EXPLORING THE EFFICACY OF DESIGN INTERVENTIONS IN A DAY CARE CENTER FOR AUTISTIC ADULTS

By

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To my grandmother and the rest of my family

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TABLE OF CONTENTS

page

ACKNOWLEDGMENTS 4

LIST OF TABLES 8

LIST OF FIGURES 9

LIST OF ABBREVIATIONS 10

ABSTRACT 11

CHAPTER

1 INTRODUCTION 13

Research Purpose 15
Definition of Terms 16

2 LITERATURE REVIEW 17

Autistic Spectrum Disorder (ASD) 17
Autism and Built Environment 24
Multi-Sensory Environments 29
Summary 32

3 METHDOLOGY 35

Research Setting 35
Primary Spaces: Main hall, Computer Room, and Quiet room 37
Main hall 37
Computer lab 38
Quiet room 38
Secondary Spaces: Entrance, Staff office, Kitchen, and Bath room 39
Entrance 39
Staff office 39
Kitchen 39
Bathroom 40
Interior Design Feature 40
Colors and lighting 40
Acoustics 41
Furniture layout 42
Snoezelen Equipment 42
Programs at the COVE center 44
Research Participants 45

Instruments 46
Architectural documentation 46
Clients Profiles 46
Behavioral Observation 46
Interviews 47
Data Collection 48
Delimitations of the Study 50

4 FINDINGS 62

Characteristics of Participants 62
Autistic Client's Characteristics 62
Staff Members' Characteristics 63
Addressing the Research Questions 64
Research Question #1: How does the Interior Environment in General Support or Not Support the Autistic Clients' Behaviors and Activities at the COVE Center? 64
Primary Spaces: Main hall, Computer room, and Quiet room 65
Secondary Spaces: Entrance, Staff Office, Kitchen, and Bathroom 68
Entrance 68
Staff office 68
Kitchen 68
Bathroom 68
The COVE center in general 69
Research Question #2: How Have the Intentionally Designed Interiors Features Influenced Autistic Clients' Behaviors and Activities? 69
Research Question #3: How Have the Snoezelen Equipment Integrated into the COVE Center Influenced Autistic Clients (Visual, Auditory, Tactile) 72
Research Question #4: How Built Environment Impact Clients with Different Types of Sensory Profiles (Hyper vs. Hypo-sensitive) 74
Research Question #5: What Are the Environmental Needs and Preferences for Staff Members to Perform Their Jobs in Relation to Assisting Their Clients at the COVE Center? 75
Summary 77

5 DISCUSSION 87

Research Question #1: How Does the Interior Environment Support or Not Support the Autistic Clients' Behaviors and Activities at the COVE Center? 87
Main Hall 87
Quiet Room 90
Computer Room 91
Research Question #2: How Have the Intentionally Designed Interiors Features Influenced Autistic Clients' Behaviors and Activities? 92
Interior Color and lightings 92
Flooring 94
Acoustics 95

Furniture 96
Research Question #3: How Have the Snoezelen Equipment Integrated into the COVE Center Influenced Autistic Clients (Visual, Tactile, Auditory) 96
Research Question #4: How Built Environment Impact Clients with Different Types of Sensory Profiles (Hyper and Hyposensitive) 99
Research Question #5: What Are the Environmental Needs and Preferences for Staff Members to Perform Their Jobs in Relation to Assisting Their Clients at the COVE Center? 100
Conclusions 101

APPENDIX

A DESIGNER'S PROFILE (Kijeong, Jeon) 104

B PAINT SCHEDULE 106

C IRB APPROVAL 108

D CERTIFICATION OF TB HEALTH REQUIREMENT 109

E CONSENT LETTER 110

F CONSENT LETTER TO CONSERVATOR 111

G CONSENT LETTER TO NON-CONSERVATOR 113

H OBSERVATION FORM 114

I INTERVIEW INSTRUMENT 115

J DEMOGRAPHIC SURVEY 117

LIST OF REFERENCES 118

BIOGRAPHICAL SKETCH 128

LIST OF TABLES

Table page

2-1 Common Autistic Behaviors Categorized by Sensitivity Level 34

3-1 Visual Snoezelen equipment 59

3-2 Auditory Snoezelen equipment 60

3-3 Tactile Snoezelen equipment 61

4-1 Autistic participants' profiles 79

4-2 Autistic participants' sensory profiles 80

4-3 Characteristics of the staff and caregiver participants 81

4-4 Autistic clients paired with caregivers 82

4-5 Number of comments on spaces from interviews 82

4-6 Observation frequency for space usage by clients' sensory profile 83

4-7 Frequency distributions from observations for spaces 84

4-8 Frequency of comments on interior design features 85

4-9 Interview data: comments on Snoezelen equipment 86

4-10 Observations on Snoezelen equipment 86

4-11 Comments on environmental needs to assist clients from interviews 86

LIST OF FIGURES

Figure page

3-1 Exterior view of the COVE center 51

3-2 Floor plan of the COVE center 51

3-3 Entrance with three LED light-boxes 52

3-4 Main hall 52

3-5 Water fountain in the main hall 53

3-6 Main hall with sensory devices 53

3-7 Quiet room 54

3-8 Computer room 54

3-9 Kitchen view 55

3-10 Annotated floor plan with Snoezelen equipment 56

3-11 Lighting installation near the entrance 57

3-12 Lighting installation near the main hall 57

3-13 Texture wall in the main hall 58

3-14 Movie projected on texture wall 58

LIST OF ABBREVIATIONS

ASD	Autism Spectrum Disorder
COVE	Community Opportunity for Vocational Experience
IRB	Institutional Review Board
LED	Light Emitting Diode
MSE	Multi-Sensory Environment
VCT	Vinyl Composition Tile

Abstract of Thesis Presented to the Graduate School
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Autism spectrum disorders (ASD) are known as complex developmental disabilities and is characterized by impairment in communication skills, deficit in social interactions, and repetitive patterns of behaviors. People with ASD also have different perceptual sensory processing, thus they are highly sensitive to the environment. Considering special environmental factors in order to accommodate specific sensory needs for people with ASD, the COVE (Community Opportunity for Vocational Experience) is an innovative new autism daycare program center designed in Paradise, CA. Using the concept of “Snoezelen”, the center was intentionally designed autistic clients by providing a variety of sensory stations. Adapting the textures, sounds, colors, and lighting to the clients created the sensory stations throughout the center.

About seven months after its occupancy, the case study was conducted to investigate the impact of the sensory environment on autistic behaviors. The assessment tools utilized in this study were in-depth interviews with 15 staff members, architectural documentation, and participatory observations of the COVE and ASD clients for two months.

Overall, individual results varied due to the different sensory issues among the ASD clients in the COVE center. However, the findings of this study showed some reduction in stereotypical behaviors and less aggression and self-injury in the stimulus environment that featured the various types of the Snoezelen equipment. The quiet room was one of the favorite spaces for the clients with hyper-visual and auditory sensory issues. Based on the results of this study, design guidelines can be developed to help not only people with ASD, but also design professionals in the built environment.

CHAPTER 1
INTRODUCTION

> But I do see a dilemma for organizations that seek to provide the ideal autism-friendly building for their children (or adults) who then go out into the world only to find that it is a noisy and confusing place with many dangers for which they are not prepared. The low functioning individual will no doubt find this less of a problem as he/she will more likely be in care for life. It is the individual who lives in both worlds that may have more difficulty. Designers must be aware of this and try to find the right balance for the particular user group that will inhabit his/her building.
>
> - Beaver, *The autism file*

What is an autism-friendly environment? How do autistic people experience the space? According to the autobiographies written by high-functioning individuals with autism, they perceive the whole environment differently (Rand, 1997; Willey, 1999), which can lead to frustration and confusion. This reveals the unique aspects of an autistic view on the built environment. Majority of autistic people who are considered non-verbal cannot even communicate their distress about the environment. Imagine you are taking an exam in the environment where lights are turning on and off rapidly, pens are tapping on desks, and the smoke detector is starting to ring. This is how autistic individuals perceive their surroundings. However, many institutional centers for autism pay no attention to the quality of the environment and are deficient in the consideration of the special needs of their clients.

According to researchers, individuals with Autism Spectrum Disorder (ASD) experience difficulty in modulating sensory input from the environment (Ayers, 1972; Baranek, 1999; Dunn, Myles, & Orr, 2002), which results in high levels of distractibility. There is a difference in perceptual sensory processing in autistic individuals, a disability commonly known as ‘sensory dysfunction’ or ‘sensory difference’ (Bauman & Kemper, 1994; Kern, 2002). Their sensory development was normal during infancy, but as they

age, these individuals show decrease, delays and regression in their sensory development, with aimless and stereotyped behavior being a particular feature (Volkmar, 1998).

An individual diagnosed with ASD may have an unpleasant reaction to ordinary sensory stimuli such as sight, sound, touch, taste, and smell from their surroundings thus making autistic individuals extraordinarily sensitive to their environment. Their response to environmental stimuli may seem unreasonable or even ‘bizarre’ to non-autistic individuals (Tidmarsh & Volkmar, 2003). They are either hypo- or hyper-sensitive to certain sights, sounds, textures, tastes, or smells. Even though the physical appearance of an autistic individual may appear normal, they react differently to outside stimuli than ’normal’ individuals.

Additionally, individuals with ASD are resistant to environmental change or changes in their daily routine. They are obsessed with detail, display repetitive behavior and prefer consistency (McKean, 2001). Some studies point out that autistic individual’s repetitive behavior could be triggered by the inappropriate environmental stimulus to help self-stimulate (Tidmarsh & Volkmar, 2003).

In recent years, awareness of autism has significantly increased. A number of studies in this field have been reported based on autistic children rather than adults. Relatively little has been written about the outcome about the effect in adulthood. A number of ASD is striking: 1 in every 88 children has been diagnosed with ASD in the United States (Centers for Disease Control and Prevention [CDC], 2012). It is life-long developmental disability; with that the need for space to accommodate autistic adults increases drastically (Volkmar, 1998).

