established several criteria for selecting an appropriate site for a facility for people with ASD. The research suggests that a building of this nature should create a caring, comfortable, home-like environment and this is dependent upon the context in which the building is sited. In the case of a facility such as this, proximity to a friendly,

residential neighbourhood is more appropriate than an industrial, commercial or central city location. With the current lack of suitable facilities for children with ASD across the greater Durban area the site needs to be in an easily accessible, central location, providing easy access to the general public, across the whole Durban area. This can be achieved by close proximity to major vehicular and public transport routes. This includes a walkable distance to the public transport routes and stops. The research also reveals the benefits that children with ASD have from accessing open outdoor space. Thus, the site should be able to provide an area where children can safely explore the natural environment. This means privacy, so that neighbours or passers-by do not interfere or ridicule the children. It has been determined that children with ASD often have sensory difficulties, thus, sites should be analysed in terms of their sensory implications as well, for example the site should have no overwhelming odours or loud noises. The site should also have a minimal slope to cater for difficulties in vestibular, kinaesthetic and motor abilities. Therefore, the factors which need to be considered when assessing the suitability of potential sites, are as follows; accessibility, residential nature, natural setting, safety, senses and slope.

Site Selection Factors	Recommended Guidelines
Accessibility	Central location outside Durban's city centre. 5 - 10 minute drive to major vehicular routes with minimum traffic lights en-route. 5 - 10 minute walk to public transport.
Residential Nature	Maximum 2 storey scale of surrounding houses. Clean, well looked after neighbourhood.
Natural Setting	Site must have ample trees for incorporation into accessible outdoor areas. The surrounding neighbourhood is recommended to have a large amount of trees and vegetation.
Safety	Access road to the site is recommended to have low levels of vehicular traffic. Site should be large, ensuring that external people cannot view or access the private functions of the building.
Senses - Sight	Contained views ensuring that the site does not feel too open and exposed. Views of nature are recommended
Senses - Smell	No harmful or toxic odours in the surrounding precinct. No unpleasant odours from the neighbouring buildings.
Senses - Sound	Low levels of noise on the site. Classroom and therapy areas require 35-45db rating.

Slope	Maximum slope of 1:12, ensuring that ramps can be used for changes in level, avoiding the use of stairs.

Table 1 Recommended Guidelines for Site Selection

In conclusion, it is noted that while research regarding ASD focuses on various therapies and medical treatments but there is minimal research regarding the positive affects which the built environment can have on the lives of these individuals. Therefore, it is recommended that further research needs to be done into understanding the complex environmental needs of these individuals and how the built environment can provide positively for these needs.

PART TWO:

DESIGN REPORT

CHAPTER 1 INTRODUCTION

1.1 Background

Autism Spectrum Disorder (ASD) represents one of the fastest growing disability categories in the world, the current statistics show that one in every 150 children is estimated to fall within the autistic spectrum (Mostafa, 2008). Based on this ratio 123,490 children in South Africa suffer from ASD's, of which 28,430 of these children are from KwaZulu-Natal (Hall, 2012). Despite this overwhelming prevalence, ASD is by and large ignored by the architectural community, thought to be a problem for medical professionals and therapists. Rarely is the built environment considered for its effects, both positive and negative, on people with ASD.

Part one of this document shows that architecture has the ability to affect people's perceptions, moods and behaviours and to arouse thoughts, feelings and emotions. Individuals with ASD, who have impaired perceptions and find it difficult to make sense of the world around them, experience the built environment differently from neuro-typical individuals, often experiencing negative and upsetting environmental experiences (Wilkes, 2005). The aggressive, challenging behaviours associated with ASD are often exacerbated by these negative environmental experiences (Wilkes, 2005) and such behaviours lead to public ridicule, causing individuals with ASD to withdraw from society.

1.2 Understanding Autism Spectrum Disorder

Autism Disorder is a term associated with a range of conditions collectively referred to as Pervasive Developmental Disorders (PDD) or more commonly known as Autism Spectrum Disorders (ASD's). ASD's are broken down into five diagnostic categories: Autism Disorder, Asperger's Disorder, Rett's Disorder, Childhood Disintegrative Disorder and Pervasive Developmental Disorder Not Otherwise Specified (Wilkinson, 2010). (Refer to figure 1.1)

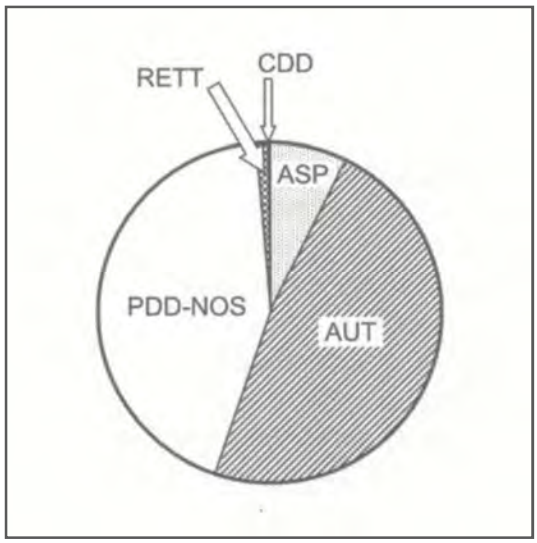


Figure 1-1 Approximate Proportions of the Different PDD's (Lathe, 2006: 21)

People with ASD experience difficulties in three main areas, known as the 'triad of impairments': these are social interaction, social communication and imagination (Deudney, 2006). A fourth area which people with ASD often also experience difficulties are unusual sensory perceptions (Southerington, 2007). (Refer to figure 1.2) There is a large variability in the severity of these impairments, and symptoms differ vastly from one person to another. The terms 'low functioning and high functioning' are used in reference to this spectrum (Southerington, 2007), where 'low functioning' refers to individuals who are severely impaired in virtually all areas of development and 'high functioning' refers to individuals who need minimal support in daily life and experience no intellectual or learning disabilities (Wilkinson, 2010).

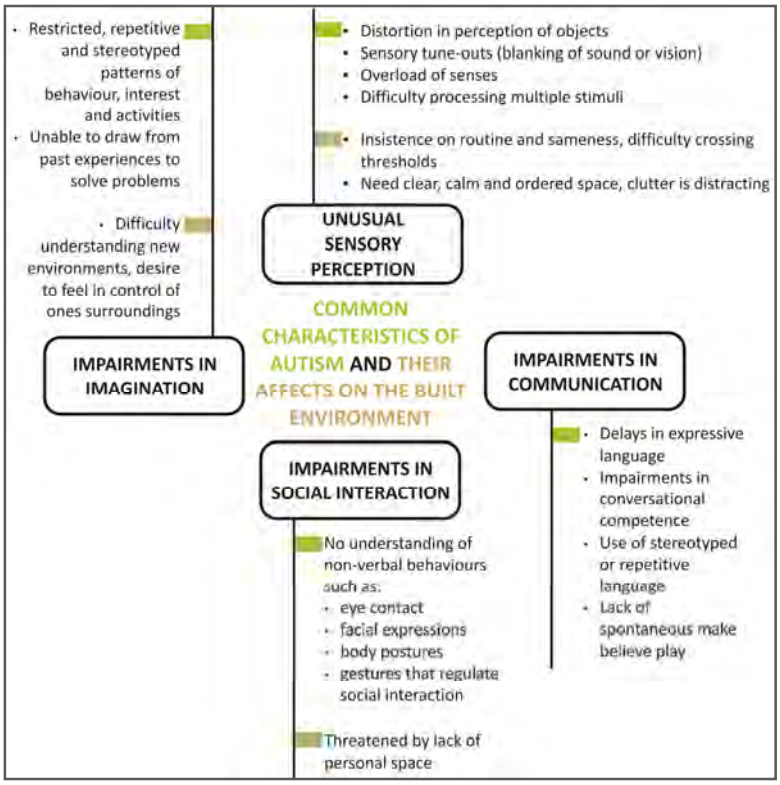


Figure 1-2 Common Characteristics of Autism and their affects on the Built Environment (Southerington, 2007: 11)

The exact origins and causes of ASD's have yet to be found, despite extensive research. There are currently no cures, only methods of management (Wilkinson, 2010). This lifelong disorder has serious implications on individuals personal, social and educational experiences and often prevents them from leading self-sufficient, independent lives.

1.3 Project Description

The design of the proposed Autism Life Learning Centre sets out to provide an environment for this currently under-catered user group, which is positive, calm, and conducive to learning. By considering the specialised needs of these children, it has been established that the most effective learning environments are those which are calm, simple and ordered, legible, naturally lit and ventilated and have good acoustics.

1.4 The Client

1.4.1 The Client's Organisation

The client for the proposed Life Learning Centre is 'Action in Autism', a Non-Profit Organisation focused specifically on improving the quality of life for people with Autism Spectrum Disorders and their care givers in KwaZulu-Natal (Action in Autism, 2012).

Action in Autism aims at ensuring that people with ASD's are respected and accepted as members of society. Their current objectives are:

- to ensure that all people with ASD's have access to appropriate educational facilities,
- establish resources across KwaZulu-Natal which cater for people with ASD's,
- provide assessment and resource centres with specialist advice and information for parents and care givers, and
- to promote awareness of ASD's.

1.4.2 The Client's Requirements

A proposed Life Learning Centre with; educational facilities to cater for the needs of 4-8 year old students with ASD's, a community resource centre serving the larger community, medical autism-friendly services and residential facilities for both children and staff.

The Centre is required to tie in with Action in Autism's short and long term objectives of creating appropriate educational facilities for children with ASD's, promoting awareness of ASD's and providing access to information and resources to the public. A set of guidelines

are to be used and developed during the design process of the Centre, which can be used by Action in Autism for future developments. (Refer to figure 1.3)

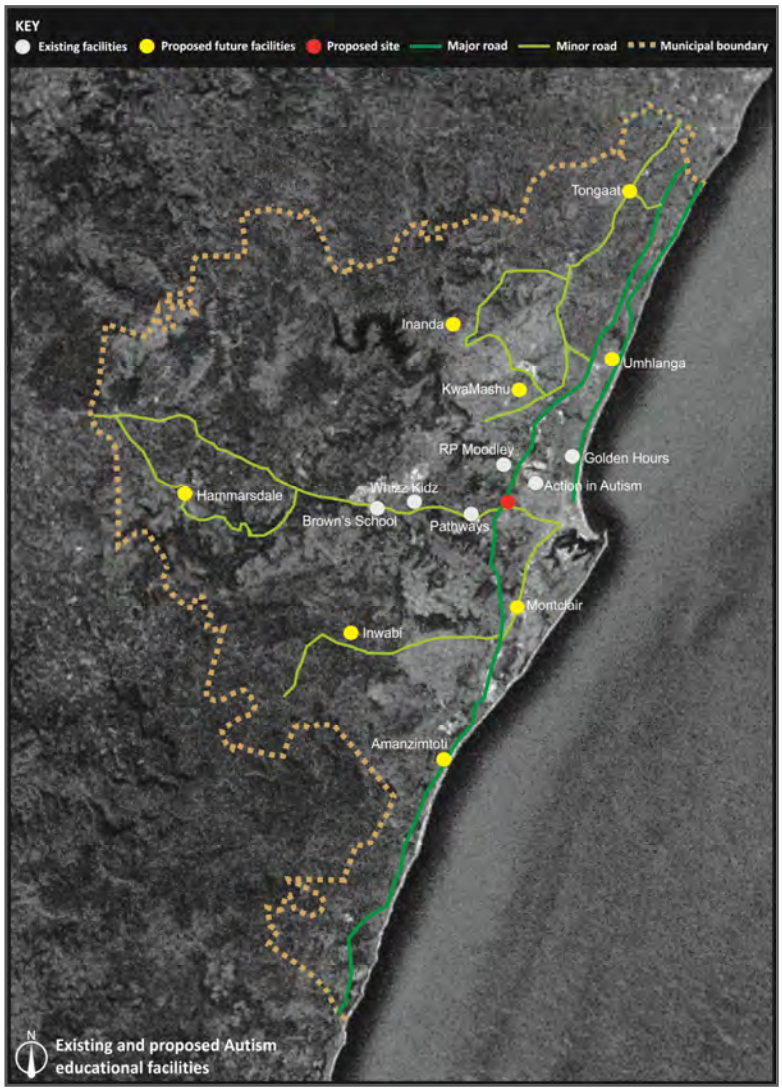


Figure 1-3 Existing and proposed future Autism facilities

1.4.3 Client's Brief

The brief calls for an educational and community facility aimed at providing information, support and a safe, positive learning environment based on the specialised needs of children with ASD's. The main objective for this Autism Life learning Centre is to provide a sensory-sensitive environment conducive to learning and therapy.

The built environment created must focus on the user experience, reducing levels of stress and discomfort while encouraging focus and concentration. These psychological considerations create environments which enhance skill development, encouraging independence and self-sufficiency.

There are several autism friendly architectural elements which influence the quality of these learning environment, as discussed in part one of this document; calm, order and simplicity, legibility and way-finding, openness and closure, transitional zones, acoustics and safety and supervision. These can be enhanced by the consideration of natural light and ventilation, contact with nature, colour, texture, materials and furnishings. In addition the design aims to create awareness and change negative public perceptions of ASD's.

1.4.4 Accommodation Schedule

The schedule of accommodation was derived from interviews with teachers of children who have ASD's, as well as through various international precedent of similar facilities. The schedule of accommodation on the following pages lists in detail the spaces to be provided, the size of the spaces and the specific requirements of each space.