Since those with autism experience overly-sensitive, blunted, distorted and hyper-perfect senses (Hernandez, 2003), all at the same time, it is critical to control the amount and type of sensory stimulation. This is directly related to interior design factors including but not limited to wall finishes, flooring materials, furniture, acoustics, and lighting. Relatively little attention is paid to providing effective interior environments to meet the needs of autistic individuals.

Research Purpose

The purpose of this case study was to measure the effectiveness of the recently designed daycare facility for adult clients with Autism Spectrum Disorder (ASD). Case study is an empirical inquiry, which focuses on a complex social phenomenon within its real-life context and boundaries (Yin, 2009). He also notes that the case study is a linear but interactive process of answering questions. The path of case study shows how the researcher carefully proposed research questions through literature review. Yin (2009) recommends using case study when the research questions start with “how” and “why”.

This case study took a place at the Community Opportunity for Vocational Experience also known as the COVE center at Paradise, California. This center was specially designed for adults with ASD. This study was to investigate the relationships between the interior environment taking into consideration the sensory environment and autistic clients. Ultimately, by means of this case study, the five specific research questions are as follows:

1. How does the interior environment support or not support the autistic clients’ behaviors and activities at the COVE center?
2. How have the intentionally designed interiors features influenced autistic clients’ behaviors and activities?

3. How does the Snoezelen equipment integrated into the COVE center affect the visual, tactile, and auditory stimulations of the autistic clients?

4. How does the interior environment impact on the behaviors of the autistic clients with different types of sensory profiles (hypersensitive vs. hyposensitive)?

5. What are the environmental needs and preferences for staff members to perform their jobs in relation to assisting their clients at the COVE center?

Definition of Terms

The following definitions are relevant to the present study.

- Autism Spectrum Disorder (ASD): Autism is a lifelong developmental disorder characterized by impaired social interaction and communication as well as repetitive behaviors and restricted interest caused by unusual sensory perceptions of the environment (Hill & Frith, 2003, Kanner 1943).

- Caregiver: A person who provides direct care (Merriam-Webster, 2013).

- Conservator: A preserver, a protector (Burton's Legal Thesaurus, 2013).

- Conserved client: An individual who has developmental disability that interferes with decision-making is protected and represented by someone else (Altar California Regional Center, 2008).

- Low-functioning autistic individual: An autistic individual with autism who has IQ of 54 or lower (Baron-Cohen, 2006).

- High-functioning autistic individual: An autistic individual with IQ of 85 or above (Baron-Cohen, 2006).

- Multi-Sensory Environment: An environment that provides relaxation, enjoyment, and inhibits behavioral challenges to the autistic clients (Lancioni et al., 2002).

- Snoezelen: A Dutch term that refers to the use of multisensory design elements to both soothe and stimulate patients with mental disabilities (Hulsegge & Verheul, 1987).

CHAPTER 2
LITERATURE REVIEW

This chapter presents a review of literature on the relationship between autistic individuals and their built environment. The review consists of three main sections. The first section introduces on autistic spectrum disorder. The second describes the overview of literature regarding autism and environment. The third explains Snoezelen concepts, which is controlled multi-sensory environment and application to environments.

Autistic Spectrum Disorder (ASD)

Leo Kanner (1943), the American psychiatrist was the first person who described autism, which has a range of communication problems and unusual sensory responses to their environment. Since late 1970s, the concept and the definition of autism have been refined (Wing & Gould, 1979), making the general public more aware of the high prevalence of autism. *Diagnostic and Statistical Manual of Mental Disorders,* known as DSM-IV-TR (The fifth edition, DSM-V is scheduled to be released in May 2013.) published by the American Psychiatric Association (APA) (2000, p. 70) contains three essential features for identifying Autism Spectrum Disorder (ASD):

1. Subject impairment in social interaction, manifested by (a) impairment in the use of nonverbal behavior; (b) lack of spontaneous sharing; (c) lack of socioemotional reciprocity; and/or (d) failure to develop peer relationships.

2. Impairment in communication, manifested by (a) delay in or lack of development in spoken language and gestures; (b) impairment in the ability to initiate or maintain conversation; (c) repetitive and idiosyncratic use of language; and (d) lack of pretend play.

3. A restricted repertoire of activities and interests, manifested in (a) preoccupation with restricted patterns of interest; (b) inflexible adherence to routines; (c) repetitive movements; and/or (d) preoccupation with parts of objects.

According to the Autism and Developmental Disabilities Monitoring Network (ADDM) (2012), there is a dramatic increase in the number of children identified with ASD. The overall prevalence of ASD is 1 in 88 and ASDs are five times more common in boys than in girls (ADDM, 2012). There are many studies trying to explain the causes of autism, but it still remains unknown. Some researchers found evidence of a genetic role in the etiology of autism (Folstein & Piven, 1991; Trottier, Srivastava, & Walker, 1999). Environmental causes starting to get more attention.

Individuals with autism show abnormal behaviors, including “stereotypy”, “compulsive behavior”, “ritualistic behavior”, “restricted behavior”, and self-injurious behavior. Stereotypy is a purposeless movement, such as hand flapping, head rolling, or body rocking which refers to repetitive body movements (Waltz, 1996). The individuals with autism that have stereotypic and operational behavior are defined as follows (Cuvo et al., 2001):

> Body Rocking is the moving behavior of the torso forward then back to an upright position; Body swaying is the movement of the torso right or left, and then back to the middle position; Picking is grasping an object between thumb and index finger, or dragging finger on surface until the finger was lifted; Mouthing of hand or object is a lick or placement of lips on hand or object, or placement of an object in mouth.

Compulsive behaviors consist of an intentional behavior, which follows a specific set of rules or orders. Ritualistic behavior is the adherence to a stick daily routine. Autistic individuals have difficulty adjusting to changes in daily routines, which can lead to having behavioral problems. Restricted behavior is limited in focus, interest, or activity. Restricted interests are encompassing topics or objects, which individuals with ASD pursue with great intensity and focus (APA, 2000; Ozonoff, 2004). For example, autistic people watching a fan spin around for hours. Lastly, self-injury, which includes

behaviors, that insures them to get an attention or to stimulate themselves (Bodfish et al., 2000).

In addition to the core diagnostic criteria for autism, many individuals with autism experience different sensory responses to environmental stimulus than non-autistic individuals (APA, 2012). These different sensory experiences affect the pattern of behaviors in autism. There is proven psychological research evidence for the abnormal sensory perception and processing in autism (Baranek et al., 2006). Among the autistic, the sensory abnormalities are present in 30-100 percent of these individuals (Dawson & Watling, 2000). O'Neill and Jones (1997) supported that unusual sensory responses were present in the children with autism.

Autism can be classified into three sub-categories: low-, med-, and high-functioning autism by overall IQ. High functioning IQ of 85 or above considers as high functioning, a range of 55-85 IQ is medium-, and below IQ 54 is low functioning individuals with autism (Baron-Cohen, 2006). These subgroups are not standardized.

Also nonverbal autistic individuals are considered as low functioning. Bogdashina (2003) found that nonverbal autistic people are more sensitive to the environment. Here are some disguised features of 'autistic perception' of the environment, based on the self-reports of high-functioning autistic individuals: Asperger's disorder

> The clamor of many voices, the different smells – perfume, cigars, damp wool caps or gloves – people moving about at different speeds, going in different directions, constant noise and confusion, constant touching were overwhelming (Grandin & Scariano, 1986, p. 129)

A study done by Kern et al. (2006) suggested a link between the sensory processing disorder (SPD) in autism and the difficulties in their daily life. Recognition is growing that sensory problem may be the underlying reason for stereotypy and self-

stimulatory behaviors such as body rocking and spinning. Therefore, understanding the sensory process in autism is important to reduce or prevent the autistic behaviors. Kern et al. (2006) presented the cross-sectional study that examined the sensory processing in the individual with autism using the Sensory Profile SP. The Adolescent/ Adult sensory profile (AASP) questionnaire (Brown & Dunn, 2002) is a widely used instrument to investigate sensory processing for autistic people. Most of instruments focused on children, but this assessment was focused on adults. The result of this study underscored the abnormal sensory processing compared to autistic adults. This tool can be helpful to optimize the desired sensory environment. It is a self-questionnaire sensory measurement. This can be used by high functioning autistic individuals but not suitable for adults at the lower end of the spectrum.

Autistic individual's sensory development was normal during infancy, but with increasing age they showed increasing delays and regressions in their sensory development, with aimless and stereotyped behavior being a particular feature (Volkmar, 1998). Crane, Goddard, and Pring (2009)'s study provides helpful research on sensory processing using the AASP in adults with autism. The study reported that adults with autism have abnormal levels of response to sensory stimuli, which is consistent with the previous literature on sensory processing abnormalities in individuals with autism (Kern et al., 2006). The majority of studies have been focused on children, but Crane et al. (2009)'s study suggests that abnormal sensory processing persist across the lifespan of these individuals. Therefore, Crane et al. (2009)'s study contrasts with Kern et al. (2006) who stated that the level of abnormal sensory processing in autism tend to dissipate with increasing age.

Crane, Gorddard and Pring's study (2009) is focused on the sensory processing difference in high functioning adults with autism. Majority studies on sensory processing focused on Children, but this study assessed sensory processing in adults with ASD. The study adopted AASP (Dunn, 2002), which is a self-report questionnaire to analyze the sensory profiles of each participant. This study supports the presence of sensory processing abnormalities in autistic individuals, but it is contrast with Kern et al. (2007)'s study, which reported that levels of sensory processing abnormality tend to decrease with increasing age. The assessment of sensory processing in low-functioning autistic adults is needed in the future study.