Function	Room Description	Activities/functions	No.	Size	Total Area	Specific Requirements
Entrance	Foyer/ Reception	Point of arrival, includes reception and waiting area	1	120	120	
					120	
Administration	Principal's Office		1	26	26	Enclosed office with ample space for storage and meetings.
	Finance Office		1	14	14	Enclosed office with an installed safe.
	Interview/Screening room	Room where children can be assessed and their parents interviewed before enrolment in the centre.	1	16	16	
	File Room	Storage room for all school records and files	1	12	12	Requires Security, linked to principal's office.
	Copy Room	Photocopier and printer room.	1	9	9	
	Meeting Room	Staff and business meeting room	1	18	18	6 seater
	Staff Room	For teaching and	1	90	90	

		administration staff, includes lounge area and kitchenette.				
	Storage Rooms		2	9	18	
	Sick Room		1	18	18	2 x bed for sick children. Linked to nurses office
	Nurses Office	For consultations with parents.	1	12	12	
					233	
Teaching	Classrooms	Includes transitional space, group activity area, individual workstation area, time out area, office, toilet and kitchenette.	12	140	1680	4 Classrooms per age group: 4, 5-6years and 7-8years.
	Computer Room		3	30	90	Space for 7 x computer workstations, includes store room.
	Time Out Rooms	An enclosed room separate from the classrooms where teachers can remove distressed children.	3	9	27	Minimal stimuli, small and enclosed.
	Library	For children's use, includes stack area, reading areas, librarian office and store room.	1	100	100	
					1897	
Therapy	Physical therapy centre	For physical therapy improving children's gross motor skills.	1	210	210	Includes gymnasium, change rooms, offices and store room.
	Speech Therapy Centre	Dealing with children's specific communication issues.	1	80	80	Includes consultation rooms, group therapy room and store rooms
	Occupational Therapy Centre	Occupational therapy room dealing with children's fine motor skills	1	82	82	Includes therapy room, offices and store rooms
	Play Therapy	Play therapy used to	1	60	60	Includes

	Centre	enhance children's social and imagination skills.				consultation rooms and store room
	Sensory Integration Therapy	Sensory therapy which arouses and calms the various senses to teach children to deal with stimuli in a more adaptive manner.	1	40	40	Sensory room and sensory pods
	Hydro Therapy Centre	Provides physical, tactile, social, cognitive and recreational therapy.	1	275	275	Indoor shallow heated pool and outdoor deep lap pool. Change rooms to double up with gym. Additional sensory technology of sound and lights.
	Enclosed space	Provides a dark enclosed space which children with ASD enjoy and feel safe in.	1	60	60	Minimal natural light
					807	
Medical	GP doctor's rooms	Doctor's rooms providing treatment and diagnosis by doctors who are trained to deal with the difficulties of children with ASD.	1	150	150	Includes reception, waiting area, 2 consultation rooms, procedure room, exam room and laboratory.
	Dentist's rooms	Dentists rooms providing treatment by dentists who are trained to deal with the difficulties of children with ASD.	1	1	150	Includes reception, waiting area, 2 x treatment rooms hygienist and laboratory
					300	
Community	Community function hall	For community presentations, meetings, as well as	1	375	375	Includes reception area, public

		use by the school if needed.				access as well as school access, good acoustic treatment.
	Parent resource library/study lounge	Educational material for parents, educators and community members.	1	150	150	Includes small rooms to view digital media.
	Assessment Centre	Facility for the assessment and diagnosis of ASD sufferers.	1	70	70	Includes test and observation room.
	Hairdresser	Providing haircuts by hairdressers who are trained to deal with the difficulties of children with ASD.	1	60	60	Includes wash basins, cutting area and waiting area.
	Teachers training centre	Dedicated area for teacher training on aspects of ASD	1	145	145	Includes seminar room, classroom, group discussion room, kitchen and foyer areas.
					800	
Residential	Staff residential units (Bachelor)	For staff to stay on site	2	45	90	Requires privacy
	Staff Residential units (2bed)	For staff and their family to stay on site	3	90	270	Requires privacy
	Children's accommodation	For children who stay far from the school and children who need additional attention.	4	150	600	Includes 6 bedrooms, games room/living room, bathroom and staff room
	Children's communal dining facility		1	100	100	Includes kitchen
					1060	
Services	Refuse area		1	60	60	Area for compost, recyclable materials and waste, needs access by small

						trucks.
	Workshop	Space for garden equipment storage and grounds maintenance.	1	70	70	
					202	
Ablutions	Males	WHB	6			
		Urinal	7			
		WC	4			
	Females	WHB	6			
		WC	11			
	Paraplegic		6			
					150	
Sports Facility	Soccer field	Soccer field which can be rented out as additional income for the centre.	1	7850	7850	
	Administration	For administration of the soccer field.	1	170	170	Includes booking office, manager's office and meeting/ conference centre.
	Change rooms		2	80	160	Includes change area, lockers, showers and toilets
	Public Toilets	For peak load of 500 people	1	145	145	
	Storage	For storage of field and maintenance equipment	1	145	145	
	Public stands	Grass seating for spectators	4	240	240	Roof covering
					8710	
				TOTAL	**14279**	
External	Playgrounds	Individual playgrounds for each of the three age groups	3	330	990	Accessed directly from the classrooms
	Sensory garden	Various different plant textures, colours and smells	1	N/A	N/A	
	Break out space	Linked to community hall as spill out space for community functions and gatherings.	1	500	500	Grassed area with minimal slope
					1490	

Parking	Drop off Zone		N/A	N/A	N/A	
	Staff Parking		50	1435	1435	
	Visitors Parking		15	425	425	
					1860	
				TOTAL	**17557**	

1.4.5 Project Funding

Action in Autism have secured various sponsors to fund the initiation and design of the Autism Life Learning Centre. The sponsors of this funding are:

- **The Association for Autism**, a South African based association aimed at promoting a better understanding and awareness of Autism, working towards the de-stigmatisation of the disorder. The association provides autism-specific services for people suffering from ASD's, offering guidance and support.
- **The Autism Research Institute** (ARI) of America supports and sponsors research on the underlying causes of, treatments for and environmental influences of ASD's. ARI collaborates with non-profit organisations worldwide in an attempt to improve methods of diagnosing, treating, and preventing autism.
- **The iCare4Autism Foundation** provides funds to a global network of organisations in support of collaborative efforts to enhance education, advocacy and treatment of ASD's worldwide. The foundation gathers research, promotes awareness, provides information, develops educational programs and provides training for teachers and therapists. The foundation's mission is to act as a catalyst, driving worldwide autism research.

CHAPTER 2 SITE SELECTION AND ANALYSIS

2.1 Introduction

The research conducted in part one of this document established the following criteria for the selection of an appropriate site for an Autism Life Learning Centre:

- **accessibility** - central location with close proximity to major roads and public transport.
- **residential nature** - friendly residential context as opposed to industrial, commercial or urban context.
- **natural setting** - Abundance of natural vegetation
- **senses** - pleasant views, no unpleasant odours, low levels of noise.
- **slope** - minimal slope allowing for use of ramps as opposed to stairs.

Three sites were identified as possible choices for the development of an Autism Life Learning Centre (Refer to figure 2.1):

- Site 1: Candella Road, Sherwood, Durban
- Site 2: 45th Avenue, Sherwood, Durban
- Site 3: Locksley Drive, Sherwood, Durban

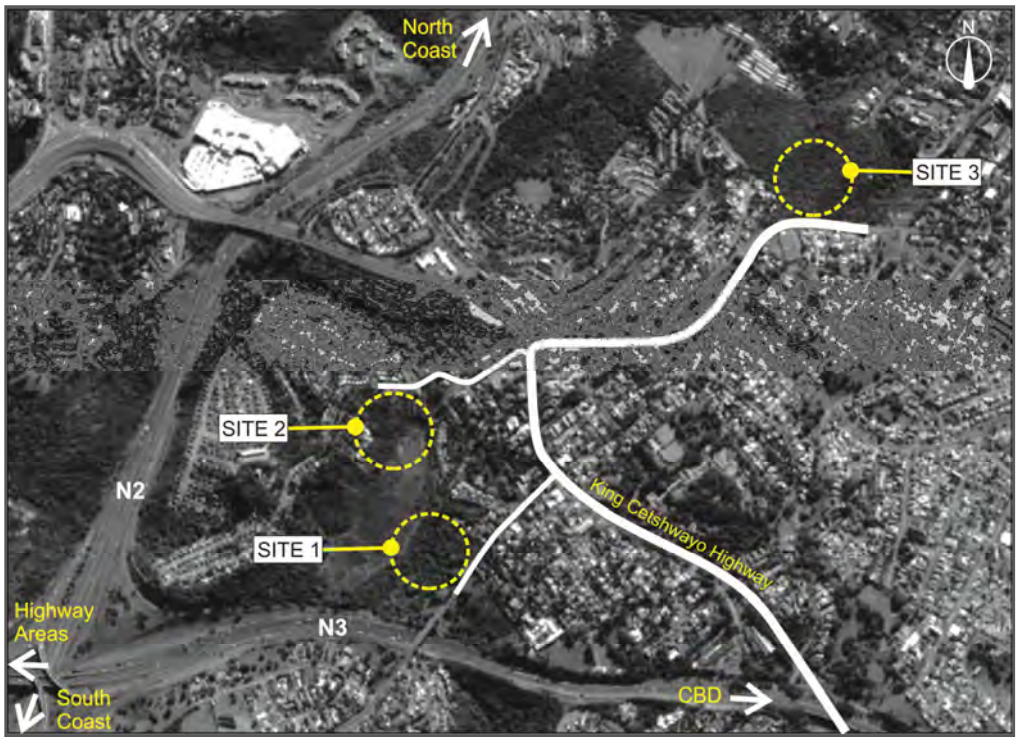


Figure 2-1 Proposed Sites

Each site was analysed according to the above mentioned criteria, in order to determine the most appropriate site for this facility.

2.2 Site Selection

2.2.1 Site 1: Candella Road

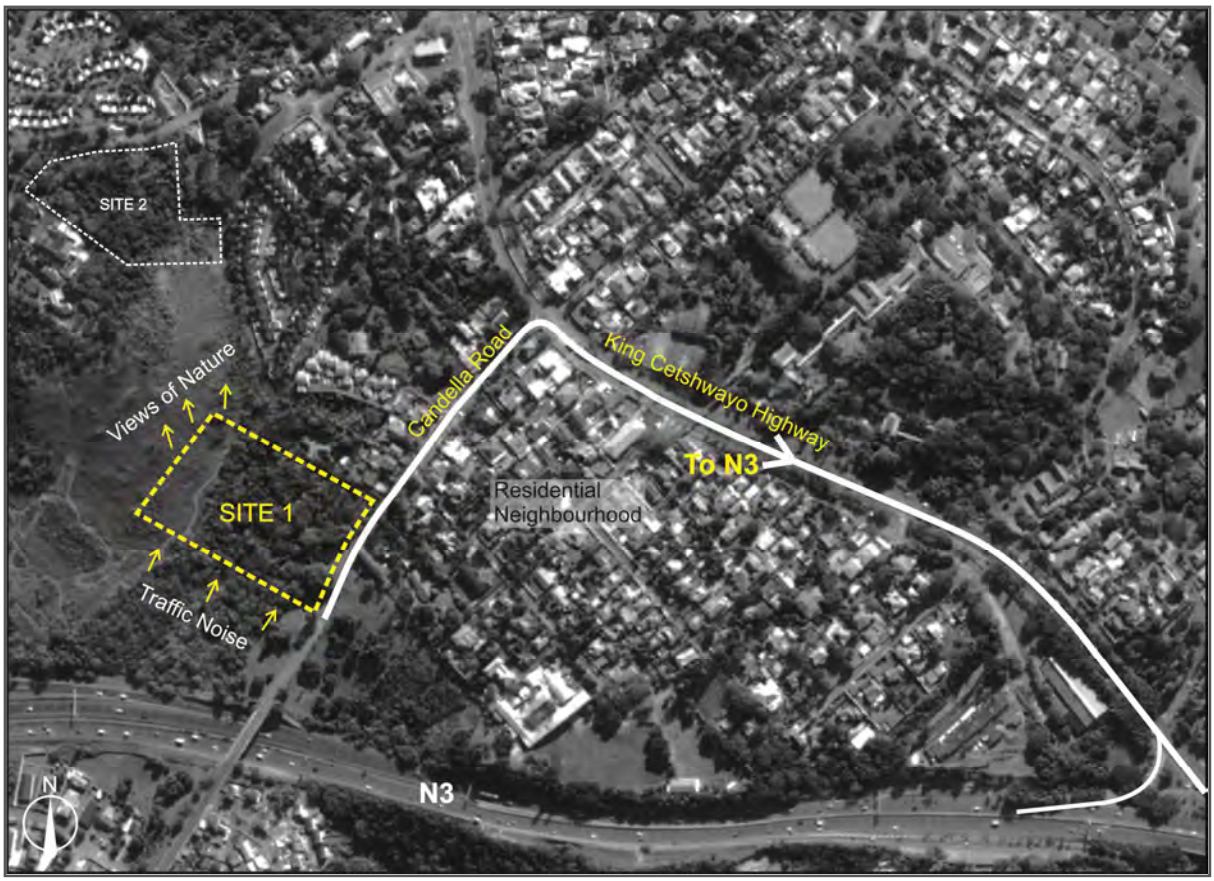


Figure 2-2 Location plan of Site 1

2.2.1.1 Accessibility

Site 1 is situated in Sherwood on Candella road, which is accessed directly off King Cetshwayo highway. (Refer to figure 2.2) Its central location as well as its close proximity to the N3 highway and spaghetti junction allows for easy access from Durban's outlying areas. In addition King Cetshwayo Highway is a main vehicular and public transport route, making the site highly accessible.

2.2.1.2 Residential Nature

Site 1 is situated at the edge of a clean, well kept residential neighbourhood, with its southern edge in close proximity to the N3 freeway. Due to it being on the periphery it is not

integrated within the residential context and becomes disconnected, forming a barrier between the residential buildings and the freeway.

2.2.1.3 Natural Setting

Site 1 is situated along a valley and being undeveloped it is covered with dense vegetation. The areas to the western and southern sides of the site are also undeveloped, resulting in the site being surrounded by vegetation on two sides. Thus, the site has a strong connection with nature.

2.2.1.4 Senses

The proximity of site 1 to the N3 freeway results in high levels of road traffic noise, specifically on the southern edge of the site. Being situated along a valley results in the traffic noises funnelling up the landscape, directly affecting the site. The sites position along the valley allows for contained views of nature within the valley, important for children with ASD who can become overwhelmed by extensive openness. The site and its surrounds are clean, well kept and free of unpleasant odours.

2.2.1.5 Slope

Site 1 is situated on the side of a valley, with the slope running from the eastern to western edge of the site, the western edge forming part of the bottom of the valley. Therefore, the site is steep along the road edge but reduces towards the west of the site. This provides an opportunity for development at the bottom of the site, allowing the building to be away from the road edge.

SITE 1	1	2	3	4	5
Accessibility					**X**
Residential Context			**X**		
Nature					**X**
Senses			**X**		
Slope				**X**	

2.2.2 Site 2: 45th Avenue

Figure 2-3 Location plan of Site 2

2.2.2.1 Accessibility

Site 2 is also situated in Sherwood, but is on 45th Avenue, accessed directly off King Cetshwayo Highway. (Refer to figure 2.3) Similar to site 1, site 2's central location as well as its close proximity to the N3 highway and spaghetti junction allows for easy access from Durban's outlying areas. In addition King Cetshwayo Highway is a main vehicular and public transport route, making the site highly accessible. Site 2 has an additional access point via the quieter Nettleton Road.

2.2.2.2 Residential Nature

Site 2 is situated between several well kept residential complexes, with a few single houses nearby. It's position among the residential buildings allows it to be part of the residential context.

2.2.2.3 Natural Setting

Site 2, currently undeveloped, is covered with dense vegetation. In addition the neighbouring complexes and road verges have a lot of planting and trees. This results in the entire precinct having a strong connection to nature.

2.2.2.4 Senses

The site is set back from the busy roads and the residential context results in a relatively quiet site, however, the N2 freeway and King Cetshwayo Highway do provide some road traffic noise along the northern edge of the site. The site is positioned on the top of a valley with views down the valley resulting in partial views of the N3 freeway in the distance. The clean well kept residential area is free of unpleasant odours.

2.2.2.5 Slope

Being situated at the top of a valley results in site 2 having a minimal slope on the northern street edge of the site, becoming slightly steeper along the southern edge of the site.

SITE 2	1	2	3	4	5
Accessibility				**X**	
Residential Context					**X**
Nature					**X**
Senses				**X**	
Slope				**X**	

2.2.3 Site 3: Locksley Drive

2.2.3.1 Accessibility

Site 3 is accessible from the N3 highway followed by two major roadways; King Cetshwayo Highway and Locksley Drive. (Refer to figure 2.4) These roadways have several traffic lights to navigate, resulting in a longer travel time from the N3 to the site. The site's central location as well as its close proximity to the N3 highway and spaghetti junction allows for easy access from Durban's outlying areas. In addition King Cetshwayo Highway and Locksley Drive are main vehicular and public transport routes, making the site highly accessible.