Autistic individuals' self-stimulatory behaviors such as body rocking, spinning, flapping their hands, tapping fingers, and watching things spin could be viewed as involuntary behaviors that reflect either hypersensitivity or hyposensitivity of each sense (Bogdashina, 2003). The reasons that autistic people engage in these behaviors are to block out or to activate their sensory receptors. There are no single solution to fulfill autistic children's sensory needs since each of them exhibit different sensory profile.

Children and Adult with Autism

Autistic children often display behavioral problems that caused by abnormal sensory processing. Tomcheck and Dunn (2007) described that there is a sensory processing impairment in children with autism. The finding was based on the short sensory profile (SSP) and analysis of this study is appeared to seek sensory input from auditory, vestibular, tactile, and proprioception. Daly-Fertel, Bedell, and Hinojosa (2001) indicates that autistic children with weighted vast is less distractive and more attentive at school. Therefore, sensory controlled environment or sensory modulation impairments are needed. The behavior reflects to a form of sensory malfunction when

assimilating stimulatory information from the surrounding physical environment (Bogdashina, 2003).

Hyper and Hypo Sensitivities

As noted previously, autistic people have sensory abnormalities, and the seven senses can be divided into hypo-(below normal sensitivity), and hyper-sensitive (excessive sensitivity) to certain sights, sounds, textures, tastes, and smells (Crane et al. 2009; Kern et al., 2007). Theses sensory malfunctions, commonly known as ‘sensory dysfunction’ or ‘sensory difference’ (Bauman et al., 1994; Kern, 2002) has been described in relation to sound, vision, touch, taste, smell, vestibular, proprioceptive, and kinesthetic (Kern et al., 2007). Even though there is seven senses, in this study, only three sensory including visual, auditory, and tactile will be examined and analyzed for both hyper- and hypo- sensitivities.

Delacato (1974) published the first groundbreaking study on the hyper- and hyposensitivity and found that autistic behavior, stereotypic behaviors namely withdrawals from social interaction and communication, are caused by these sensory problems. Delacato (1974) categorized each sensory channel as hyper -the channel is too open, as a result too much stimulation gets in for the brain to handle, hypo- the channel is not open enough, as a result too little of the stimulation gets in and the brain is deprived. Therefore, hypersensitivity is defined as acute/heightened, or excessive sensitivity and hyposensitivity stands for below normal sensitivity.

In the study by Bogdashina (2003), autistic individual’s common behaviors are categorized by hyper- and hypo-sensitivities. Table 2-1 presents examples of typical behaviors by hyper- and hypo- sensitivities regarding visual, auditory, and tactile sense. Each sensory has two levels of sensitivities: hyper and hypo. Each individual with

autism can have mixed levels of sensory sensitivities. For example, an autistic individual can be hyper-visual, hypo-auditory, and hypo-tactile.

An auditory processing difference is one of the most common sensory dysfunctions in autism. The Greenspan and Weider's (1997) study reported that all participants with autism showed difficulty with auditory responding either as hyposensitive or hypersensitive to sounds. Baranek et al. (1997) found that autistic people are overly sensitive to tactile input, which is described as an intense feeling that can be overwhelming and confusing. For example, certain fabric texture of the space could make them extremely anxious and distracted. The autistic clients with high levels of tactile hypersensitivity could show inflexible behaviors, repetitive verbalizations, and abnormal focused attention (Baranek et al., 1997). In contrast, special textiles make them feel comfortable and relaxed. Designing spaces for autism individuals are complex. For example, although autistic children enjoyed the experience when over-stimulated, the children become hyperactive and aggressive for the rest of the day. Therefore, a sensory balance is required not to over-stimulate them.

Trevarthen's (1998) study points out that one of the characteristics of autism is being highly sensitive to certain stimuli, or abnormal responses to the sensory environment. The individual may become very excited or obsessed by self-produce stimulation. Moore's study identifies that a various sensory stimulation should help the individuals with autism to reduce, avoid or channel these traits. Self-regulation is the coping mechanism to control one's own behavior. Individuals with autism simultaneously seek sensory stimulation to calm and self-regulate their nerves system (Stadele & Manlaney, 2001). Temple Grandin (1995) is a high functioning adult with

autism who designed a “squeeze machine or hug box”. It is to provide self-regulated deep pleasure across the body. She mentioned “Using the squeeze machine on a daily basis calms my anxiety and helps me to unwind” (Grandin, 1995, P.64). This box is widely used during a therapy session to help an autistic child’s sensory problem. This article ties in with the tactile stimulation needs of people with autism. To offer pressured tactile stimuli is needed for the autistic individuals to provide a feeling of calmness.

According to Bogdashina (2003), simply changing sensory environment can reduce many challenging behaviors of autistic individuals. For example, adding or removing sensory equipment in the space or alter interior design features can change one’s behaviors. For hyper-visual individuals, changing color of the walls can help autistic people to reduce behaviors by reducing visual distractions.

Autism and Built Environment

Since autistic people are overly sensitive to the environment, special environmental supports can accommodate clients’ specific sensory needs (APA, 2000). The built environment can play an important role in a part of autistic individuals’ daily life and their sensory processing. Many studies focused on hyper-sensitivity side of autistic client and recommend reducing stimuli in the environment, but there are some people with hypersensitivity and the more study is needed.

They experience a lack of stimulation and the stereotypical behaviors are engaged to fulfill their need for sensory stimulation. The best way to understand autistic people is learning how each of autistic individual senses work (O’Neill 1999). But keep in mind that each individual have different patterns of sensory perceptual experiences in environment and it can be difficult to meet all the individual’s sensory need at the same time and surrounding.

The built environment plays an important role in autistic individuals and requires attention while designing the facility for them. There are a numerous studies regarding the influence of the built environment upon user behavior in typical non-autistic users (Altman, 1975; Bechtel, 1997; Hall, 1966; Sommer, 1969). But research on understanding the eyes of autism and developing them into design guidelines are very limited. It is important to consider the different types of materials and finishes which are soothing for autistic individuals to filtering and mitigating the sensory impacts on them. Most of the time, overall effects of the sensory built- environment on autistic people's psychological comfort level have been ignored such as the impact of noise level; the effect of fluorescent lighting. According to Paron-Wildes (2006), the individual with autism could encounter a negative reaction when they are exposed to striped wallpaper in primary colors or hearing the hum of a fluorescent lamp.

Shabha (2006)'s study was examined the impact of the sensory environment especially visual and acoustical stimuli on autistic children's behavior in school settings. This study focused on sensory malfunction of autistic individuals as the underlying reason for stereotypic autism behaviors such as repetitive body movements or movement of objects (Waltz, 1996). The study concluded that sensory stimuli are very complex and greatly affected by the spatial characteristics, design layout and furnishing of the classroom. Also the stereotypical behavior is aggravated by the source of light, echoing sound and reverberation in larger spaces, and hard floors. This study provided comprehensive measuring framework on sensory environment and autism but the focus was on children.

Mostafa (2008) took an impacted first step in developing architectural guidelines for the autistic individuals who require a great deal of attention in educational setting in Egypt. The impact of the architectural elements on autistic clients' behavior and development was analyzed. The study was based on the 'sensory design matrix, the framework which organized into the complex and dynamic relationship between the built environment and sensory distinctiveness of the autistic children in educational setting. This study has indicated that by using an altered architectural environment we could improve the individual with autism's behavior such as increase attention span, reduce response time and improve behavioral temperament. According to Mostafa (2008), acoustics is one of the most critical factors on autistic individuals in school setting followed by the spatial layout. Some studies suggest that autistic clients have hard time to processing sound. Therefore, the acoustic qualities of the space such as mechanical systems must be designed to be as unobtrusive as possible (Myler, Fantacone & Merritt, 2003). This study considered the complex range of autistic sensory issues and related them to the architectural environment.

Heflin and Alberto (2001) discussed that the overall structure and layout of the space have a high impact on individuals with autism's level of engagement with, and ease of navigation in the surroundings. Controlling the environmental variables promotes the engagement and also draws on positive outcomes for individuals with autism (Logan et al, 1983). Regarding space layout, Mostafa (2008) defined the importance of a spatial compartmentalization in her intervention in classroom space. In order to control overstimulation and avoid an excessive number of social interactions, subdividing space into smaller areas is needed (Richer & Nicoll, 1971). Most studies

have investigated autism and environmental factors in educational settings for autistic children.

Color and Lighting

Few researchers have considered difference in individual responses to color and light. Especially, the color of the space should be taken into consideration in the facilities for autism. Hue, saturation, and value are three dimensions of color (Morton, 1995). Hue is the proper name for what we call color in everyday language (i.e., red, blue, green etc.). Saturation is the purity of the hue (i.e., vividness, with lower saturation colors containing more grey). Value refers to the luminance or light-dark aspect of the color (i.e., black-to-white quality) (Gifford, 2007).

Color is an important variable in interior design as it is a relatively easy way to alter the appearance of an environment. Previous studies suggest a link between colors and emotions, with warm colors associated with aroused feelings and cool colors with calming ones (Kaya & Epps, 2004; Valdez & Mehrabian, 1994). However, these results are not always consistent and sometimes they are even contradictory.

There are some studies about the relationships between color and behaviors. First, Schauss (1979) claimed that pink color effects on the suppression of aggressive behaviors for a short amount of time. The pink color acts as a natural tranquilizer and provides relaxation and calmness. Schauss (1979) suggested pink color should be applied where sudden or uncontrollable aggression is present. Also in Raja Yoga practice, the pinkish color of the lighting is used to promote the relaxation for the meditation. But the later study by Pellegrini et al (1981), which they changed the color of a county jail from pale blue to hot pink to see the reduction in prisoners' aggressive behavior. But the result was not substantiated. There was no indication of aggression-

reduction attributable to pink. These studies only the hue of the color was considered and they ignored the different values and saturations of the pink. Guilford (1934) states the brightness and saturation of the color influence whatever affective value accrues to colors. Perhaps a specific shade/value of pink should be used to see the “Tranquilizing” effects of pink.

Some studies have been suggested that a child with autism tend to experiences the obsessions (Moore, 2004) and sensitivity to colors but there have been limited experimental investigation. Franklin et al. (2008) provides ample information about color perception in children with autism. This study is based on the two experiments, color memory (experiment 1) and color target detection tasks (experiment 2), between children with autism and typically developing children. Franklin et al. (2008) found that children with autism have less accuracy of the color memory and color target detection than those without autism. There is no strong empirical evidence for specific color recommendations for autism facilities, but warm neutral colors prevent overstimulation with ASD children and have negative effects for primary colors (Clay, 2004). Based on Gaines and Curry (2011), functional aspects of colors are more important the aesthetics of colors for inclusive individuals.

According to Mostafa (2008)’s Sensory Design Matrix, the use of bright colors is needed for hypo-visual and neutral colors are better for hyper-visual individuals with autism. Also the quantity of color usage is important in physical learning environment. Large amounts of color usage over stimulate individuals. Verghese (2001) states too much color, motion, or pattern as distracters making visual search difficult which can be lead to a stressful environment.

Paying attention to lighting is a crucial. Fluorescent lights flickers 60 times per second (Shore, 2001). Fluorescent lighting is a common source for distracting stimuli, because it is a repetitive flashing stimulus, which makes the autistic people's brain confused and complicated (Darius, 2002). The construction and installation of a fluorescent lamp requires ballast that generates an audible hum and a cyclical flicker from the electric input (Rea & Mark, 2000).

Many studies suggest that fluorescent lighting can create unexpected behavior from autistic children (Beaver, 2010). Considering incandescent lighting is the most important feature of creating more accessible environments for autistic individuals (Davidson, 2009). Light-emitting diode (LED) light is a new lighting technology, creating new collective colors of light.

Multi-Sensory Environments

Multi-Sensory Environment (MSE) is a therapy for people with autism or developmental disabilities. It consists of placing the person in a soothing and stimulating environment, the "Snoezelen room". These rooms are specially designed to deliver stimuli to various senses, using lighting effects, color, sounds, music, scents, etc. (Cuvo et al., 2001)

The multi-sensory stimulation environment can provide relaxation, enjoyment, and inhibit behavioral challenges to the autistic people (Lancioni et al., 2002).

Snoezelen concept more known in Europe was initially developed in Netherlands in 1975 (Thompson & Martin, 1994), which considered as a leisure and recreation facility. The word of Snoezelen made of two Dutch words, "snufflel", to sniff out or explore one's environment, and "doezelen", to doze or relax (Hulsegge & Verheul, 1987). Flag house Company first adopted the European Snoezelen concept and

launched equipment in 1992. Flag house signed an exclusive distribution agreement for North America with ROMPA, the owners of the Snoezelen trademark. Now, there are more than 700 Snoezelen installations in North America (Flag house, 2013).

A Snoezelen environment consists of sensory equipment such as mirror light balls, vibrating floor mats, bubble columns, rocking chairs, sounds of animals or the sea, and fiber optics. MSEs are used with individuals with sensory modulation disorders, including autism and asperser's diseases. Pinkney (1997) concluded that selecting a combination of the appropriate stimulation for each individual is needed, instead of waiting to see something happen in the MSE.

Based on Pagliano (1997)'s study, MSE helps to reduce stress, and self-injury behaviors, communication skills have been improved as well as staff/client interaction. Also increase length of calmness and in skill repertoire. This study was interviewing staff from an Australian special school with the MSE over a two-year period. The study suggested the MSE should use as an 'open-minded' space: A living environment, where the environment is determined by the needs of the user and bring diverse selections of society together (Pagliano, 1997). Also there are few studies which reported decreased frequency and duration of challenging behaviors for children with moderate and severer intellectual disabilities in a MSE compared to a playroom (Shapiro, Rarush, Green, & Roth, 1997).

Cuvo, May, and Post (2001)'s study involved two experiments to test effect of a room with sensory environment on challenging behavior. First part of an experiment found that stereotypic behavior such as body rocking, hand flapping, and head rolling decreased in the Snoezelen environment because the autistic clients obtained more

sensory reinforcement from interacting with the sensory equipment than from engaging in stereotypy. This was effective only when the participants went from their living room to the Snoezelen room. But decrease in engagement when they returned to the living room from the MSE. However, there is little evidence of any persisting, and significant carryover to the non-Snoezelen environment.

Second part concluded the autistic individuals, were most favored outdoors, followed by Snoezelen room and least favorable in the living room. Second, there is a positive effect of walking and swinging on stereotypic behavior, which support previous studies done by Bachman and Fuqua (1983), and Kern et al. (1984). These studies suggested a positive relationship between intensity of exercise and reducing in challenging behaviors. This study shows the effectiveness of the Snoezelen environment over the living room, and outdoor condition may have been more effective than the Snoezelen condition. It could be explained by the visual stimulation provided by outdoor was much greater than by sensory equipment in the Snoezelen room (Cuvo et al., 2001).

According to Mckee, Harris, Rice, and Silk (2007) study, there are no relationship between aggression and challenging behavior in three autistic participants. This study did not support the effectiveness of Snoezelen environment to autistic clients, such as decrease in challenging and aggressive behaviors. This study suggests that, the fund should be used for hiring more behavioral technicians or providing behavioral training to current staff instead of expanding Snoezelen environment.

In recent literature, a number of studies support positive effects on socially adaptive and maladaptive behaviors, such as aggression and self-injury, of the

developmentally disabled individuals while they were exposed to the Snoezelen environment (Cuvo, 2001, Mckee et al., 2007, Singh et al., 2004). An environment of controlled sensory stimulations could demonstrate calming, gradient lightings, soft motions and calming music. The MSE environment could benefit to clients with more relaxed and calming spaces that could help their sensory processing. Autistic behaviors can be influenced favorably by changing the sensory environment. Some researchers found a link between the autistic individuals with sensory integration problems and their difficulties with daily life (Dunn, 1999). By understanding the characteristic of this disorder special sensory need of the autistic users, this environment may be designed favorably to adjust the sensory input, and perhaps change the autistic behavior.

In summary, individuals with autism react differently to the environment than typical individuals. But within autistic individuals, each of them has different sensory responses (such as hyper- or hyposensitivity) to the same environment. Therefore, designing the space, which could accommodate two groups, is a critical issue.

Since 1980, there has been the tremendous increase in research on autism. Most studies have been involved in children and still there is a large gap in understanding of autism with adult. Therefore, the case study of the recently designed facility for the adult clients with autism was conducted to understand the effectiveness for autistic behaviors in the designed space.

Summary

The literature describes the association between autism and the built environment. However, there are limited studies focused on autistic adults and did not look at the different levels of sensitivities of autistic individuals. Autism is a lifelong developmental disability, and challenging behavior changes with age from simple to

more complex interest (Huebner, 2001). Therefore the researcher must consider this group of people and provide them appropriate environments.

Autistic individuals experience the sensory processing impairment. They are extremely sensitive to the environment than non-autistic people. Each sense can be divided in two categories: hyper- and hyposensitivity. Many studies suggest that appropriate multi-sensory environment can help to reduce challenging behaviors of autistic individuals. Also evidence based interior design features such as color, lighting and space layout can facilitate them to engage and reduce self-injury behaviors. This study is necessary to identify different environmental needs for distinctive sensory groups of adult autistic individuals.

Table 2-1. Common Autistic Behaviors Categorized by Sensitivity Level

Sensory Issues	Sensitivity	Common Behaviors
Vision	hypo-sensitive	Is attracted to light Looks intensely at objects or people Moves fingers or objects in front of the eyes Is fascinated with reflections, bright colored objects Runs a hand around the edge of the object
	hyper-sensitive	Constantly looks at minute particles Picks up smallest pieces of dust Dislikes dark and bright lights Is frightened by sharp flashes of light, lightning, etc. Looks down most of the time COVErs or closes eyes at bright light
Sound	hypo-sensitive	Bangs objects, doors Likes vibration Likes kitchen, bathroom Likes crowds, traffic, etc. Tears paper, crumples paper in his hand Is attracted by sounds, noises Makes loud rhythmic noises
	hyper-sensitive	COVErs ears Is a very light sleeper Is frightened by animals Dislikes thunderstorm, sea, crowds, etc. Dislikes haircut Avoids sounds and noises Makes repetitive noises to block out other sounds
Touch	hypo-sensitive	Likes pressure, tight clothes Seeks pressure by crawling under heavy objects Hugs tightly Enjoys rough and tumble play Prone to self-injuries Low reaction to pain and temperature
	hyper-sensitive	Resists being touched Cannot tolerate new clothes; avoids wearing shoes Overreacts to heat/cold/pain Avoids getting ‘messy’ Dislikes food of certain texture Avoids people

CHAPTER 3
METHDOLOGY

This chapter presents the research methods of this study: the research setting, the study participants, the instruments, and the data collection procedure as well as architectural limitations. To accomplish the purpose of the study, this POE study was used the data collection strategies including architectural documentation, participatory observations, client profile, and in-depth interviews.

Research Setting

California Vocations Inc is a non-profit organization where provides residential and vocational support to developmentally disabled adults (18 years and older) in California. The organization offers three sub-programs: Licensed Residential Cares, Supported Living Services, and Day Programs. The California Vocations Inc. opened a Day Program naming the Community Opportunity for Vocational Experience (COVE) center in Paradise, California. The COVE building has been renovated from an old church building into the vocational center. Since it has opened in December 2008, the center serves as a place for community-based behavior management program for developmentally disabled adults including those with autism.