Figure 2-4 Location plan of Site 3

2.2.3.2 Residential Nature

Site 3 is situated at the edge of a residential area, with several houses and a municipal substation across the road. Due to the wide busy road, as well as the boundary walls of the houses the area loses its residential nature.

2.2.3.3 Natural Setting

The site, being undeveloped, is densely vegetated, however the neighbouring houses have minimal trees and vegetation. The lack of trees along the busy road edge creates a sense of exposure and reducing the connection with nature.

2.2.3.4 Senses

The busy road results in high levels of traffic noise on the site. The high level of the site provides views of a wide area, creating an expansive sense of exposure, not ideal for children with ASD's.

2.2.3.5 Slope

Site 3 is flat along the road edge but drops away steeply towards the north of the site, providing little opportunity for low scale development using ramps and minimised stairs.

SITE 3	1	2	3	4	5
Accessibility			**X**		
Residential Context		**X**			
Nature				**X**	
Senses				**X**	
Slope		**X**			

2.2.4 Summary and Conclusion

Each of the three sites were rated according to their performance for each of the site selection criteria, with 1 being poor and 5 being excellent. This allows each site to be analysed in terms of how suitable it would be for the development of the proposed Autism Life Learning Centre. These ratings have been compiled in the scorecard below so as to easily compare the three sites suitability.

	Accessibility	Residential Context	Nature	Senses	Slope	Total
Site 1	**5**	**3**	**5**	**3**	**4**	**20**
Site 2	**4**	**5**	**5**	**4**	**4**	**22**
Site 3	**3**	**2**	**4**	**4**	**2**	**15**

From the analysis Site 2 on 45th Avenue is seen as the most suitable site for this project. This is due to its accessibility, strong connection with nature and surrounding residential context.

2.3 Urban and Site Analysis

2.3.1 Urban Analysis

The precinct in which the site is situated is centrally located, outside the city centre. The precinct forms the node between the N2, N3 and King Cetshwayo highways. (Refer to figure 2.5) The close proximity to these major roads means that the precinct is well connected with the greater Durban area, making it easily accessible to a greater area of people.

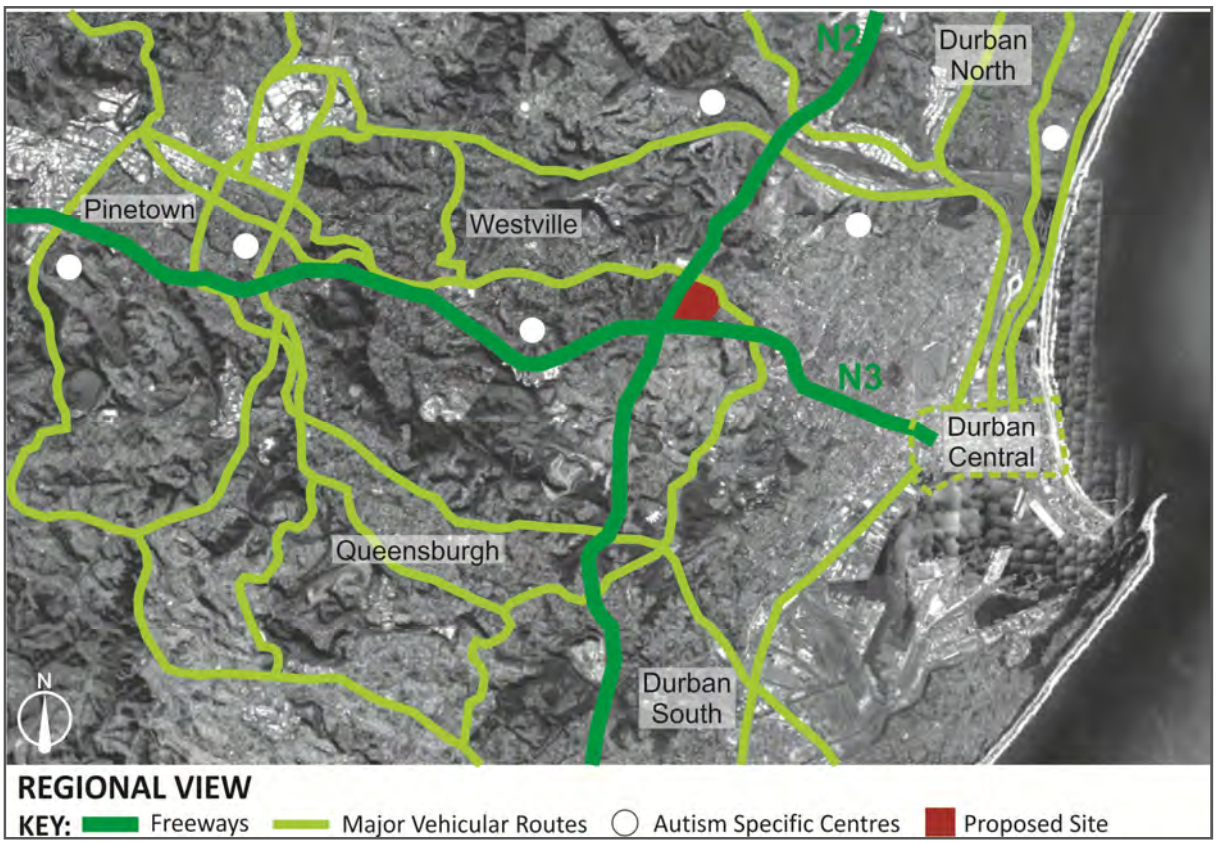


Figure 2-5 Regional view indicating the precincts central location

The three major roads experience heavy traffic and form physical barriers defining the precinct. (Refer to figure 2.6) In addition these roads provide public transport routes, increasing the precincts accessibility. Public transport stops are located at the intersection of 45th Avenue and King Cetshwayo Highway within a walkable distance from the site. 45th Avenue, being a residential road has a low level of vehicular movement, ideal for the safety of children walking to the site.

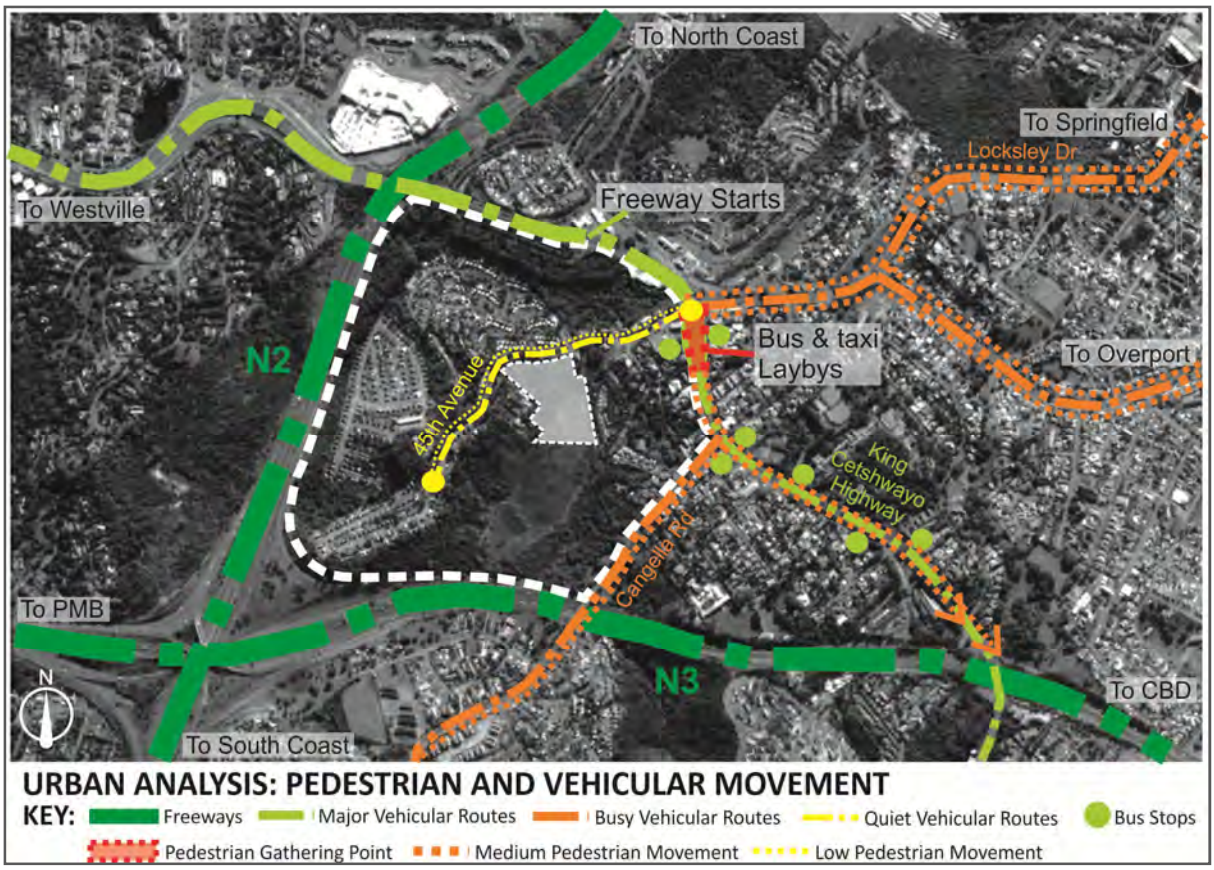


Figure 2-6 Aerial indicating the precincts vehicular and pedestrian movements

Figure 2-7 Aerial map indicating the zoning of the precinct

The zoning of the precinct is residential with high levels of natural vegetation, and an area zoned for public open space, which is currently un-utilized. (Refer to figure 2.7) The natural and residential context results in a calm, tranquil precinct, ideal for a development of this nature.

In terms of sound, the N2, N3 and King Cetshwayo Highway create high levels of traffic noise at the edges of the precinct. (Refer to figure 2.8) The natural topography protects the site from the N3 traffic noise with a natural berm. The slope up towards the site on the

northern edge of the precinct carries traffic noise from the N2 and King Cetshwayo Highway, affecting the northern edge of the site.

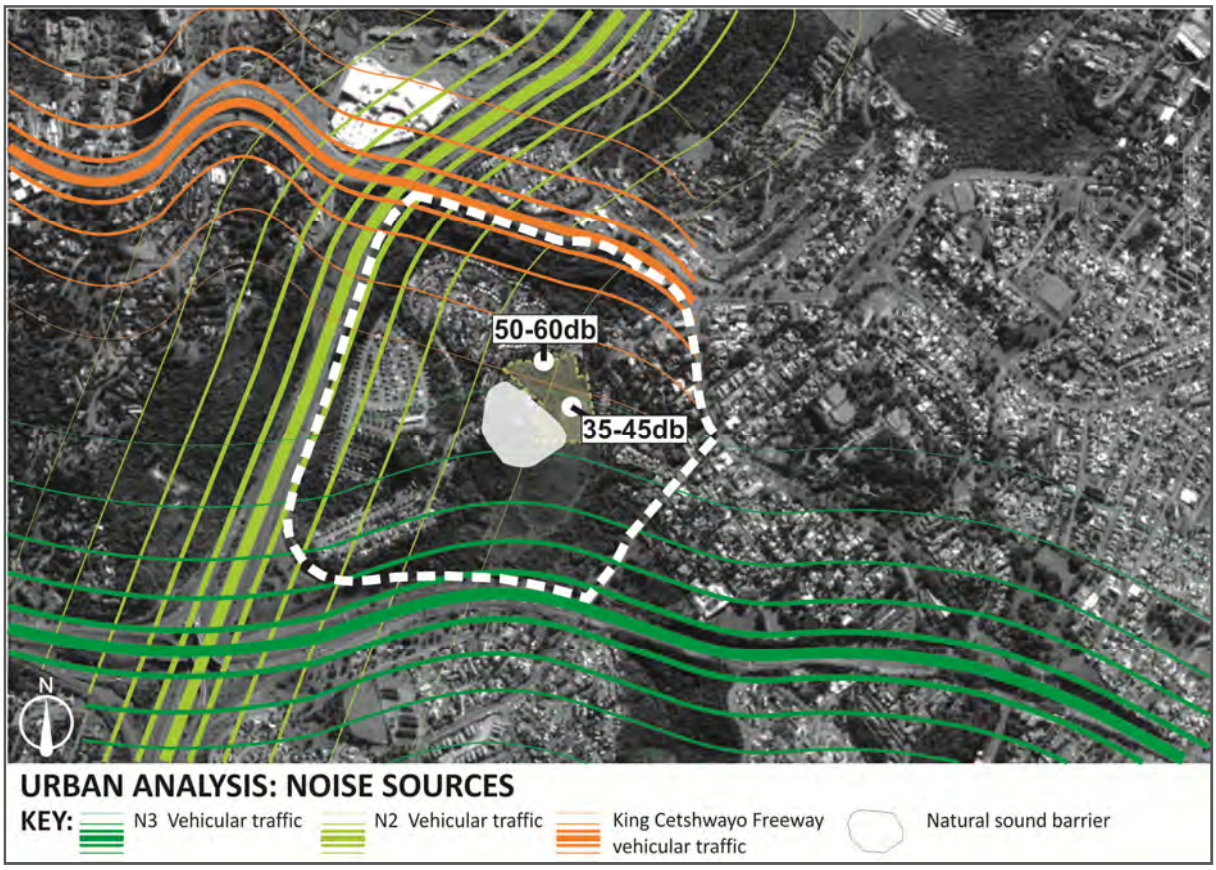


Figure 2-8 Aerial map indicating the affects of traffic noise on the site

2.3.2 Site Analysis

The site, as mentioned, sits within a residential precinct resulting in a built fabric that consists of small dispersed blocks. The fragmented blocks are scattered, running along the contours of the area. In order to respond appropriately to the massing of the context the development should be of smaller scale, and fragmented on the site.