The COVE offers flexible individualized programs to each client, where mainly focuses on vocation-related curricula for developmentally disabled people. Each client has a personalized daily schedule created by project managers based on their interests and needs. Every Monday, project managers create the schedules according to clients and staff members' availabilities. Not only the COVE center offers indoor programs to the client, but also helps them to engage in a various outdoor activities. During the weekdays, the center operates from 9 am to 2 pm for developmentally disabled clients;

and after hours, the center opens to the public for a community-gathering place by appointments.

The COVE center is located on 565 Pearson Road in Paradise, California; right across from the Paradise Elementary School. The building lay out in a rectangular form and the overall size of the building is 56’ by 50’. From the exterior view, the center looks no different than a typical building (Figure 3-1). However, entering the building, remarkable interior design features in the building are geared to provide a soothing and calming atmosphere for visitors.

The interior designer, Kijeong Jeon, a licensed award-winning designer (Appendix A) renovated 2,800 square feet of interior spaces into a vocational hub for adults with developmental disabilities including autistic individuals. Based on the designer’s initial background research on autism, he applied the knowledge into the unique design features throughout the COVE center. As shown in Figure 3-2, the COVE building has an office, a main hall, a kitchen, two restrooms, a computer room, storage, and a quiet room.

In order to understand the designed COVE center, each space is further explained based on the information obtained from the designer and by the researchers’ observation. The researcher categorized the COVE center into two groups: Primary and secondary spaces. Primary spaces include: Main hall, computer room, and quiet room. Secondary spaces include: Entrance, staff office, kitchen, and bathroom. The following section will describe each group, but focus on the primary spaces.

Primary Spaces: Main hall, Computer Room, and Quiet room

Main hall

A main hall is about 1,568 square feet (56’ by 28’) with a ceiling height of 11’-0”, which is higher than rest of the spaces (Figure 3-4). Throughout the main hall, cork tiles are installed on the floor. There are five 3 inches wide cork tile stripes with darker finishes, which form liner floor patterns. The each stripe connects two built-in plasters across from each other and it creates visual connections between two.

The overall paint color in the main hall is BM HC-32 Standish White (Munsell color match is 10Y 9/2) (Figure 3-9). There are fourteen slanted built-in plasters painted with BM Dark purple (Munsell color match is 7.5RP 2/2), which definitely stands out from the overall wall color. Edge of the ceiling is curves and it creates more enclosed feeling of the space. Acoustic ceiling tiles are installed and COVE lightings are integrated into the ceiling. The main hall is filled with various sensory devices (Figure 3-5) that will be explained in later section in depth.

The main hall can be divided into three areas by activities: Movie lounge area, arts and craft activity area, and water fountain area. The custom designed water fountain (Figure 3-5) is placed in the middle of the main hall. It is sculpted from the metal and should the water gurgling down in a consistent rhythm according to the designer. The perimeter of the fountain itself also provides seating. There are two tables and six chairs placed in movie/lounge area. A textured wall has been installed on right side of a main hall wall. The textured wall is made of different sizes of rectangular blocks, which creates optical illusions. In front of that wall, a projector screen is mounted on a ceiling. The clients watch movies on textured wall or projector screen.

Computer lab

A 10’-0” by 30’-0” rectangular room with 8’-0’ ceiling height serves as a computer room (Figure 3-7). The computer room has a single 4’-0” by 3’-0” window with blind facing the South, Pearson Road of the building and a 4’-0” by 4’-0” observation window creates unobstructed views to the main hall. Four personal computers with touch screens, a MAC workstation and a multi-functional printer are placed on a built-in countertop. One of a computer is connected to the weather device to track the weather from inside.

This room can be used as a technology learning laboratory, and the movies, games, video clips can be played on the computer. The computers are placed on top of a linear built-in counter top. Extra stacking chairs are stored in this room for other events. Lightweight stacking chairs promote the portability and flexibility. Vinyl composition tiles (VCT) are applied on the floor that composed of yellow tone colored vinyl chips. There are four recessed lights installed in a ceiling. All walls are treated with BM HC-32 Standish White color (Munsell color match is 10Y 9/2) and SW7004 Snowbound (Munsell color match is 10GY 9/2) for the ceiling.

Quiet room

A quiet room also known as a pink room is 10’-0” by 16’-0” with 8’-0” high ceiling (Figure 3-6). The only one wall painted pastel blue accent color (BM824 Ying Yang; Munsell color match is 2.5 PB 5/4) with pink circles accent. The rest of the walls are painted in pastel pink color (BM1283 Heart Delight; Munsell color match is 7.5R 8/4) with blue circles on the top for the walls side to the blue wall. This room has two 4’-0” by 3’-0” windows on exterior wall of the building. A 4’-0” by 4’-0” observation window was drawn on an original floor plan, but it was not there on site.

Two windows looking outside have blinds and usually it is closed most of times. This room has an interactive bubble tube, a crushed mat, a vibro-music chair, two color wheel projectors, and two fiber optic light sets.

Secondary Spaces: Entrance, Staff office, Kitchen, and Bath room

Entrance

The dimension of the COVE entrance is approximately 9’ by 11’ with 8’ high ceiling. The overall color of walls is Benjamin Moore, BM474 Mistletoe (Figure 3-9). The left entrance wall is accent painted with BM272 Avant Garde and, around a doorframe is painted BM028 Rich Coral color (Appendix B). The COVE center’s signature signage is located on the same side of the left sidewall and welcomes visitors to the building. On the opposite wall, three LED color-lighted panels are installed (Figure 3-3). The floor covering changes from tile to cork and two doormats are placed on the floor.

Staff office

An office is located on the left side of the entrance, where the door frame is painted with BM 028 rich coral color (Munsell color match is 5R 6/8) . The size of office is 190 squre feet (10’ by 19’), it is the same size as a quiet room.

Kitchen

Kitchen area at the COVE center (Figure 3-8) has snack bar with healthy snacks, coffee, and other beverages. It also has a popcorn machine so during a movie time, all users can enjoy popcorn. This 12’ by 12’ square kitchenette painted with Standish color walls features with white cabinets and darker finish counter tops. It has a window opening (32” AFF) in the wall facing the main hall. This opening helps to serve the snacks or beverages to the clients. Also it has two single windows above the sink,

facing the parking lot. The floor is also treated with vinyl composition tiles (VCTs). It has yellow and white floor tile pattern.

Bathroom

There are two unisex bathrooms in the COVE building. The larger bathroom (8' by 12') is ADA compliant bathroom, which has accessible stall, sink, grab bars and shower. Also shower chair is provided. It has accent tile wall on the left side of the bathroom and uniquely designed. The smaller one (7' by 8') has accessible stall, grab bars and sink. Both bathrooms have 8' high ceiling with CFL recessive lighting. Also tiles are installed for flooring. All walls are treated with BM HC-32 Standish White color in bathrooms.

Interior Design Feature

Colors and lighting

An overall color scheme of the COVE building is neutral color tone with some accent paints. Ten different paint colors from different vendors were used throughout the building: Standish White, Snowbound, Avant-garde, Mistletoe, Brewster Gray, Rich Coral, Mythodology, Ying Yang, Adirondack Green, and Hearts Delight (Figure 3-9). Table 3-1 presents the paint schedule of these ten different colors.

Munsell color system is an official color system, which created by Albert H. Munsell. It is widely used in color research and has three-color properties, which include hue, value, and chroma. In this study, the paint colors of the COVE building has been converted to Munsell color notations for simplify color communication and minimizing guess work.

Various light sources are used in the center. First, color-changing LED lights are installed in right side of the entry wall to partial ceiling in the entrance (Figure 3-10) and

in the COVE ceiling at the main hall: A COVE ceiling provides a soft curve or slope between the wall and the ceiling (Figure 3-11). LED rope lights are placed in three wall light panels. The dimension of wall panel is 15” by 72” each and placed three on the right side of the entry wall. And continuing of those panels, three more panels are installed perpendicular to the previous panels, and mounted on the ceiling. These LED lights allow the lights to cycle through a continuous color-changing pattern (red, blue, green, and yellow), or stop the controller, which located in the office at any preferred color depends on daily activities.

Second, there are six track-mounted 150W halogens “Theatrical lights” installed in recessed light well which is 18” wide, track in horizontally across the main hall. Third, recessed lightings were located throughout the building.

Flooring

There are three different flooring materials applied: cork tiles, VCT tiles, and ceramic tiles. The main hall floor and the quiet room are finished with cork tiles. Two different shades of cork tiles are applied on the surface of those two areas. Flooring borders and four stripes on main hall floorings are treated with darker cork colored finish than the rest of the main hall cork tile flooring. Second, VCT tiles are installed in a computer room and a kitchen. Lastly, bathrooms and partial entrance are finished with porcelain tiles.

Acoustics

Walls of the COVE center are installed with kicking prevention and soundproof wall. Also the ceiling is treated with acoustic ceiling tile to absorb sounds (Figure 3-11).

Furniture layout

There are five square tables and fifteen stackable yellow chairs throughout the main hall (Figure 3-4). Two tables and six chairs are located right side of the main hall near movie/lounge area, so the client can watch the movie or eat lunch. The users also play board games in here. Three tables and nine chairs are placed the left side of the main hall near the art activity area.

Snoezelen Equipment

For autism clients, the designer incorporated the concept of “Snoezelen” which is a controlled multi-sensory stimulation (Lancioni, Cuvo, & O’Reilly, 2002) into the COVE center. The COVE center is equipped with a various types of Snoezelen stations and carefully placing them by their functions and purposes (Figure 3-9). The concept of Snoezelen is based on the belief that there are basic human needs to seek sensory stimulation, to make senses of the world, for relaxation, and for enjoyment (Haggar & Hutchinson, 1991)

The Snoezelen environment provides different spatial configuration and stimulus arrangements; offering the person’s multiple stimulation opportunities, covering all sensory channels (G.E. Lancioni et al., 2002). A variety of sensory stations at the COVE were designed to explore textures, colors and lights such as bubble tubes, calming music and LED lighting provide client with a stress free learning environment. This COVE is one of the few public centers for people with ASD considering the interior environment to support the autistic clients at the State of California.

Nineteen Snoezelen interventions where purchased from Flag house, which offered visual (Table 3-1), auditory (Table 3-2), and tactile (Table 3-3) stimulation. Visual stimulated equipment contains four multi-color bubble tubes, two color wheel

projectors, two fiber optic comb light curtains, three fiber optic light sets, a diamond bubble wall, and a bubbling water panel.

Multi-color bubble tube is a flood of air bubbles in a tube of water and changes color at the press of a switch. Interactive bubble tubes that located in the quiet room allow user to press the individual buttons on the switchbox controller to initiate a color change or to stop/start the bubble flow. Also it can be pre-programmed display, so the client can relax and enjoy the visual stimulation. Fiber optic comb light curtain and fiber optic light set is up as cascading waterfall effects, and also it can be served as a tactile stimulation by touching them.

Color wheel projector provides different shapes or images of lava lamp-like effects. It can be used on any flat surface including walls or ceilings. Diamond bubble wall can mirror all ocular input and multiply every move and action of the users. Bubbling water panel is a wall-mounted panel, which intrigue the visual perception with the flowing, ever-changing colors. It mounted on the wall near the art and craft area.

Tactile stimulated equipment includes two vibro-music beanbag chairs, two sensory weighted blankets, two fiber-optic comb light curtains, and a “Rock Gel” Set. Vibro-Music beanbag provides a comfortable support with music-responsive vibration. Sensory weighted blanket creates a secure therapeutic solution to the clients. “Rock Gel” Set brings a sensory integration program into the wall-climbing unit.

Auditory stimulated equipment includes a giant 8-tone drum and three vibro-music beanbag chairs. Giant 8-tone drum helps auditory processing. Large drum produces deep vibration and eight separate tones.

Additionally, there is a COVE lighting installed at the ceiling that gives Snoezelen lighting effect. LED lights transit colors from blue to green, purple, white, and yellow. The COVE uses soft, multicolored fiber optic lighting for the ceiling outer part of the tray of the ceiling and lava lamps that change colors.

Programs at the COVE center

As the COVE stands for the community opportunity for vocational experience, they offer the community based work and behavior management program for developmental disable adults. The COVE as a day program center offers a structured daily program with regular activity schedule for adult with autism. Three program managers create a weekly schedule at the COVE center. The COVE offers indoor and outdoor activities depends on individual's needs and preferences. The managers at the COVE center try to balance these activities.

Typically, autistic clients stay at the COVE center for an hour to three hours. During the wintertime, they tend to spend more time at the COVE center than the summer time due to the weather. The duration of staying for each client at the center depends on the activities and number of occupants. Project managers avoid scheduling more than two activities for different groups of clients at the same time.

The indoor activities are as follows:

- Technology enhancements at a computer lab
- Watching movies
- Arts and Craft
- Listening to the music
- Meditation time at the quiet room
- Playing board games
- Snack and Lunchtime

Research Participants

The participants for the study were developmental disabled clients (18 years and older) who use COVE facility. Also staff members who work for California Vocations Inc. and are assigned to the COVE Day Program were included in the study. There are twenty-two staff members: five administrative staff (a director, an assistant director, and three program managers) and seventeen caregivers. Thirty-seven developmental disabled clients were registered for the Day Program at the COVE center. Fifteen out of the 37 clients were diagnosed with autism. The samples for this study were these 15 autistic clients: 2 females and 13 males.

Prior to the study, approval from the University of Florida Institutional Review Board (IRB) was obtained (Appendix C). Also, consent letters were prepared by the researcher to obtain authorization for accessing their confidential personal profiles. Among fifteen autistic clients, ten were conserved while five were not conserved. By sending a consent letter to the conservators of the autistic clients and obtaining permission from them, the researcher was able to access the personal profile of the clients through a designated staff member at the COVE. The rest of five non-conserved clients signed consent form to access their profiles in the presence of a designated staff member at the COVE center. Therefore, thirteen profile files were granted for the study, which was 87% (n=13) response rate. Also, conservators of the autistic clients, clients by themselves (if they are not conserved) and staff members signed consent forms for the observation of fifteen clients while they use the COVE facility and the interviews with the staff members. The participants' names remained anonymously and coded by numeric and alphabetic letters. For the interviews, caregivers and staff members signed a consent form.

Instruments

To support a case study, the mixed method research strategies including, analysis of architectural documentations, participatory observations, profiles of the clients, and in-depth interviews were used.

Architectural documentation

First, the designed interior environment for the developmental disabled clients was thoroughly documented as part of the multi-method approach to gather further information. The architectural features of the COVE center were examined. Room sizes and square footages were noted, as was adjacency and location of rooms. Interior design features including colors, lighting, acoustics, furniture arrangements, room materials and finishes were documented as well as Snoezelen integrations and design details in relation to multi-sensory issues.

The documentation was depicted through taking photographs and sketches of the furniture arrangement, room location, and adjacencies. Video camera (Camcorder) was used to capture the simulation effect of the LED light and color and the autistic clients behaviors in special events and environments.

Clients Profiles

A client's profile was used to help verify and confirm information gathered through the interview process, as well as to document clients' environmental behaviors and patterns in the purposefully designed interior spaces of the COVE center.

Behavioral Observation

A participatory observation was conducted as a primary research method to collect data. The researcher participated in the activities with the autistic clients in the COVE center for the two months of the period collected from June –August, 2009. The

researcher observed the COVE center and how clients behavior in thirty-minute intervals.

Two major observation tools were employed to gather information regarding environment and behavior issues: 1) a semi-structured observation form, 2) a scaled floor plan of the COVE center was used to trace the any behavioral and physical movement changes. The observation form (Appendix H) was created to observe by detecting the autistic clients' individual and group behaviors. Some of program components to observe were age and gender differences/similarity, the role in the activity, social interaction, the use of the COVE spaces, environmental interaction, and Snoezelen equipment involvements, etc. The scaled plan was used to depict behavioral mapping in order to observe the individuals and groups behavioral patterns and their relationship to the use of the designed space at the COVE center. Typically most of clients came to the facility daily based on their daily schedules, which generated by project managers. Each client varied the time they were spending at the center.

Interviews

In addition, personal private interviews were conducted with staff members only because of the limited ability of the autistic clients' communication skills. The interview questions for staff members had two parts: 1) a simple questionnaire for demographic information, 2) a guided interview questions to answer the purposes of this study. Semi-structured interview questions were developed to have a series of topics covered; yet allow the option to change the sequence or the form of questions depending on the given situation. Interview questions were included the staff members' environmental needs and preferences in relation to assisting their clients at the COVE center.

Additional question was asked regarding their perspectives of their clients' behaviors in the intentionally designed interior environment (Appendix I).

Data Collection

Upon the permission to the POE study of the COVE center, the researcher had to take care of some requirements by the regulations of the California Vocations Inc. because the COVE operates under the State of California Community Care Licensing. Prior to arriving at the COVE center to collect data, the researcher had to take a TB test and the test result of the researcher was negative. All regulations to participate in the events at the COVE center were received from the California Vocations Inc. and the researcher signed forms of requirements and agreements. It was required that the researcher can be present in the COVE facility as a volunteer, under the agreement that the researcher should not provide any of "direct care" to the clients, and should be supervised by the one of staff members all the time.

To collect data, the researcher was on the site for two months from June 2009 to July 2009, on the weekdays from 9:00 a.m. through 2:00 p.m. The data collections took place at the COVE center during seven weeks. All on-site data collection methods were used for the study; include the architectural documentations, client profile assessment, and personal interviews with caregivers of the clients, and participatory observation.

The first day, upon arrival of the center, the researcher attended a mandatory meeting with the director and the interior designer of the COVE center to discuss the scope and the needs of the study. Also the researcher reviewed rules to follow usage of the facility, and met all staff members at the COVE center. Following the meeting, a detailed tour of the COVE center was provided by both designer and the director of the COVE. On the next day, the researcher walked through the COVE center independently

to have a better understanding of the spaces and to create an inventory of the space: the use of the spaces, interior design features, furnishings and sensory equipment in the center. The rest of the first week was used to understand the usage of each space, getting familiar with all autistic clients, and trained by the staff members about the systems and programs at the COVE.

For this study, nine assigned caregivers and five administrative staff members were able to conduct in-depth interviews at their convenient times. Participation was voluntary and they were asked to read and sign the consent form and fill out the questionnaire for the personal information prior to the interview. Each session of the interview lasted approximately 30 minutes and all interviews were tape-recorded.

By obtaining consents from the conservators of the clients and client themselves, the participatory observations were made for twenty to thirty minutes duration on each autistic client's behaviors whenever the fifteen participants were occupied in the interior spaces for individual and group activities. Observations were typically made Monday through Friday between 9:00 AM to 1:00 PM.

Summary

This case study was conducted at the COVE center, a daycare facility for autistic individuals with the permission of the director. A mixed method was utilize to collect data. The primary spaces were a main hall, a computer room, and a quiet room. Entrance, staff office, kitchen, and bathrooms were considered as secondary spaces. In this study, the researcher focused on primary spaces. Also each interior design feature such as colors, lighting, flooring, acoustics, and furniture layout in the COVE center was described in this chapter. Lastly, detailed list of Snoezelen equipment throughout the center was illustrated and programs at the COVE center was presented. Architectural

documents, participatory observations, profiles of the clients, and interviews were used to collect rich data set of the study.

Delimitations of the Study

Since data were collected during the summer, the autistic clients spent most of their time outdoors with their caregivers. Therefore, no observations were made some days in the COVE center. Also, because the nature of most autistic client's characteristics is being non-verbal, the direct interviews with them were not able to perform. The clients' behaviors and reactions of the COVE center were expressed through their primary caregivers during the interviews. Although it was the participatory observation during seven weeks, only one researcher observed the client's behaviors in the COVE center.