The site has two access points, the main entrance for the development would be most suitable off 45th Avenue, with a secondary entrance off Nettleton road. 45th Avenue has a low volume of vehicular and pedestrian traffic, with people moving from the residential units to King Cetshwayo Highway and the public transport stops, which are within 5-10 minutes walking distance. (Refer to figure 2.9)

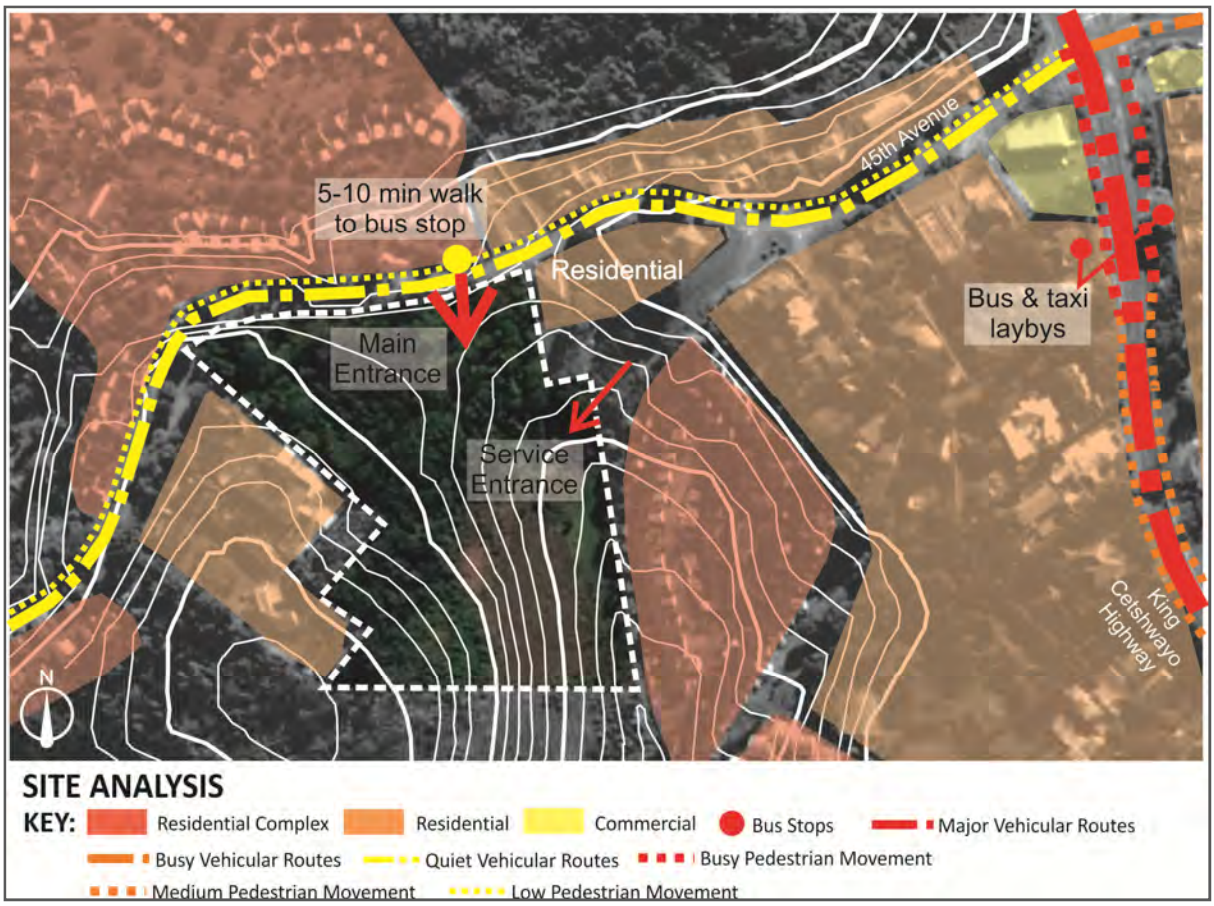


Figure 2-9 Aerial map of the site indicating the zoning, access and connectivity

The site experiences 50-60db on its northern edge from the traffic noise travelling from the N2 and King Cetshwayo Highway, as previously discussed. These sound levels are suitable for administration and office functions, however are not suitable for classroom functions, which require quieter settings so that children can focus. The Southern edge of the site is protected from the N3 traffic noise, as discussed, resulting in a 35-45db rating, which is suitable for classrooms.

CHAPTER 3 DESIGN DEVELOPMENT AND RESOLUTION

3.1 Conceptual and Theoretical Issues

The theoretical framework discussed in part one, deals with the following three concepts and theories:

3.1.1 Perception Theory

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 (Gropius cited in Barr, 1970). Perceptual theory looks at understanding people's observations and reactions to the world around them (Hochberg, 1964) and their totality of experiences. There are two main aspects of perception as defined by Philosopher Taylor Carmen (2008):

- a sensory dimension which deals with passive sense experiences, and
- an active motor dimension which deals with bodily actions.

In everyday experiences these sensory and motor dimensions work together seamlessly so that awareness and action unfold as an integrated, continuous experience (Seamon, 2010).

3.1.2 Phenomenology

Phenomenology is the interpretive study of human experience (Seamon, 2000). These experiences are derived from the response of human senses to the elements, stimuli and spaces that surround them (Horvath, 2010). Many phenomenologist's have discussed the quality of people's experience in relation to place in both the built and natural environments (Vischer, 2008). For example, Norberg-Schulz (1980) identifies phenomenology's potential in architecture as the ability to make the environment meaningful through the creation of specific places.

3.1.3 Concepts Of Mankind And The Environment

Norberg-Schulz (1965: 130) states that "architecture dominates our physical environment and influences us constantly." However, this relationship between mankind and

environment is bi-directional. This interrelationship between mankind and the environment is crucially linked back to sensual experiences and human perception (Rapoport, 1995). The features of the environment combine to form the perceived environment, which in turn affects the behaviour and responses of the people within that environment.

3.1.4 Design Concept

The theoretical framework highlighted LANDSCAPES as a key conceptual driver for this design, specifically the natural landscape, physical landscape and psychological landscape. Each of these three landscapes needed to be considered and overlaid in order to design a rich environment for the Autism Life Learning Centre.

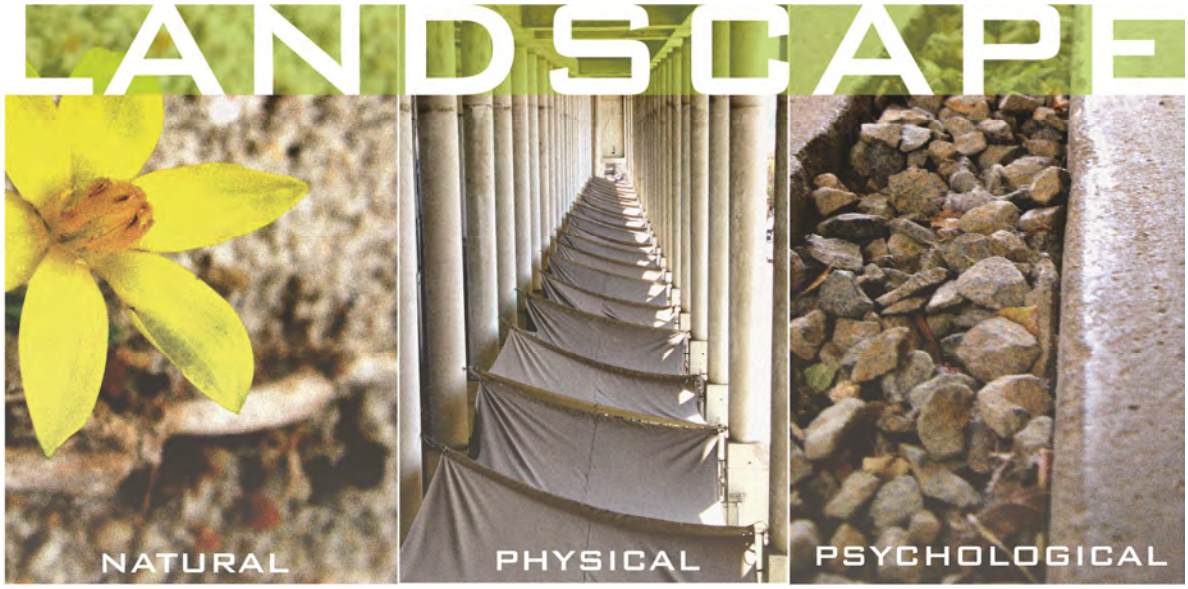
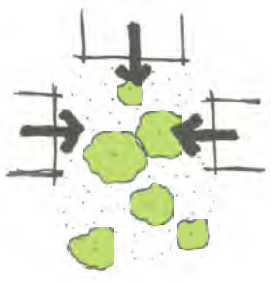


Figure 3-1 Landscapes as the key conceptual driver

3.1.4.1 Natural Landscape

CONTACT WITH NATURE: Nature provides a calming effect on individuals and provides an outlet for reducing stress. Nature has the opportunity to become a learning and therapeutic tool.



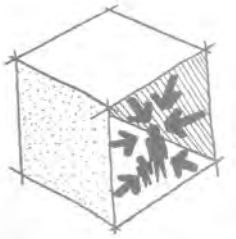
3.1.4.2 Physical Landscape

MOVEMENT: The considered physical journey through space (of both vehicles and pedestrians) to and within the building and site. The slope, level changes and physical barriers which are encountered.

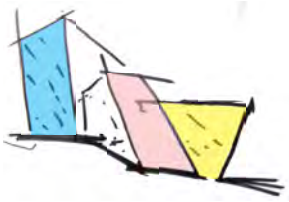
LEGIBILITY: Clearly defined paths make buildings easier to use and understand. Legibility enables children with ASD to navigate independently.

3.1.4.3 Psychological Landscape

EXPERIENCE OF SPACE: Consideration of the emotional effects of the built environment, influenced by: light quality, scale, acoustic quality, ventilation, comfort, etc.



MATERIALITY: Materials selectively chosen for their colour, texture, odour, size, acoustic quality, pattern, etc. influencing the perceptual experiences of the built environment.



3.2 Final Design Proposal

3.2.1 Urban Design Intervention

The proposal for the urban precinct is focused on the development of a public park to the north of the N3 freeway. (Refer to figure 3.2) This park is connected to the rest of the precinct by clearly defined pathways. The public park will provide much needed green open space for the surrounding residential areas. A soccer field, recreation centre, tea garden, children's play area and amphitheatre provide additional recreational activities within the park for the local community.

Figure 3-2 Urban Design Proposal

3.2.1.1 Natural Landscape

The existing site is an unused grassed valley, the park design adds and enhances to this natural aspect of the site. Additional trees and vegetation break up the expanses of grass, providing shade and opportunities for people to gather.

3.2.1.2 Physical Landscape

The site is currently utilized as a thoroughfare for people moving from the residential areas to the major transport routes in order to catch public transport. The proposal formalises these existing pedestrian routes, providing seating and lighting in order to ensure a feeling of safety for people using the pathways. A hierarchy of pathways ensures that these main routes through the park are clearly defined with smaller pathways branching off.

The pathways in the park and pavements throughout the precinct are suitable for all access, with ramps dealing with the slope and changes in level. The paving materials remain consistent throughout the precinct ensuring that the entire precinct is experienced as a whole, and becomes easy to navigate.

3.2.1.3 Psychological Landscape

The trees, grass and natural vegetation creates a quiet, calm environment. The parks position ensures that the Autism Centre will have easy access to a large open green space, while being buffered by a natural barrier from the major roads. The trees and natural contours of the landscape forms this natural barrier for both sounds, odours and views from the N3 freeway.

The pond and water feature provide a central focal point within the park, allowing people to easily orientate themselves. The water feature brings natural life to the park and masks traffic sounds from the N3, adding to the tranquillity of the park setting.

3.2.2 Design Intervention

3.2.2.1 Natural Landscape

As discussed, the site has existing vegetation and slopes down towards the south of the site. The building is designed to sit within this natural landscape with trees and natural vegetation filtering in between the fragmented buildings. By allowing nature to filter in between the buildings it emphasizes the users contact with nature and allowing the calming effects of nature to be felt continuously as a person moves through the building. (Refer to figure 3.3)

Figure 3-3 Plan indicating the natural landscape

3.2.2.2 Physical Landscape

The physical landscape refers to the built form, this consists of four distinct zones; administration and community, therapy, classrooms and residential. (Refer to figure 3.4) The administration and community and therapy blocks respond directly to the street edge and provide an acoustic wall protecting the classrooms and residences from the traffic noises on the northern edge of the site. The quieter classroom blocks are of a smaller, more intimate scale. This allows children to feel comfortable and safe within the classrooms which encourages them to focus and learn. The classroom blocks are constructed of timber and glass, blending them into the natural landscape. Several of the classroom blocks are cut into the landscape with the landscape wrapping over the building, further integrating the building with nature.

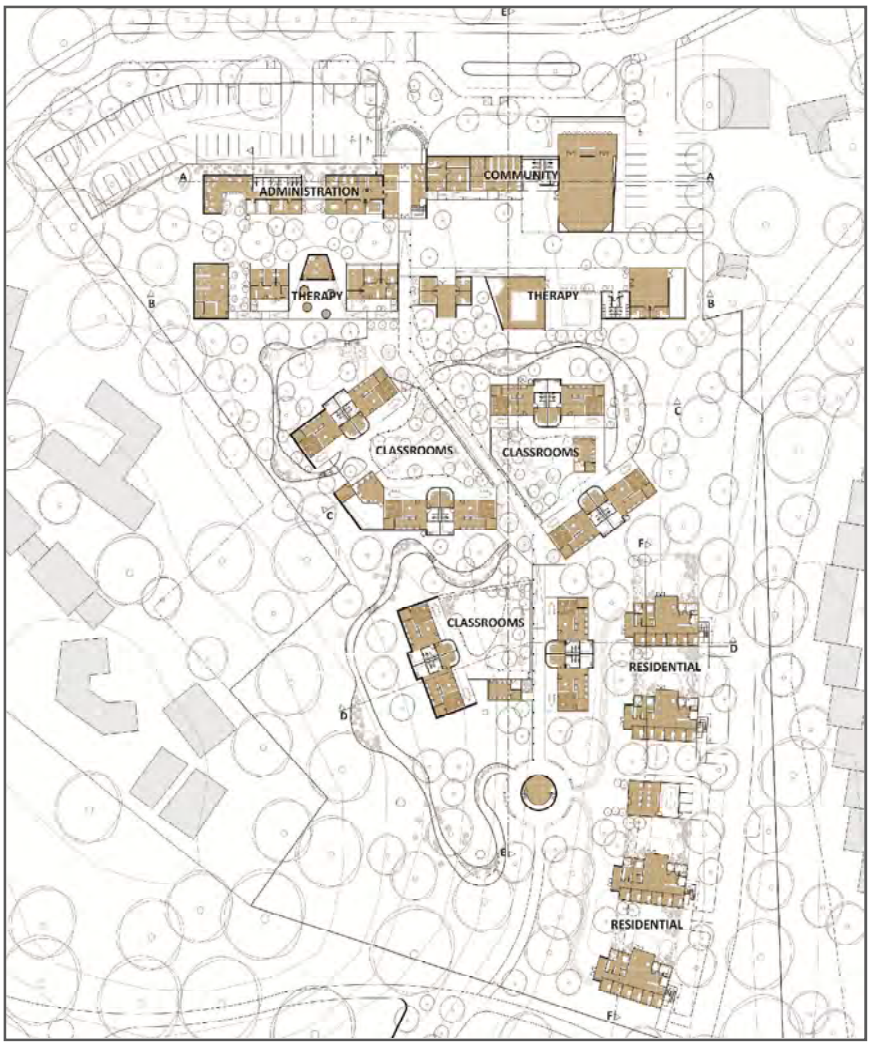


Figure 3-4 Plan indicating the physical, built landscape

3.2.2.3 Psychological Landscape

Two routes have been designed to run through the building. (Refer to figure 3.5) The first is the direct route which is clearly legible and runs through the centre of the building, with all functions being accessed directly off it. The orthogonality of the route suggests its direct nature. The route kinks in order to follow the contours of the natural landscape as well as eliminating the intimidation which a long straight walkway would create. Visual consistency is maintained along the route by the use of a continuous roof, flooring and columns. This visual consistency helps children to transition through the building.

The secondary route through the building is a sensory route which winds through the buildings, activating the spaces between the built forms. The route is broken down into areas for each of the senses and encourages children to explore, addresses their sensory issues and challenges their motor skills and co-ordination. A comprehensive list of the elements used in

the sensory garden can be found in APPENDIX H. This sensory route becomes an outdoor therapy tool and further integrates the physical and natural landscapes.

Various nodes along the main route highlight important events along the route. These are nodes are expressed by built forms or materiality and assist children in way-finding, easily locating themselves along the main route. The nodes highlight the start and end of the main route, emphasize the change in direction of the main route and indicate the intersection between the main and secondary routes.

Figure 3-5 Plan indicating the psychological landscape of the two circulation routes

3.2.3 Planning

3.2.3.1 Administration and Community Functions

The administration and community functions are located on the northern edge of the site responding to the street edge. The main entrance to the building is central to this block and is accessed of the street. The main entrance is emphasised by its verticality, with a canopy structure in front of the main entrance doors which reduces the scale of the entrance.

A public and staff parking area sits directly in front of the administration wing with a natural barrier of trees and shrubs shielding it from view from the street. This leaves the community wing and main entrance to become the public face of the building as opposed to the institutional administration block.

The community meeting hall's main entrance is also off the street, but at a smaller scale so as not to compete with the main entrance. This street entrance allows the hall to function after hours and be rented out to bring additional revenue to the school. A glass wall and secondary entrance allows views from the hall into the centre, connecting the public with the centre without interfering them with its functioning. This secondary entrance opens out onto a paved spill out area which opens out further onto an open grassed area. This open grassed area provides a simple open space for the children to enjoy, as well as providing an area where fetes and fundraising events can be held. The shape of the hall responds to its acoustic requirements, with the roof angled to reflect the sound to the audience area, away from the stage area. Additional acoustic panels are designed on the walls of the hall to reduce flutter echo and enhance the acoustic quality of the space.

3.2.3.2 Therapy Wings

The therapy block is split into two wings, the noisy therapy functions (occupational therapy, physical therapy and hydro therapy) and the quiet therapy functions (play therapy, speech therapy and sensory therapy) The quiet therapy functions are placed on the same side as the administration block because it is a similarly quiet function. The noisy therapy block is placed on the same side as the community block, responding to the more public community hall and spill out areas which are noisier functions.

The therapy wing is designed to stimulate the senses with the use of various smooth, reflective, textured, coloured, etc. surfaces. A handrail along the walkways ensures that a child can be in constant contact with the building as they move through the therapy wings. The sensory room and pods are the main accentuation of the sensory considerations. Four enclosed pods deal individually with the senses of sight, sound, touch and smell. Each pod is

designed to clearly indicate externally the sense it encapsulates internally. For example, the sight pod has LED lights which change colour according to the occupants activities within the pod, whereas the touch pod has a rough textured external finish.

The therapy block is fragmented allowing views through between the different therapy centres, visually defining each centre. Transition spaces are created in front of each centre with calming water and garden features. These areas allow a child to prepare themselves for their therapy sessions. The fragmented therapy block is an intermediary between the rigid built form of the administration block and the scattered more organic placement of the classrooms. Despite the therapy blocks fragmentation a continuous roof runs over the entire therapy section, unifying the individual blocks and creating its own architectural character.

3.2.3.3 Classroom Blocks

The classroom blocks are at a small scale, creating feelings of safety and intimacy. This comfortable atmosphere is more conducive for children with ASD, encouraging them to focus and learn. Access to the classrooms is via an outdoor transition zone, which doubles up as an outdoor teaching space. These transition zones allow children views into the classroom before they enter into it, easing their transition from the outdoors to indoors.

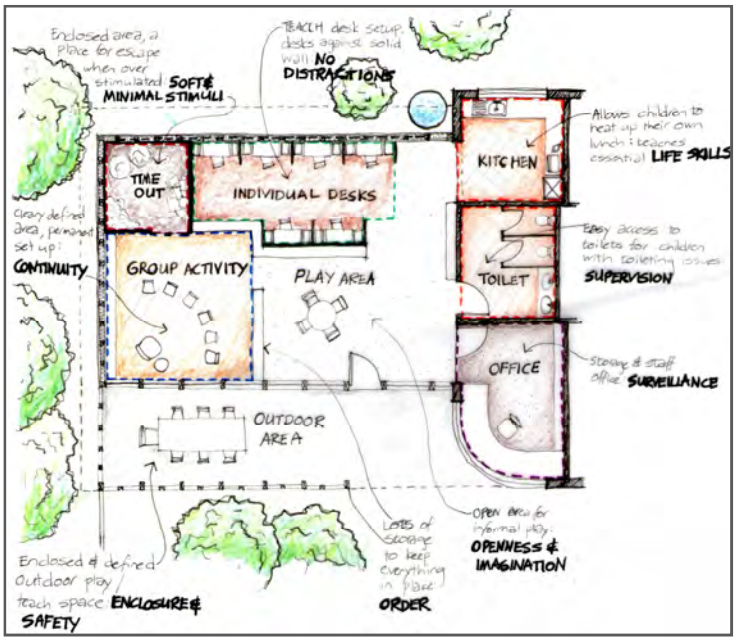


Figure 3-6 Plan of typical classroom indicating design considerations

The classrooms are designed with several key areas which are clearly defined using the furniture and carpets to visually demarcate them. (Refer to figure 3.6) For example, the group activity area is defined by a different shade of carpet to the rest of the classroom and is bordered by shelving units. All areas in the classroom are fixed so as to retain an element of surety and consistency which is calming to children with ASD.

A service block provides kitchen and toilet facilities for each classroom. This allows for both the encouragement of independence and the ability to monitor the children during

these activities. The teacher's office is designed to have views of the classroom, the outdoor transitional zone and the playgrounds, ensuring that the teacher can have constant visual surveillance of the children.

The classrooms are designed to have minimal stimuli, allowing for stimuli to be added and removed as is necessary for the specific children in that class. The classrooms have clear high level windows and sandblasted lower level windows, allowing for high levels of natural light within the classrooms, but without the distracting views. Acoustic walls and ceilings as well as carpeted floors create a quiet interior, with no distracting reflected noise. Paint with no odour is to be used, and the toilet blocks are to be well ventilated to eliminate any toilet odours. All surfaces within the classrooms are smooth and soft, creating a minimal stimulating tactile environment.

The classroom blocks are designed to surround the playgrounds, allowing for that constant surveillance from the teacher's offices and classrooms. It also ensures a direct connection between the classrooms and playgrounds. The seemingly awkward spaces in the playgrounds, which are created by the formation of the classroom blocks, present themselves as opportunities to create retreat spaces within the playground. These small, sheltered spaces provide a retreat for children who become overwhelmed by the stimuli of the playground. The playground encourages exploration and skill development. A climbing structure encourages physical movement and development while slides, rockeries and sand pits introduce tactile components.

The playgrounds are fenced for security purposes, however, they relate directly to the main circulation route. This adds additional surveillance to the playgrounds as well assisting with a child's transition into the classroom. They have visual links into the playground before they enter, the playgrounds leads off to the transitional spaces of the classrooms, which ends up leading into the classrooms themselves.

3.2.3.4 Residential Component

The residential component of the site is placed on the south east edge of the site, this provides privacy for the residential blocks from the rest of the Centre. Nettleton road provides private vehicular access for the staff accommodation. This ensures that the functioning of the Centre and the staff residential units remains separate. Two single bed units and three two bed units provide space for staff and their families to stay.

The residential blocks are orientated towards north and follow the contours of the site. The spaces defined between the blocks forms the outdoor play spaces for the children's

residential units. Unlike the classrooms, it is important for the residential blocks to have views of an outdoor area which the children know they can access whenever they want to. This encourages them to explore and develop an independence in their 'home' environment.

The children's residential unit has six bedroom areas, the defined bedroom spaces allow each children to have their own space which they can personalize and retreat to if need be. A staff residential unit allows a staff member to be constantly present to monitor the children. The staff unit is designed to ensure that the staff member can easily monitor the children from within.

3.2.3.5 Sports Facility

The sports facility is a part of the public park, however it belongs to the Autism Life Learning Centre. A pathway connects the centre with the sports facility, allowing the facility to become a larger extension to the physical therapy centre. The sports facility has a booking office which allows the field to be hired out to the public, bringing additional revenue to the centre.

3.3 Environmental Response Strategies

3.3.1 Orientation

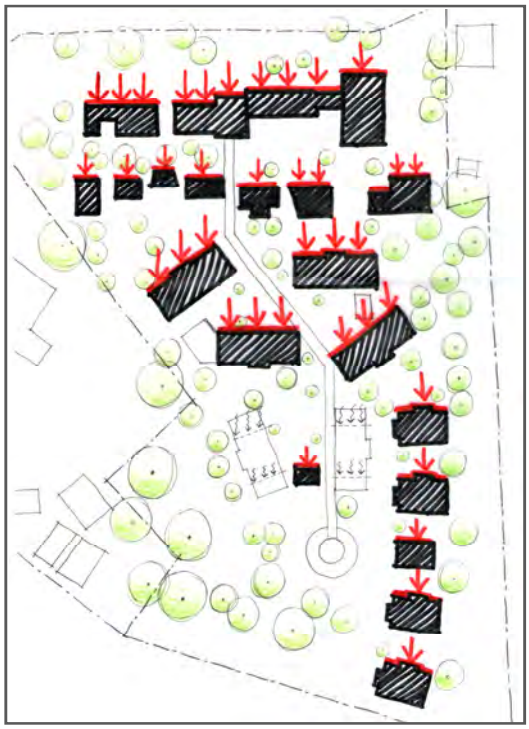


Figure 3-7 Sketch plan indicating response to orientation

The administration, community and therapy wings and residential blocks are orientated to face north, allowing for best light conditions. (Refer to figure 3.7) By orientating these blocks to face north it reduces the lighting, heating and cooling needs of the blocks.

The roofs of the classroom blocks allow for a skylight strip which faces north, allowing north light to penetrate the interior of the classrooms. (Refer to figure 3.8)

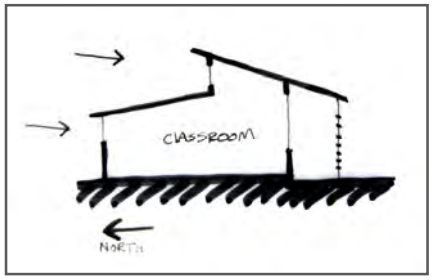


Figure 3-8 Classroom block with roof designed for north light

3.3.2 Natural light, Solar shading and Overhangs

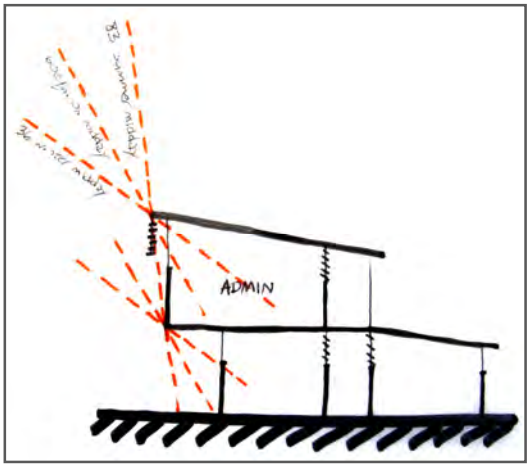


Figure 3-9 Sketch section through Administration block showing use of solar screens and overhangs

Where appropriate solar screens have been incorporated to prevent excessive solar gain on the north facades of the building. (Refer to figure 3.9) In the classroom blocks, large overhangs protect from excessive solar gain on the northern facades. Overhangs are used in the classrooms because the light patterns which screens would create may be distracting to certain children.

The majority of room depths are kept below 8m, allowing for natural light to penetrate into the buildings interiors.

3.3.3 Ventilation

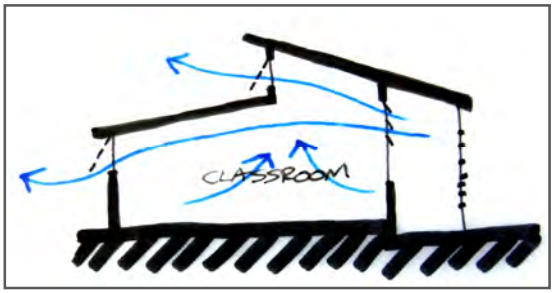


Figure 3-10 Sketch section through classroom indicating natural ventilation

Where possible it has been designed that cross ventilation can occur. This is achieved by operable windows allowing users to control their environment, increasing their comfort levels. Interior partitions are not full height allowing for ventilation to remove the stale air as it rises out of the partitioned areas. In the classrooms, the high level strip windows are mechanically operated to allow hot air to escape at high levels, this natural ventilation allows the classroom space to be cooler. (Refer to figure 3.10)

3.3.4 Green roofs and walls

Green walls have been used on the northern facade of the administration and community blocks. The north orientation is ideal for the green walls, providing ample sunshine for the plants to grow. The green wall assists with noise reduction on the street edge by assisting with breaking up sound waves. The green wall also improves the air quality, absorbing some of the harmful gases produced by the cars in the road and parking areas.

Green roofs have also been incorporated, these roofs assist with noise reduction and heat gain in the building. Much like the green wall it improves air quality.

3.3.5 Vegetable Garden

The taste section of the sensory garden has various fruit trees and plants as well as vegetables. These vegetable gardens are to be maintained and the food grown will be used in the children's residential dining facility. By growing food on site, children can explore and learn the process of growing food. They are given fresh produce to eat, which is free of chemicals and the cost of providing food for the residential children is reduced.

3.3.6 Rainwater harvesting

Rainwater from all the roofs of the buildings is either stored in rainwater tanks for future use on the gardens or channelled directly to water the gardens.

3.4 Technical Resolution

3.4.1 Roof Systems

3.4.1.1 Pitched Roofs

A combination of mono-pitch and offset double pitch with high level window roofs are used, consisting of; galvanised corrugated steel roof sheeting conceal fixed to S.A. pine purlins fixed to Balau timber rafters with a minimum pitch of 8°. Acoustic and thermal insulation is to be installed in the spaces between the rafters and the ceiling.

3.4.1.2 Green Roofs

The green roofs are composite roof structures consisting of the following layers; a 255mm thick reinforced concrete slab, a bituminous waterproofing membrane laid on the slab, min 25mm screed to 1:100 falls, a root barrier membrane, a drainage fabric with water retention fabric bonded to it, a geo-textile filter fabric and finally a lightweight growing medium. The roof is designed to ensure the fast effective drainage of any water on the roof, to ensure that there is minimal water build up which would add extra weight to the structure.

3.4.2 Ceilings

3.4.2.1 Acoustic Ceiling

Timber ceiling slats are to be nailed to brandering with 10mm gaps between the slats exposing the thermal and acoustic insulation. The exposed insulation and gaps reduce the amount of reflected sound in a space, thus increasing the acoustic quality.

3.4.3 Wall and Column Structures

3.4.3.1 Acoustic Brick Wall

300mm thick common brick cavity wall with acoustic and thermal insulation filling the cavity space. This wall is designed as an acoustic barrier to decrease the high db rating experienced within the administration and community blocks due to traffic noise.

3.4.3.2 Timber External Wall

Timber external walls consisting of; an internal 12mm thick plasterboard screwed to timber studs with a DPM stapled to studs between the plasterboard and studs, horizontal and vertical timber studs creating a frame, acoustic and thermal insulation in between the studs, 12mm thick plywood nailed to external face of studs, a breather membrane stapled to plywood, vertical battens nailed to plywood and horizontal timber cladding fixed together and nailed to battens such that nail heads are not visible. Vertical studs to act as columns supporting rafters as well.

CHAPTER 4 CONCLUSION

The design approach was developed as a response to the specific and specialised needs of individuals with Autism Spectrum Disorders who are currently an unconsidered user group in the built environment. The approach has resulted in a Learning Centre which is positive, calm and conducive to learning. As one of the first Autism specific Centres in Durban the design can be used as a guide for the development of future facilities across the greater Durban area.