The COVE center was a pro bono project, which was on conservative budget. It could limit from fully accommodating special needs for the autistic clients. For example, the designer could not execute all of his initial design due to the budget. We do not know if that design should make a huge impact on autistic client's behaviors. There should be a balance between efficient and cost effective autism center design and design that focuses on providing for the unique needs of special needs people with ASD.

Figure 3-1. Exterior view of the COVE center (Photo courtesy of Mina Bevan)

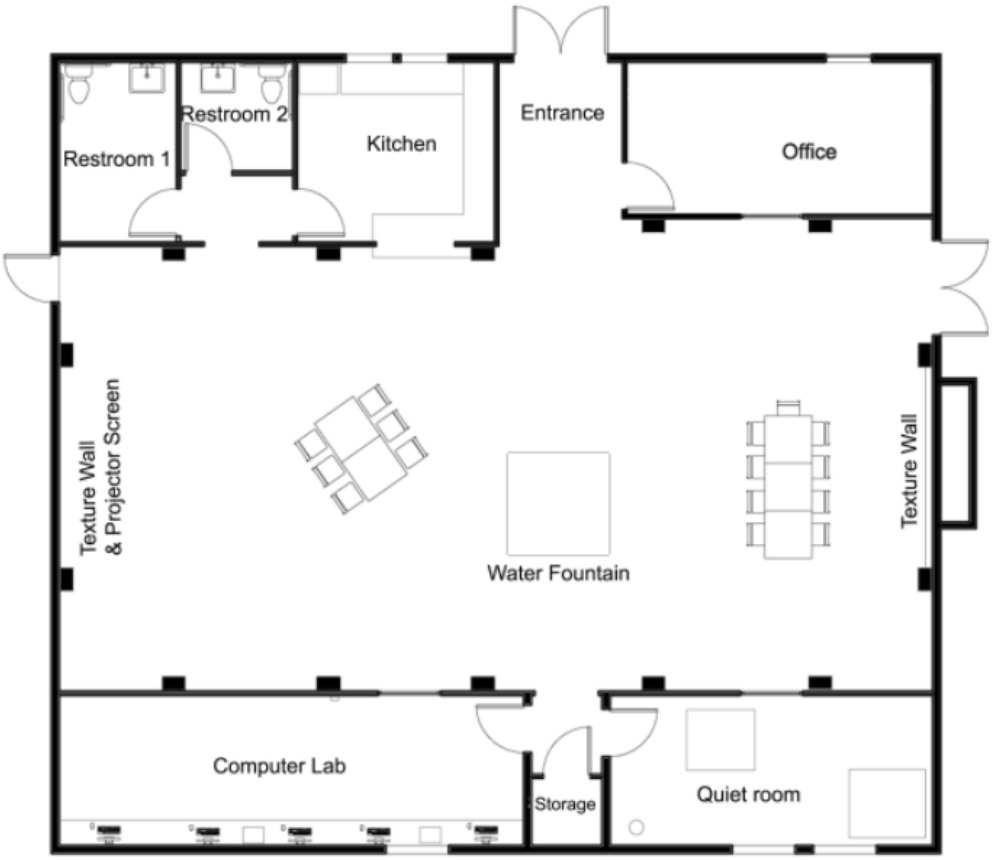


Figure 3-2. Floor plan of the COVE center

Figure 3-3. Entrance with three LED light-boxes (Photo courtesy of Kijeong Jeon)

Figure 3-4. Main hall (Photo courtesy of Mina Bevan)

Figure 3-5. Water fountain in the main hall (Photo courtesy of Mina Bevan)

Figure 3-6. Main hall with sensory devices (Photo courtesy of Kijeong Jeon)

Figure 3-7. Quiet room (Photo courtesy of Kijeong Jeon)

Figure 3-8 Computer room (Photo courtesy of Mina Bevan)

Figure 3-9. Kitchen view (Photo courtesy of Mina Bevan)

Figure 3-10. Annotated floor plan with Snoezelen equipment

Figure 3-11. Lighting installation near the entrance (Photo courtesy of Kijeong Jeon)

Figure 3-12. Lighting installation near the main hall (Photo courtesy of Kijeong Jeon)

Figure 3-13. Texture wall in the main hall (Photo courtesy of Kijeong Jeon)

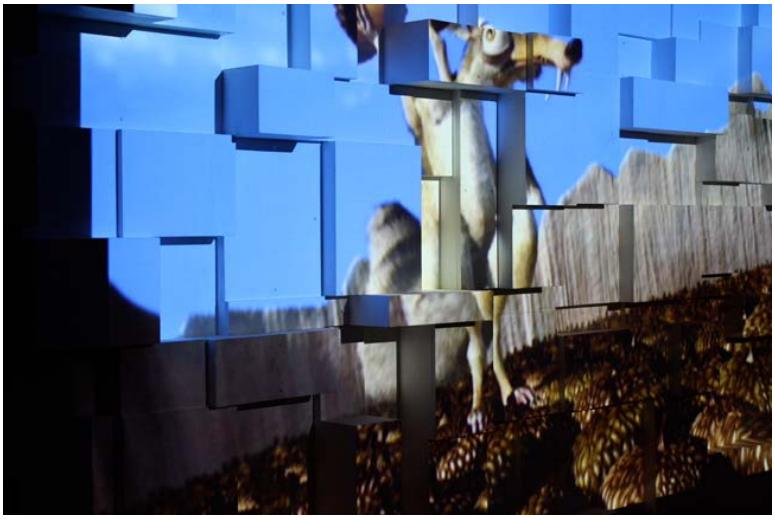


Figure 3-14. Movie projected on texture wall (Photo courtesy of Kijeong Jeon)

Table 3-1. Visual Snoezelen equipment (Images and descriptions from www.flaghouse.com)

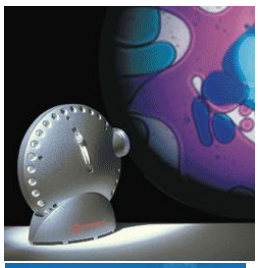
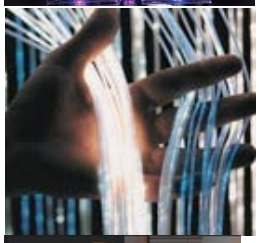
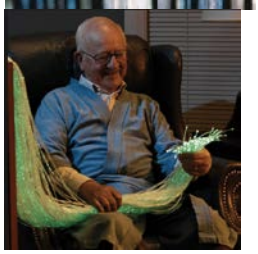
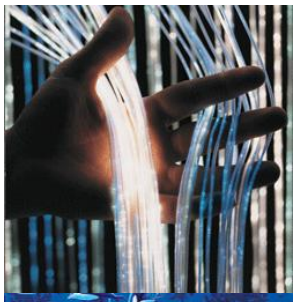
Equipment	Image of Equipment	Quantity	Sensory Stimulation	Description
Multi-color Bubble Tube		4	Visual	A flood of air bubbles ascends in a tube of water that can change color (red/blue/green/yellow/orange) at the press of a switch.
Color Wheel Projector		2	Visual	Projecting lava “bubbles” onto any flat surface, including walls or ceilings.
Diamond Bubble Wall		1	Visual	Mirroring all ocular input and engendering continued curiosity
Bubbling water panel		1	Visual	Intrigue the visual perception with the flowing, ever-changing colors of this wall mounted water panel.
Fiber-Optic Comb/ Light curtain		2	Visual/ Tactile	It provides visual and tactile stimulation and offer clear, crisp light and brilliant colors. Automatically changes colors
Fiber Optic light set		3	Visual/ Tactile	Lie on them. Wrap your body in them. Stroke them gently with your fingers. Extremely effective method of providing visual and tactile stimulation

Table 3-2. Auditory Snoezelen equipment (Images and descriptions from www.flaghouse.com)

Equipment	Image of Equipment	Quantity	Sensory Stimulation	Description
Giant 8 Gone Drum		1	Auditory	Large drum produces deep vibration and 9 separate tones.
Vibro Music Bean Bag		2	Tactile; Auditory	It combines comfortable support with deep music-responsive vibration. Ideal for positioning, calming, hyperactivity, relaxing and more.

Table 3-3. Tactile Snoezelen equipment (Images and descriptions from www.flaghouse.com)

Equipment	Image of Equipment	Quantity	Sensory Stimulation	Description
Vibro Music Bean Bag		2	Tactile; Auditory	It combines comfortable support with deep music-responsive vibration. Ideal for positioning, calming, hyperactivity, relaxing and more.
Fiber-Optic Comb/ light curtain			Visual/ Tactile	It provides visual and tactile stimulation and offer clear, crisp light and brilliant colors. Automatically changes colors
Sensory Weighted Blanket		2	Tactile	Non-removable weights are evenly distributed throughout the blanket and are shown sewn in permanently to create a safe therapeutic solution that will last for years.
IT ROCKS Gel Set		1	Tactile	The gel pads bring a sensory integration program into the wall-climbing unit. The tactile stimulation that the individuals experience from these gel pads will help them focus by fiving them the motivation

CHAPTER 4
FINDINGS

This chapter presents the results of a case study of the COVE center in two sections: the first section describes the building occupants' characteristics including autistic clients and caregivers, and the second section presents by answering the five research questions.

Characteristics of Participants

Two groups of participants were included in this study: autistic clients and caregivers who assist their autistic clients. The COVE center's mission is to support and provide self-directed life style for adults with developmental disabilities. Their vision is to see that clients meet their potential and mingle with the community where all belong.