The centrally located facility provides community support and Autism specific facilities which are accessible to the public, allowing the Centre to become a central hub for all Autism needs. Thus, the Centre helps the lives of more than just the children who attend.

By considering the three landscapes, natural, physical and psychological, in conjunction with the specialised needs of the users the design process has resulted in a positive, calm learning environment where children can feel safe and comfortable without fear or insecurity. This reduction of stress levels and discomfort encourages focus and concentration and leads towards skill developments, fostering self-sufficiency and independence.

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LIST OF ACRONYMS

AD - Autism Disorder

ASD - Autism Spectrum Disorder

SEN - Special Educational Needs

PDD - Pervasive Developmental Disorder

PDDNOS - Pervasive Developmental Disorder Not Otherwise Specified

ABA - Applied Behaviour Analysis

PECS - Picture Exchange Communication System

EIBI - Early Intensive Behavioural Intervention

LIST OF FIGURES

Part One

Part Two

APPENDIX A

DSM-IV CRITERIA FOR DIAGNOSING PERVASIVE DEVELOPMENTAL DISORDERS (ALSO KNOWN AS AUTISM SPECTRUM DISORDERS)

Listed below are the diagnostic criteria for the five Pervasive Developmental Disorders as defined by the Diagnostic and Statistical Manual of Mental Disorders - Fourth Edition (DSM-IV), published by the American Psychiatric Association, Washington D.C.,1994.

299.00 Autistic Disorder

An autism screening tool must meet all three primary areas defined by the DSM-IV description for autistic disorder (#'s 1-3 under A below) to qualify for a positive rating from First Signs:

A. A total of six (or more) items from (1), (2), and (3), with at least two from (1), and one each from (2) and (3):

(1) qualitative impairment in social interaction, as manifested by at least two of the following:

(a) marked impairment in the use of multiple nonverbal behaviours, such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction

(b) failure to develop peer relationships appropriate to developmental level

(c) a lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest)

(d) lack of social or emotional reciprocity

(2) qualitative impairments in communication, as manifested by at least one of the following:

(a) delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gesture or mime)

(b) in individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others

(c) stereotyped and repetitive use of language or idiosyncratic language

(d) lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level

(3) restricted, repetitive, and stereotyped patterns of behaviour, interests, and activities as manifested by at least one of the following:

(a) encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus

(b) apparently inflexible adherence to specific, non-functional routines or rituals

(c) stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting or complex whole-body movements)

(d) persistent preoccupation with parts of objects

B. Delays or abnormal functioning in at least one of the following areas, with onset prior to age 3 years: (1) social interaction, (2) language as used in social communication, or (3) symbolic or imaginative play.

C. The disturbance is not better accounted for by Rett's disorder or childhood disintegrative disorder.

299.80 Pervasive Development Disorder, Not Otherwise Specified (PDD-NOS)

This category should be used when there is a severe and pervasive impairment in the development of reciprocal social interaction or verbal and nonverbal communication skills, or when stereotyped behaviour, interests, and activities are present, but the criteria are not met for a specific pervasive developmental disorder, schizophrenia, schizotypal personality disorder, or avoidant personality disorder. For example, this category includes "atypical autism" --presentations that do not meet the criteria for autistic disorder because of late age of onset, atypical symptomatology, or sub threshold symptomatology, or all of these.

299.80 Asperger's Disorder (or Asperger Syndrome)

An Asperger/HFA screening tool must meet all six areas defined by the DSM-IV description of Asperger Syndrome (A-F below) to qualify for a positive rating from First Signs:

A. Qualitative impairment in social interaction, as manifested by at least two of the following:

(1) marked impairment in the use of multiple nonverbal behaviours, such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction

(2) failure to develop peer relationships appropriate to developmental level

(3) a lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest to other people)

(4) lack of social or emotional reciprocity

B. Restricted, repetitive, and stereotyped patterns of behaviour, interests, and activities, as manifested by at least one of the following:

(1) encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus

(2) apparently inflexible adherence to specific, non-functional routines or rituals

(3) stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting, or complex whole-body movements)

(4) persistent preoccupation with parts of objects

C. The disturbance causes clinically significant impairment in social, occupational, or other important areas of functioning.

D. There is no clinically significant general delay in language (e.g., single words used by age 2 years, communicative phrases used by age 3 years).

E. There is no clinically significant delay in cognitive development or in the development of age-appropriate self-help skills, adaptive behaviour (other than in social interaction), and curiosity about the environment in childhood.

F. Criteria are not met for another specific pervasive developmental disorder or schizophrenia.

299.80 Rett's Disorder (or Rett Syndrome)

A. All of the following:

(1) apparently normal prenatal and perinatal development

(2) apparently normal psychomotor development through the first 5 months after birth

(3) normal head circumference at birth

B. Onset of all of the following after the period of normal development:

(1) deceleration of head growth between ages 5 and 48 months

(2) loss of previously acquired purposeful hand skills between ages 5 and 30 months with the subsequent development of stereotyped hand movements (i.e., hand-wringing or hand washing)

(3) loss of social engagement early in the course (although often social interaction develops later)

(4) appearance of poorly coordinated gait or trunk movements

(5) severely impaired expressive and receptive language development with severe psychomotor retardation

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299.10 Childhood Disintegrative Disorder

A. Apparently normal development for at least the first 2 years after birth as manifested by the presence of age-appropriate verbal and nonverbal communication, social relationships, play, and adaptive behaviour.

B. Clinically significant loss of previously acquired skills (before age 10 years) in at least two of the following areas:

(1) expressive or receptive language

(2) social skills or adaptive behaviour

(3) bowel or bladder control

(4) play

(5) motor skills

C. Abnormalities of functioning in at least two of the following areas:

(1) qualitative impairment in social interaction (e.g., impairment in nonverbal behaviours, failure to develop peer relationships, lack of social or emotional reciprocity)

(2) qualitative impairments in communication (e.g., delay or lack of spoken language, inability to initiate or sustain a conversation, stereotyped and repetitive use of language, lack of varied make-believe play)

(3) restricted, repetitive, and stereotyped patterns of behaviour, interests, and activities, including motor stereotypes and mannerisms

D. The disturbance is not better accounted for by another specific pervasive developmental disorder or by schizophrenia.

APPENDIX B

THE CORE IMPAIREMENT DOMAINS OF AUTISM AND EXAMPLES OF THEIR BEHAVIOURAL CHARACTERISTICS

Core Domain	Examples of Behavioural Characteristics
Social Interaction	Inability to respond to social cues Inappropriately intrusive in social situations Problems with turn taking Difficulty establishing and maintaining eye contact Trouble with back and forth social interactions
Communication	Delayed use of gestures Echoing what is said directly, later, or in a slightly changed way Oddities in volume, cadence and pitch (prosody) Pronoun reversal or misuse Scripted language Problems with reciprocal conversations
Restricted / stereotyped patterns of behaviour / interests	Interest in parts of objects Preoccupation with topics or intense interest in details Stereotypic movements (e.g. rocking, flapping, twirling) Preoccupation with tasting and smelling objects Unusual response to sounds Insistence on routines, resisting change

NoteA diagnosis of Autistic Disorder requires the presence of six or more symptoms, with at least two being symptoms of impaired social interaction, at least one being a symptom of impaired communication, and at least one a symptom of restricted / stereotyped behaviour / interests.

Source Autism and Asperger Syndrome in Schools, 2010

APPENDIX C

SENSORY DIFFICULTIES EXPERIENCED BY INDIVIDUALS WITH AUTISM SPECTRUM DISORDER

Balance (vestibular) system

Hyposensitive Reactions

- The need for rocking, swinging and spinning

Hypersensitive Reactions

- Difficulties in activities which include movement - such as sport
- Difficulties in stopping quickly or during an activity

Body Awareness (kinaesthetic) system

Hyposensitive Reactions

- Proximity - Standing too close to others
- Lack of awareness of personal body space
- Difficulties in navigating rooms - avoiding obstructions
- Bumping into people

Hypersensitive Reactions

- Difficulties with fine motor skills; manipulating small objects (buttons, tying shoe laces)
- Movement of the whole body to look at something

Sight (visual) system

Hyposensitive Reactions

- May see things darker and lose features or lines
- Some may concentrate on peripheral vision because their central vision is blurred. Others say that a main object is magnified and things on the periphery become blurred
- Poor depth perception - problems with throwing and catching; clumsiness

Hypersensitive Reactions

- Distorted vision occurs
- Small objects and bright lights can jump around
- Fragmentation of images as a consequence of too many sources
- Focusing on particular details such as sand grains may be more pleasurable than looking at something as a whole

Smell (olfactory) system

Hyposensitive Reactions

- Some individuals have no sense of smell and fail to notice extreme odours
- Individuals may lick objects

Hypersensitive Reactions

- Smells can be intensified and become overpowering
- Toileting problems
- Dislike of individuals with distinctive perfumes, shampoos

Hearing (auditory) system

Hyposensitive Reactions

- Sounds may only be heard with one ear, with the other ear either only having partial hearing or none at all
- The person may not acknowledge particular sounds
- May enjoy crowded noisy places, kitchens, bangs doors and objects

Hypersensitive Reactions

- Volume of noise can be magnified and surrounding sounds distorted and muddled
- Inability to cut out particular sounds, leading to difficulties concentrating
- May have a lower hearing threshold, which makes them particularly sensitive to auditory stimuli, for example hearing conversations in the distance

Touch (tactile) system

Hyposensitive Reactions

- Holds others tightly
- Has high pain or temperature threshold
- Self-harming
- May enjoy heavy objects on top of them

Hypersensitive Reactions

- Touch can be painful and uncomfortable and they will often withdraw from aspects of touch, which can have a grave effect on their relationships with others
- Dislike of having anything on hands or feet
- Difficulties in brushing and washing hair
- Only likes certain types of clothing textures

Taste (gustatory) system

Hyposensitive Reactions

- Likes very spicy food
- Pica: eats everything - soil, grass, materials

Hypersensitive Reactions

- Some flavours and foods are too strong and overpowering for them
- Certain textures may cause discomfort. Some children will only eat smooth foods such as mashed potatoes or ice cream

Source: Autism South Africa and The National Autistic Society, 2005 - The Sensory World of the Autistic Spectrum: a Greater Understanding by Kate Wilkes.

APPENDIX D

INTERVIEW SHEETS - PARENTS

Interview 01

Name of Child: Johnny*(alias)

Age of Child: 8 years

Interviewer: Helen Reeves Date: 25/04/2012

Which School does your child attend:*Browns School*

From my research I understand that Autism is broad spectrum disorder with individuals experiencing a wide range of symptoms that vary in severity. Where does your son sit on this spectrum?

Johnny is a lower functioning child, but not the worst case. He can still comprehend and his verbal and communication skills are improving.

Does Johnny experience any sensory deficiencies, such as sensitivities to sights, smells, sounds, etc.?

Yes, in fact we picked up his sensory issues before he was diagnosed with autism.

Please explain these sensory sensitivities and how your son reacts to them

Johnny experiences overstimulation with all his senses. He battles with bright lights and will cover his eyes when exposed to them. He finds florescent lights particularly difficult to cope with. Bright colours, such as the primary colours, are over stimulating to him. He also battles with loud sounds or noises and will cover his ears to try and control the sound. We have given him a pair of earphones that he can wear if he becomes overwhelmed by sounds. He enjoys making loud noises himself, like playing the drums, but he needs to feel in control of this, so that he knows he can make it stop when he wants it to. He does not like food that has a texture or graininess to it. Food need to be smooth. He is also really sensitive to smells; I was not able to wear perfume up until last year, because he would just avoid me. He likes soft textures, like fleece, and likes to rub it or hold it against himself. He also likes enclosed spaces and heavy weights around his body, they seem to make him feel safe and help him to self-regulate when feeling over stimulated. Otherwise if he experiences too much stimulation he tends to hide.

B. Education

How does the school cater for Johnny's special needs?

Brown's school has small classes, about seven children in a class with a teacher and a teacher's assistant. This allows for a lot of individual attention. Everything is designed around the individuals; each child has their own desk that has high partitions enclosing the child so that there are no distractions. A down time area in the classrooms allow for children to escape when they feel overwhelmed. There is also a sensory room that is designed to stimulate the senses. Different areas within the room are demarcated for each sense. The stimulus is toned down from what we would consider to be stimulating.

C. Therapies and Treatments

There is a vast range of therapies and treatment methods available, which methods has your son been exposed to?

I have tried many different therapies, people try and sell you 'cures' for your child, but in reality there is no cure for autism. I have tried various herbal medications. He is now on Ritalin which is working wonders for him; his verbal and writing skills have improved drastically. He has also been to various speech and occupational therapists. He was in a class that used Applied Behaviour Analysis, but where his peers showed signs of improvement he did not. I have forced him to play and interact with his sisters, and that has helped him a lot. At first he would not play with them but he does now, however it must be on his terms. It is important to have early interventions for children with autism but most schools do not cater for children at such a young age.

D. Home Environment

Are there any specific features which you have included in your home to help your son?

Having his own room, his own space, which he knows belongs to him and that he can escape to if he wants. We put a picture of him on his room door so that he knows that is his space. Because of his sensitivity to bright colours, the walls in his room are painted cream. There are also blinds in his room so that he can control the amount of light entering. There is a semi-basement in our house and he used to love going into it and playing there, it was a small dark room so I refurbished it to make it a play room for him, with tiles and lights. He doesn't go in there anymore; I think he used to enjoy the darkness and enclosure, like a cave. There is also a felt board on the wall in his room that he likes to stick things on, he likes to find things to put up on it, it is all under his control.

E. Public Environment

How do everyday buildings, such as shopping centers, offices, etc. affect Johnny?In your opinion how could public spaces be better designed for him?

Public spaces are a nightmare with him. There are lots of people, open spaces, lots of smells and sounds, all of which he cannot control. This is very overwhelming to him. There are no public spaces that he can cope in, even church. To make it worse, people look at him and think he is just being naughty and needs to be disciplined. I try and wear Autism awareness t-shirts so that people understand his behaviour. It might not make a difference but it makes me feel more relaxed, it is a psychological thing. Although most people still do not understand, at least they are more empathetic towards him. I often take a carer with when I take him to public places because in public he needs undivided attention. There is not much that can be done in public spaces; the stimuli are just too overwhelming and uncontrollable.

F. Architecture and the Built Environment

How do the following architectural aspects affect you son:

- order
  Johnny likes order; everything has to be in its place. It is very important for him that everything in a room is organized.

- simplicity
  Too much detail, or too many colours are difficult for him to handle, even on clothing too much detail disturbs him.

- acoustics
  The most important factor is that he needs to able to stop any loud sounds or noises if he needs to. He also finds spaces that echo very traumatic.

- way-finding
  Johnny battles to navigate himself within new spaces. For example at school he knows exactly where his classroom is and goes directly there. When he had to change classrooms he found it difficult to understand. What Brown's school do is they use the Picture Exchange Communication System and put pictures drawn by the children and their names outside the classrooms so that they know that this classroom is theirs. If I take him to a new environment I need to take him and show him where everything is otherwise he will not ask or look for himself.

- colour
  Even though he finds bright colours disturbing he does like the colour red. I have colour coded a lot of household items so that he knows which ones are his. It is all about the routine, the same things over and over.

G. Nature

Nature has always been seen as providing a sense of calm and having healing properties, how does Johnny interact with nature?

Johnny likes to lie on his back and look up into the openness of the sky, it seems to calm him. At our old house we had a trampoline which he used to really enjoy. He loves being outdoors, nature, and animals although he doesn't have the normal fear about unknown animals. The old house used to have a big garden which he used to spend ages exploring, he likes to explore, the new garden is smaller and doesn't explore it as much. There used to be a hut out in the garden which he loved spending time in, again I think it is that sense of enclosure that he craves.

H. Closing Statements

Have you found any other important environmental factors which have not been mentioned, or are there any other points you would like to share?

I battle with the wooden floors at home, he runs around a lot, especially when he is coming off his medication, and the wooden floors make a big noise. He likes playing video games, in fact there is a new computer based therapy which is emerging. Routine is very important. Him feeling in control is also a very important consideration. He likes having his own things, he has difficulties in understanding the concept of me and mine, it is as if you are taking a part of him if you take an object of his. He also loves reading books. Otherwise he is quite self-sufficient around the house.

What recommendations would you would give to someone designing a building for individuals with autism?

The key things to consider would be to allow children to have their own space, that everything must be neat and tidy and there must be a place for everything. A sensory room is a must as well as a down time area.

Interview 02

Name of Child: Paul*(alias)

Age of Child: 15 years

Interviewer: Helen Reeves Date: 12/06/2012

Which School does your child attend: Browns School

From my research I understand that Autism is broad spectrum disorder with individuals experiencing a wide range of symptoms that vary in severity. Where does your son sit on this spectrum?

Paul has high functioning Autism. One of the biggest problems he has is with social interaction. Ever since he was young he became very distressed when strangers came near him, up to a point where he would scream if anyone except my husband or I came near him. He has always been a very fearful child and up until he was eight used to follow me around the house and up until 14 he was not able to sleep on his own.

Does Paul experience any sensory deficiencies, such as sensitivities to sights, smells, sounds, etc.?

Oh yes, definitely. He is highly sensitive to sounds and covers his ears when there are loud or high pitched sounds. He is also hyperactive; he is always moving and never keeps still. He exhibits a lot of stereotypical movements such as rocking and hand flapping, especially when he becomes overloaded with sensory inputs. When he was younger he liked to be held all the time, that closeness and pressure calms him down. He doesn't need it as much now that he is older. He also has big food issues, all his food has to be bland otherwise he refuses to eat it; he is extremely fussy with his diet.

B. Education

You mentioned that Paul is fearful of strangers, how does he cope in the school environment?

When Paul was around 6 years old he was diagnosed with Autism, this along with his fear of strangers led to us home schooling him when he was younger. It was very difficult because I was not able to have a break during the day, he needed my constant attention. His repetitive questions and behaviours were very tiring but by working with him constantly he has made great progress and has been able to join the school system. I found that by concentrating on things that interested him he focused and enjoyed things more. One of the things he enjoys the most is the computer. We used to spend hours together, while he played educational games we used to talk about what he was doing in the game. The computer is a whole world that he can control which is great for him because he really battles with unpredictability. The computer helped reduce his fear of strangers as well, when I used to have visitors over he used to hide away from them, so I used to ask him to show my friend what he was doing on the computer. He would agree but as long as my friend did not talk to him. As he began talking about his computer games his fears diminished so that eventually he was having a discussion with my friend.

How does the school cater for Paul's special needs?

Brown's School has a computer classroom which Paul loves, as well as a computer set up in his classroom that the children are allowed to use as a reward for good behaviour. The

classes are small so that Paul still gets a lot of individual attention which he is used to from being home schooled.

C. Home Environment

Are there any specific features which you have included in your home to help your son?

Of Course! My son has never been very curious and he does not really explore his surrounding environments. In fact if I bought something new or took him somewhere new he would not show any interest, he would just be highly distressed and anxious because of the change and unknown. He does however have a selection of specific interests and that is what I have focused and expanded on in our home. For example, he really likes this large relief map that is hung up on one of our walls and he spends ages just staring at it. So I have hung up other maps around the house that are a bit different providing him with the opportunity to possibly expand on his interests. The walls of our house are covered with visual aids, pictures and shelves with a wide range of books providing ample stimuli which Paul may develop an interest to at some point or another. Because of Paul's fearful nature and aversion to change we have to ensure that we have structure in our daily lives. For Paul this structure is dependent on both the stability of his surrounding environment and of the behaviour of the people in it. My husband and I have to try and be calm the whole time otherwise it distresses Paul. Paul's day also needs to be carefully organised, he needs to know exactly what we are doing and when. When Paul was younger we used to make a personalized visual flow chart that was hung up outside his bedroom door so that he could predict what was going to happen during the day. Another problem which Paul battles with is transitioning from one thing to another. I find that I can help him with this because I am sensitive to his needs. We have designed our home to make it easier for him to navigate himself, for example, we have used different paint colours in each room to visually separate each space, this helps Paul to distinguish different rooms within the house.

D. Architecture and the Built Environment

How do the following architectural aspects affect you son:

- order and simplicity

As much as Paul needs routine he also needs order in his surroundings. He becomes very upset when exposed to mess and clutter. Our house has a lot of cupboards and storage units where everything is kept. For Paul everything has a place and must be kept in that place.

- artificial lighting

Paul cannot cope with florescent lighting, he used to cover his ears and start rocking when exposed to florescent lighting. He has learnt to cope with it but it still affects him.

- colour

Paul really likes the colour blue, so we have painted his room a shade of blue which he really likes.

E. Closing Statements

Do you have and last comments?

For Paul the most important things we have had to consider are structure, peace and his interests. He really needs a strict routine otherwise he becomes extremely upset. We try and maintain a calm environment so as to keep him calm and reduce his anxiety, and we focus on his particular interests because he engages with us more if he is interested in what he is doing. I believe that children learn best when they are doing what interests them and that by teaching Paul things through his interests he has built self-esteem because I am emphasising that what interests him has value.

Interview 03

Name of Child: Brody*(alias)

Age of Child: 7 years

Interviewer: Helen Reeves Date: 12/06/2012

Which School does your child attend: Browns School

From my research I understand that Autism is broad spectrum disorder with individuals experiencing a wide range of symptoms that vary in severity. Where does your son sit on this spectrum?

Brody is seven now and was diagnosed with Autism four years ago. He is towards the lower functioning of the spectrum and he also has some severe sensory and motor skill issues. I began to suspect that Brody was autistic at about fifteen months when he started to display abnormal behaviour. He was very quiet and became increasingly withdrawn, avoiding eye contact. He did not respond to loud noises or even to his name. He did not respond when we spoke to him and did not speak or make any noises back.

You mentioned that Brody has sensory issues; can you explain these in more detail?

Brody is extremely sensitive to sensory stimulation. On the one hand he needs constant input from certain stimuli and on the other hand he can only handle a certain amount of stimuli before become overwhelmed and distressed. He is extremely sensitive to certain types of noises, especially loud noises, for example, I remember taking him on the Ferris wheel at one of these travelling amusement parks and every time we passed the bottom Brody would cover his ears with his hands to try block out the music. He has terrible food issues, he will not eat anything that is wet, there are several food textures that he will not touch and he is very picky

flavour-wise. Getting him to eat is a nightmare! He is also sensitive to the feel of fabrics and I have found that the only fabrics he will wear are soft cotton and fleece. Despite all this he also requires certain constant sensory input. When he was small the only way he would fall asleep was in a vibrating bouncy chair with a movie playing on the TV. If we put him in his cot in a quiet room he would scream and scream until he vomited! Now that we understand his sensory needs a bit better we know that he has a need for constant sensory input and most nights he falls asleep in his room with the TV on. If Brody experiences sensory overload he loses it, throwing tantrums. The tantrums are difficult to cope with in public because people look at you judgingly as if I am a bad parent. It is difficult.

B. Therapies and Treatments

There is a vast range of therapies and treatment methods available, which methods has your son been exposed to?

Over the past four years I have tried a variety of treatments and therapies. I have developed a home program to supplement the therapies which he gets at Brown's School. I have a behaviour therapist who works with Brody for the home program after school and during the school holidays. The skills that my son needs right now are language and improvement on gross motor skills. I cherish days when I see Brody progress.

C. Home Environment

Are there any specific features which you have included in your home to help your son?

We have set up our house to ensure that Brody is safe. For example, we have turned our dining room into a time-out room where we take Brody if he is throwing tantrums. The room has neutral cream walls and soft cushions and furniture where he is not over-stimulated and can calm down. I also have to ensure that certain cupboards are locked, for example the cupboards in the kitchen with all the plates and glasses. He doesn't understand the dangers of broken glass. I have also had to ensure that there are no sharp objects or dangerous objects that may harm Brody when he is throwing a tantrum. Because Brody has hardly any communication skills and often does not understand what is being said to him I use a lot of visual aids. Our house is covered with pictures of objects with their name written below them. This helps Brody communicate his needs around the house without having to speak.

D. Public Environment

How do everyday buildings, such as shopping centres, offices, etc. affect Brody?

A change in routine or visiting a new unfamiliar place often results in Brody throwing tantrums. His distressed behaviours result in me not being able to take him out into public places often. I guess the change and unfamiliarity and overload of new sensory stimuli in shops and such is just too much for him and he starts hitting, screaming and kicking. I guess it is his only way of expressing the distress and frustration he is feeling.

E. Closing Statements

Any last comments?

I have found with Brody that I need to keep him actively engaged and busy. The additional home therapy which he gets in addition to the school program has helped him make progress and pick up new skills.

Interview 04

Name of Child: Kim*(alias)

Age of Child: 16 years

Interviewer: Helen Reeves Date: 14/06/2012

Which School does your child attend: Whizz Kidz, Pinetown

From my research I understand that Autism is a broad disorder with individuals experiencing a wide range of symptoms that also vary in severity. Will you explain the symptoms which your daughter experiences?

Kim's main problem is that she is non-verbal. She does not speak at all. She does understand what we say to her, she just does not speak back. She is extremely demanding and craves attention all the time. She is especially close to her mother and harasses her constantly when at home. For Kim negative attention is just as good as positive attention, and if she doesn't get her way she has what we call 'melt downs'. She will bite, smack and break things. What we have to do is remove her from that stressful situation until she calms down. For example, if she has a meltdown at home we will take her out for a walk on the beach until she calms down. When we return home she falls back into the bad behaviour but to a much lesser degree.

Does your daughter experience any sensory deficiencies, such as sensitivities to sights, smells, sounds, etc.?

Kim battles the most with the sense of touch, specifically with clothing. When she was younger we would often dress her in the morning, she would seem happy, but then later when we went out she would strip all her clothes off and run around much happier that the clothes were off, even if it was freezing cold that day. There might be a particular jersey that she likes but once it is washed the washing powder might make it feel different and she won't like the feel of it any more. What we do is we let her feel all the clothes in her cupboard in the morning and pick the one that feels the nicest to her. Bedding also has an effect. We bought her a nice new duvet, only to find that she was sleeping on the floor because she did not like

the feel of it. It is difficult to tell her other sensitivities because she cannot talk and tell us, it is guess work for us. We do not know how sensitive she is to sound, but she definitely does not like the sound of whistling. Kim does have a good sense of smell, for example, she likes to smell things first before she decides if she wants to eat them. We have her on a gluten free diet at the moment, as parents we keep trying different things to see if it might help her. It is difficult though because her favourite foods are dairy and bread and she does not understand why she cannot have bread.

B. Education

Tell me more about Whizz Kidz and how they provide for Kim's special needs.

Whizz Kidz caters for children with multiple disabilities who are considered 'unteachable' and are not accepted at Brown's School. It is extremely difficult to get your child into Whizz Kidz. It is a small school with 4 classrooms and 21 children in total. These small classes mean that you have 2/3 children to one teacher which I think is crucial because each child with autism has the demands of seven regular children. I am a member of the board of Whizz Kidz and we learnt the hard way that bright colours do not work with children with autism. They were scared of the bright colours and it used to take them a good 10 minutes to actually enter the classrooms. Now we have used various shades of white which work better.

C. Therapies and Treatments

There is a vast range of therapies and treatment methods available, which methods has your daughter been exposed to?

The only therapy Kim has been to is speech therapy, which she goes to at school, because her main problem is her lack of speech. It has reached a point though that she no longer attends speech therapy, the therapist says that the muscles in Kim's mouth have deteriorated to a point where she will probably never be able to speak. Kim is very good with jigsaw puzzles, she is very sensitive to shapes and at five years old she was easily finishing 100 piece puzzles. We have also used pictures with her. For example we would have a picture of a book and the word 'book' written. When we ask Kim where the book is she will point to the picture of the book and when we ask her which is the written word she will point to it. We do not know if she actually reads the word and understands or if she knows from memory which words and pictures go together. We have also tried various medicines, Ritalin being one; she is currently on a calming medicine which helps us cope with her.

Has your child been exposed to any specialized sensory rooms or sensory gardens?

No, Whizz Kidz does not have any sensory rooms.

D. Home Environment
Are there any specific features which you have included in your home to help your daughter?

All the glass in the picture frames in our house are gone because Kim has smashed them over the years during her 'meltdowns'. Our whole house is beige; we have never gone for any bright colours because of Kim. We also don't put anything high up because Kim will find a way to climb up, children with autism do not have the best balance, and she could hurt herself. I have put up a white board in the house for Kim to draw on, but because of her attention seeking she will rather draw on the walls. So I recommend a good quality paint that can be washed! Kim has had to adjust to our lifestyle, rather than us adapting our house to suit her.

E. Public Environment
How do everyday buildings, such as shopping centers, offices, etc. affect your child?

As a rule my wife and I will take Kim where ever we go, so if we are invited to a friend's house and they will not accept Kim then we will not go there. We have a full time baby sitter for Kim. It is essential for us because she is so demanding, needing attention all the time that my wife and I sometimes just need a break. She doesn't have any issues with the shops in terms of sensory overload or anything. In fact she is excited to go to the shops. Her favourite shop is Makro, I do not know why, but she pushes the trolley and knows exactly where she is going and what she wants to buy. The problem comes when she finds something that she wants and we refuse to buy it, she then has one of her 'melt downs'. I must mention that although Kim does not talk she is very noisy. When we go to the shops she shouts all the time, people know that she is disabled and I must say I can only remember one time that I have had a negative response from someone.

F. Closing Statements
Any last comments?

Routine is very important for Kim. The routine at school is very good for her. Every day they do the same things in a set order. Every two years she changes teachers and classrooms but that does not affect her as long as the routine remains the same. The difficulty comes on weekends and school holidays, when there is no routine. My wife and I play a lot of golf and we always take Kim with us. She sits in the golf cart as happy as anything. She is very well behaved. I am trying to make Saturday golf day part of her routine. I hope that one day she will eventually play golf, but that may be wishful thinking.

APPENDIX E

INTERVIEW SHEET - TEACHER

Interview 01

Interviewer: Helen Reeves Date: 07/05/2012

The research I am doing is based on the idea that the built environment has an impact on people both physically and emotionally, this is of course an important consideration for all people, and particularly relevant for people with special needs, such as children with autism disorder. Because autism is such a vast spectrum of disorders very little architectural research has been done to determine what positive impacts it can have on the behaviour, education and lives of children with autism. This research is attempting to bridge that gap.

A. Background

The class which I teach comprises of low functioning children in the higher age group. Each child needs a high level of individual support and one-on-one attention. There are seven children in my class and most of them are non-verbal. Our focus with the children is teaching them life skills and developing their abilities to take care of themselves. Brown's School itself caters for a range of special needs children, we are just a unit within the bigger school and that puts restrictions on the facilities which we have.

Although an established routine is important for the children I have found that each day is different with different challenges. Once a week we have an outing to the shops, each child has a visual card showing their 'shopping list'. At the shop they are assisted in finding the items and paying for them. This helps the children learn how to exchange money and thank the teller. It also exposes them to everyday public spaces. At first my class battled in the public environment but they have adjusted to it over time.

B. Sensory Issues

One area of particular relevance to my research is that of the various senses. From my research I understand that children with autism often suffer from sensory difficulties. What have you found to be the major sensory issues in your class?

Because these children are nonverbal I cannot tell what their particular sensory sensitivities are because they cannot tell me. I can only assume from their behaviours what is troubling to them. For example, one child battles with the sound of running water and any time someone uses the sink he covers his ears.

I believe you have a sensory room at the school, how does it work, what are the benefits of it and what are the most effective elements within it?

The sensory room has several defined areas which are designed to stimulate the senses. The children go into the room barefoot because special flooring has been used. A particular smell has been used in the room, I do not like the smell, but the room definitely calms the children. There is a section with pillows and a bubble machine, a radio is used to play music when the children are in the room, there is a tent which the children love to climb inside and zipshut. Another area is closed off using screens creating a small space which the children enjoy. The pictures on the walls, which we made ourselves, have a whole lot of different textures which the children like to feel. I normally bring four children in here at a time otherwise the room gets too crowded. I find ventilation to be a big problem in here because there are no openeable windows. The room gets very stuffy with a couple of people inside.

C. Architecture and the Built Environment

My research thus far has led me to a couple of key building design considerations. Please explain from your experience how the elements affectchildren with autism, both positively and negatively andhow these issues are addressed in your classroom.

- order

There are a lot of shelves and storage trays in the classroom so that everything has its own place and is stored in a particular area of the classroom. This sense of order and everything being in its place is not as important to my children as in some of the other classes.

- simplicity

Yes, there are quite a few pictures on the walls, but the pictures help the children to learn and it is important for them to be able to see them. There must not be too many pictures though; it must not be too busy.

- natural light

Natural light is very important for children with autism because they have a tendency to go into depression and dark spaces move them towards depression. The high level windows in my classroom do create a bright light with high levels of glare but this only lasts for the morning and the effects do not seem to bother any of the children.

- acoustics

Too much noise agitates the children. I have incorporated a surround sound system in the classroom and play instrumental music in the background, this helps maintain a familiar sound and helps to calm the children.

- colour

The walls were white when I first moved into this classroom, they got dirty very easily. I decided to paint the classroom a shade of blue and since then the children have been

noticeably calmer. I also covered the screens in blue and greys to keep the colour scheme uniform and simplify the environment.

- flexibility

I think flexibility is essential in a classroom for children with autism, the needs of the children are changing all the time, also new children who join the class have different needs, thus fixed permanent would not be suitable. Furniture that looks fixed but is able to move would be the ideal solution.

- enclosure

Often when the children become stressed or overwhelmed they need to be held very tightly, this helps them to relax. They like play equipment that holds them tightly and spaces that are enclosed. My classroom has a small breakaway room that has cushions and books in it, the children can go there when they need a break.

- safety and security

The security gate on the classroom door was because one of our past students was a 'runner' and he used to escape out of the classroom and run up and down the passages. Once he even managed to climb onto the flat roofs and was running on the roof tops.

From what I understand a structured classroom layout is extremely important, how has the classroom been organised to provide this?

All the classrooms are set up with the TEACCH system, as you can see the work stations have trays were the work that needs to be done is stored and there are lots of visual aids around the classroom. Because my children need one-on-one attention screens partition each workstation. This allows the children to work at their own individual workstation on work that they can handle while not being distracted. In classes where the children are higher functioning the desks do not need partitions because the teacher can address the whole class and give a single instruction to all the children. If the children become distracted or something is upsetting them they have the verbal skills to tell the teacher about it. The transition between and defining of spaces is very important. The children are not allowed to eat at their workstations, it is important to differentiate the different areas for different activities.

D. Nature

What outdoor facilities are available to the children?

The school has two playgrounds specifically for the autism division, so that the children do not interact with the rest of the school. There is a separate playground for the younger and the older children.

How are the outdoor spaces beneficial for them?

The veranda area is a new addition to classroom but has been great for the children. It gives them a space to relieve their stress and escape to if they need it. It also leads out to the garden where we do gardening. It is also nice to do activities such as painting together outside. The garden area gives them a space to 'be autistic', where they can run, jump and release all their pent up frustrations, I try and control these behaviours in the classroom, so it is good for them to have a space to unleash it.

E. Closing Statements

Is there opportunity for more Autism Specific Facilities within the greater Durban area? If so, where do you think the most appropriate place would be?

Yes, most definitely. I think it should be centrally located so that a wider group of people can access it. It should also be a day facility because a lot of parents do not want their children sleeping away from them; the central location would help with this as well. Currently a couple other schools have facilities for children with autism they are; Autism in Action, Pathways, RP Moodley, Golden Hours and Whizz Kidz. These schools have all been adapted from old houses or incorporated into existing school buildings. There is also a need for a specialized adult facility, where do the children go once they have finished school?

Is there anything else that you would like to mention? What improvements would you like to make to your classroom?

My classroom has a kitchen area where the children can warm up their food independently. In fact they all work together to prepare the food and they know how the others like their food, one child will set the table while the others prepare the food, then they will all sit together and eat. The sink is an important element in the classroom, it allows me to teach the children to wash their hands, it has to be concrete and they have to do it physically for them to understand. There is a specific computer room which the children go to for lessons. The computers have specific programs which monitor the children's progress in subjects such as maths. There are also some computers in the classroom itself which the children are allowed to use if they have been well behaved; it is a treat for them to be allowed to go online. The storeroom provides an area where things can be kept out of the way so that it does not clutter up the classroom space. I let the children wander in and out of here freely. I also brought an exercise bike from home and put it here because one of the children likes to move.

If I had to improve my classroom I would suggest better ventilation, there is almost no ventilation in here and it gets very stuffy. The classroom is badly orientated and is really hot in summer and really cold in winter. I would also like a toilet in the classroom, currently the children have to walk a bit to get to the closest toilets and it would be nice to have one easily accessible from the classroom. The work space would be better designed away from the door to the passage because the children get easily distracted when someone walks past the door.

APPENDIX F

INTERVIEW SHEET - TEACHER

Interview 02

Interviewer: Helen Reeves Date: 07/05/2012

The research I am doing is based on the idea that the built environment has an impact on people both physically and emotionally, this is of course an important consideration for all people, and particularly relevant for people with special needs, such as children with autism disorder. Because autism is such a vast spectrum of disorders very little architectural research has been done to determine what positive impacts it can have on the behaviour, education and lives of children with autism. This research is attempting to bridge that gap.

A. Therapies, Treatmentsand Education

Which methods of therapies are used here at Brown's School?

Occupational and speech therapists have therapy rooms within the school and provide therapies for all the children in the entire school who need it. Physiotherapists are also available, but children with autism don't usually have anybody deformities and don't often need physiotherapy. The occupational therapists have individual treatment rooms as well as a large group session room where various different activities can be set up for the children. The speech therapists also have individual treatment rooms and a group room which is very beneficial for the children. The therapy rooms also have an assessment room. This is monitored by a sound proof room with one way glass alongside it. Currently the assessment room doubles up as a tea room so it is not as comfortable as it could be.

B. Architecture and the Built Environment

My research thus far has led me to a couple of key building design considerations. Please explain from your experience how the elements affectchildren with autism, both positively and negatively andhow these issues are addressed in your classroom.

- simplicity

I like art so my classroom is very busy, the children are proud of their pictures so we also stick them up on the walls. The children don't seem to mind it.

- light and ventilation

The windows should be higher, but this is an existing building and it seems to work. The lights do affect the children but most of them are used to it and have adapted to them. The ceiling fans, however, are a big problem; some children get obsessed with its movement and will stop and stare at it rotating.

- way finding and orientation

This is a big school but the children with autism generally stick to their area and do not wander around. There are also no steps in the school because it is a special needs school and

there are a lot of children in wheelchairs, this is not as crucial for children with autism though.

From what I understand a structured classroom layout is extremely important, how have the classrooms been organised to provide this?

It is important for each child to have their own workstation and it is best if the work station is up against a wall. In my classroom each workstation has a desk drawer system. This comprises of three trays stacked on top of each other, each with a number on it and a different colour. The children take work from one of the left trays and once finished move it to the right tray of the same number and colour. I also have a ring of chairs for circle time. These chairs are never moved and every morning we have circle time and talk about the weather and what day it is, it is all about the routine.

C. Nature

What outdoor facilities are available to the children?

The outdoor playground for the little ones is great, the children are all in their own little worlds and in the playground there is place for them to cycle, hide and hammocks where they can curl up. There is also a little hut which they love; they often go sit in the hut when they need a time out.

D. Closing Statements

Do you have any other comments?

I have been down to Vera School in Cape Town which is an Autism specific school. They have hooks for the children's bags outside the classrooms so that they don't have to have the out-dated open lockers (that one finds in preschools) inside the classrooms. It also means that there is more space inside the classrooms. Each classroom has a one-way glass window so that visiting therapists or parents can observe the class and children from the passageway without interfering with the children. Each classroom also has an individual room off it where speech therapy happens.
Velcro is fantastic, it allows us to stick things up and pull them down easily, the Velcro also allows us to stick things to children's clothing and all sorts of other things as well. There is a visual schedule at the doorway of my classroom that shows children what they are to do next; it would be good if there was a felt board there that could be used instead. I also have a table of interest that I get the class involved in redesigning every now and then, the children really enjoy it. At the moment we are collecting leaves for the autumn display.

What recommendations would you give to someone designing a building for individuals with autism?

The must haves for any centre for children with autism are an; occupational therapy department, speech therapy department and a medical station with a paediatrician and a nurse. My ideal classroom would consist of a playroom, a room for workstations, a relaxation/sensory room, a toilet (preferably more than one), a very big storeroom (because I am running out of space in my one) and a veranda which opens out onto a playground. A shared fun room would also be nice, a place where children can watch DVDs, play music and have a music ring. A swimming pool is important because children with autism just love water. Carpets are important; it stops furniture screeching against the floor and also stops

the children from rocking in their chairs. Ideally a class should have 7 children, 6 if they are low functioning, 8 children become just too many too handle.

APPENDIX G

INTERVIEW SHEET - PRINCIPAL

Interview 01

Interviewer: Helen Reeves Date: 15/05/2012

A. Background

The research I am doing is based on the idea that the built environment has an impact on people both physically and emotionally, this is of course an important consideration for all people and particularly relevant for people with special needs. Very little architectural research has been done to determine the positive impacts that the built environment can have on people with learning disabilities. This research is attempting to bridge that gap.

This school teaches children with a variety of disabilities such as learning disabilities, dyslexia, emotional difficulties, ADHD and hearing impairments, a lot of the children also suffer from anxiety because of their low self-esteem. The building was built as a school in 1910, so is now over 100 years old. This means that the upkeep is difficult; when anything needs to be replaced it has to be custom made. The building is also a heritage building, so any work done on it needs to be approved by Amafa. When I first moved to this school it was a very grey institutional building and I thought to myself, why would anyone take their children out of mainstream schools which have nice buildings and atmospheres to this institution? I have worked to uplift the buildings and now parents find the school comfortable and homey and feel good about bringing their children here. In fact children now come to this school from all over the Durban area, from Ballito to Amanzimtoti. Not as many children come from the highway areas because there are two schools out that way which cater for them. The school now caters for 470 children.

B. Architecture and the Built Environment

Have you found any specific elements of the building which affect the children in either a positive or a negative way?

The building definitely impacts on the children and their parents as well.

My research thus far has led me to a couple of key design considerations. Please explain how these elements have been treated in Livingstone Primary School:

- ventilation

Ventilation within the classrooms is good but because these children need to concentrate additional air-con units have been incorporated (hidden of course because of Amafa). By ensuring a cool environment all year round the children are more easily able to focus and do not become as irritable or distracted.

- acoustics

Some of the children experience what is called Sensory Processing Auditory Disorder, which is when they battle with reverberation and distorted sounds. In some of the larger classrooms we have placed FM systems which are designed to ensure that the sound within the classrooms is the same all around and they also stop distorted sound. Carpeting is also used where possible. Acoustics are a big problem in this school; even the wooden floors provide bad acoustics. The hall as well, due to its high volume has poor sound quality; sound absorbing tiles have been placed at high levels to help with this.

- accessibility

The school has a few ramps but this is mainly for parents who are in wheelchairs. We do not cater for children with physical disabilities, only those with disabilities. There are a lot of stairs and various different levels to the school but this is suitable for the children that we have here. The children come and go throughout the school building because they go to various different therapies during the day. We have covered the external walkways with shade cloth, it is not too expensive but on rainy days it keeps these circulation spaces relatively dry.

- colour

When I got here the school was painted a dull grey colour which made it look very institutional. Slowly I have repainted the school to create a homier feel.

- openness and closure

The classrooms are small and the ideal size for the small classes that we teach here, there are a maximum of thirteen children per class. If the classes had more children the classrooms would be too small.

What outdoor facilities are available to the children?

We have a lot of play equipment and a 'commander training course' which are beneficial to the children. Nature is very important. Due to lack of funds and the lack of available land we can't expand the school, we have a playground but ideally it should be much bigger. We keep the gardens tidy and well looked after, I feel that it is so important to have good gardens; it makes the school friendlier and looks taken care of. I have planted various indigenous plants; I have also chosen the plants for their variety of colours, textures and smells which are all stimulating. When I got here there were a row of tall pine trees on the road just outside the school. I arranged for them to be chopped down because, other than the danger of them falling, they made the entrance to the school look very dark and unwelcoming. Since the trees have been chopped down the front of the building feels as though it has been completely opened up.

C. Closing Statements

All in all the school has a peaceful family feel to it and the calm environment helps the children and the parents feel more at ease. The building definitely gives a sense of hope to the children. The carpeting was also used to replace the red corridor floors in order to make the building feel less institutional. We have various play, speech and occupational therapy rooms for the children. The parents association often organise fundraisers for the school and we have a kitchen specifically for them. We also have a small library section for the parents.

APPENDIX H- Sensory Route Plants and Features

This table lists some of the types of plants and accessories which will be used in the sensory garden route through the building. This list is not exhaustive.

Taste

- Tomatoes
- Parsley
- Sugar cane
- Nasturtiums
- Strawberries
- Mint
- Chives

Touch

- Trees with rough and smooth bark
- Lamb ears
- Stones and rockeries
- Water feature
- Silver sage
- Soft lichens and moss
- Textured walkways
- Soft hammocks

Sound

- Long grasses
- Bamboo
- Palm trees
- Water features
- Bird bath and bird feeder
- Wind Chimes
- Dried leaves
- Pebbles

Smell

- Sweet pea
- Curry plant
- Lavender
- Mint
- Chives
- Coriander
- Grassy area that requires mowing
- Lily of the valley

Sight

- Marigolds
- Sunflowers
- Palm trees
- Ferns
- Aloes
- Roses
- Honey Suckle
- Brightly coloured elements
- Statues
- Tunnels
- Mobiles