Autistic Client's Characteristics

Fifteen autistic clients were participated in the study. Two (13%) of them were female and thirteen (87%) of them were male. The average was 33 years old ranging from 22 to 60 years of age. Only two clients were living with their family members, and the remaining adults were living in a supported residential community with others having developmental disabilities. Ten were conserved while five were not conserved (Table 4-1).

In this study, the sensory profiles for each participant were summarized based on interviews with caregivers, confidential client profiles, and close observations of autistic clients while using the COVE center. The clients' sensory profiles were focused on three senses: visual, auditory, and tactile. Each sensory issue was sub-categorized as "hyper" or "hypo", adopting the Carl Delacato (1974) study categorization. In this study,

‘hypersensitivity’ is defined as acute or heightened, or excessive sensitivity whereas ‘hyposensitivity’ stands for below normal sensitivity.

As can be seen in Table 4-2, the analysis of the 15 sensory profiles shows that there are more hyposensitive clients than hypersensitive clients: 2 hyper-visual vs. 13 hypo-visual; 5 hyper-auditory vs. 10 hypo-auditory; 1 hyper-tactile vs. 14 hypo-tactile. Therefore, hyposensitive clients were dominant at the COVE center.

Staff Members’ Characteristics

Out of 22 staff members at the COVE center, eleven were caregivers who were directly paired with autistic clients to assist their assigned clients. For this study, nine assigned caregivers and five administrative staff members were able to conduct in-depth interview (Table 4-3). It shows, 50% (n=7) were female and 50% (n=7) were male with age ranging from 18 to 66. Age groups 18-25 (n=5) and were most prevalent. Most of them (n=9, 64%) attended some college.

Based on client’s behavior type and documented profile, each autistic client was assigned to a caregiver also known as a non-resident supervisor (Table 4-3). Depends on the client’s needs and their availability, a caregiver can work up to three clients. Therefore, as can be seen in Table 4-3, for fifteen autistic clients, there were eleven caregivers. Except caregivers A and H, nine of them were conducted interviews for this study. The caregivers provide social support to clients and help them function in the community. Caregivers spent substantial time with their clients from Monday thru Friday, 8 hours per day.

Addressing the Research Questions

To answer the four research questions, data collected from the participatory observations, interviews, client's profiles, and architectural documentation were analyzed using content analysis method (Neuendorf, 2002).

Research Question #1: How does the Interior Environment in General Support or Not Support the Autistic Clients' Behaviors and Activities at the COVE Center?

To answer this research question, a participatory observations and interviews were analyzed. Autistic clients used seven interior spaces while they were in the COVE center: entrance, main hall, quiet room, computer room, bathroom, kitchen, and staff office. In this section, primary spaces were focused as follows: main hall, quiet room, and computer room. Secondary spaces include entrance, staff office, kitchen, and two bathrooms. Each primary space was organized to look at how positively or negatively affect the autistic clients' behaviors and activities (Table 4-5).

Over the span of seven weeks, the total number of the observations was thirty-three times (Table 4-5). During these observations, client 10 was not available to observe because he rarely used the COVE center. The number of observations for each client was varied; it was depends on their regular usage of the COVE center. The results of the observations showed that the main hall was used the most frequently (n=69, 56%), six clients were stepped outside (n= 24, 20%) of the COVE center during the observations, and that counted as the second most frequently used space. The each space was identified in the order of clients' frequent usage: computer room (n= 21, 17%), the quiet room (n=9, 7%). Then, the observations were analyzed by each client's sensory profiles: the primary spaces of the COVE center was used predominately by hypo-visual (n=39, 32%) and hypo-tactile (n=40, 33%) clients. Hyper-auditory (n=18,

15%) and hypo-auditory (n=23, 19%) clients were using the COVE about the same amount of time. Hyper-visual (n=2, 2%) and hyper-tactile (n=1, 1%) clients were infrequently used the center during the observations.

Findings from the interview data show that there were more negative comments (n=31, 55%) than positive comments (n=25, 45%) on primary and secondary spaces.

Primary Spaces: Main hall, Computer room, and Quiet room

Main hall

There were a total number of 14 comments made on main hall and two of them were holistic positive comments: For example, caregiver E said, “This place is great” and caregiver B said, “[It’s] awesome”. However, twelve negative comments were revealed. Four of them were regarding the spatial layout of the main hall. The main hall was designed to have two intended activity zones: the left side as a “quiet area” and the right side as a game/movie room. From the observations, it was discovered that the space was not quietly working as the designer had planned. Most of the time, the left side of the main hall was used for other activities because usually some movies were played using the projector screen on the right side wall.

The interior designer created a textured-wall to stimulate autistic clients. According to caregivers, clients enjoy watching movies on the textured-wall (on the right side of the main hall, behind a projector screen) and often walk up to the wall and touch the images. From the interview with caregivers, there were five positive comments on the textured wall while there were two positive comments on the regular screen. Caregiver B said, “The clients pay more attention to the movies on a textured wall and they like to go up to the wall and touch it.” However, the caregiver often played movies on the regular projector screen rather than the textured-wall. Also it was observed that

most autistic clients do not pay much attention during the movie time while they were the main hall.

Twelve negative comments were made and two of them were related to the water fountain located in the middle of the main hall. At the time of the observations, the water fountain did not work. Caregivers were complaining about it, for instance caregiver A said, “The location of the fountain causes a barrier in the middle of the main hall and it’s blocking the view…when someone enters the COVE building, the water fountain is supposed to serve as a focal point in the space but it appears distracting instead”. It was observed that the fountain was used for a place to sit for clients while they were waiting for next activities or a ride back home.

The main hall has a higher ceiling (11’-0”) than the rest of the spaces. The client 8 often screamed in the main hall and enjoyed the echoes. One caregiver mentioned the main hall generates echo in negative way. Caregiver B also mentioned, “The COVE center is too overwhelming for some of the clients…even we avoid taking certain hyper sensitive clients into the center because of the negative feedback from clients… most clients prefer to participate in outdoor activities”. It was observed client 2 grinds his teeth as soon he walks into the center.

From the observations, 56% (n=69) of clients used main hall. From these, 2 were hyper-visual and 21 were hypo-visual; 7 were hyper-auditory and 16 were hypo-auditory; 1 was hyper-tactile and 22 were hypo-tactile clients. Therefore, clients with hypo-visual, hypo-auditory, and hypo-tactile sensory preferred to use the main hall.

Quiet room

Results from the interview showed that over one third (clients 3, 6, 9, 13, 14, and 15) used the quiet room more than other clients. Out of 20 comments, there were fifteen

positive comments and five negative comments on the quiet room. Six out of fifteen positive comments were about the positive relationships between the quiet room and client's behavior. Caregiver E explained, "Whenever client 6 has problems, he runs into the quiet room and shuts the door…after a few minutes, he will be ok" Two negative comments: caregiver D said, "The quiet room is too overwhelming for some clients." Because of that, clients 8 and 11 refuse to enter the quiet room. Because Client 11 is obsessed with lines in general, the outlined circles on the walls in the quiet room distract him and avoid him to go inside of the room.

But, also the researcher has observed the relaxations of some clients in the quiet room several times. Such as lay down on the vibro-bean bag chair and touching the fiber optic light set. Out of seven, five comments were focused on the quiet room, which they were all positive effects on client's behavior. Caregiver M responded "Self-abusive behavior is decreased when clients spend time in the quiet room." There were seven positive comments on the relationship between the overall interior spaces and the clients' behavioral changes in the COVE center.

Computer room

The computer room was selected the second most liked space (n=4, 27%) for clients in the COVE center based on analyzed interviews. The observation support this findings as well. Seven out of 21 observations, clients used the computer room voluntarily (Table 4-6). The caregiver M said, "He [client 6] likes to just watch people in the computer room." Also Client 6 was observed to looking outside from the computer room window.

Secondary Spaces: Entrance, Staff Office, Kitchen, and Bathroom

Entrance

There were no remarks from the interview on the entrance of the COVE center. It was observed that the entrance door was not automatic and opening the door was difficult when caregivers help clients with wheel chairs. Based on the observations and confidential client's profile, client 11 is obsessed with doors. He literally spent about half an hour opening the entrance and bathroom doors at the COVE center.

Staff office

Staff T has made one negative comment during the interview, which is: "No one really works here or uses the office." Based on the observation made by the researcher support this clearly by this office space was filled with moving cardboard boxes, and no one used it.

Kitchen

There were two negative comments on the size of the kitchen. Both comments were suggesting a larger kitchen space. Also there was a comment how the window wall opening from the kitchen to the main hall makes clients want to enter the kitchen. The observation showed that clients entered the kitchen area five times. According to caregivers, most clients were obsessed with food, so the kitchen was locked and only caregivers were accessible to the kitchen.

Bathroom

The designer chose to install energy-efficient bulbs in the bathrooms, but there were many negative comments on that. Many caregivers complained, one of them saying that it takes longer to sufficiently light the space. According to caregiver F said

“Bathroom lights are bothering me.” Another negative comment stated that the tile could be slippery when a client takes a shower.

The COVE center in general

Overall, the clients’ favorite spaces were a main hall (n=9), computer room (n=4) and a quiet room (n=2). Eight comments were made on the positive behavior changes when the clients entered the building. Their self-abuse and self-stimulation behaviors decreased in the main hall and clients became relaxed in the quiet room. According to staff N, “For client 5, it was first time to see him socializing with other clients at the COVE center.” Five comments on negative behavior changes, for example, caregiver G said: “Client 2 gets tense in the COVE building”, and five comments were neutral: caregiver A said, “It is hard to tell about the behavioral changes.”

Research Question #2: How Have the Intentionally Designed Interiors Features Influenced Autistic Clients’ Behaviors and Activities?

> The finished interior environment incorporates spatial volumes, architectural details, colors, lighting and sounds that respond to the particular sensory needs of the clients, while still functioning as an educational environment.” (Jeon, 2008)

Based on the findings from only the interview data, the interior design features at the COVE center were organized into five categories including color, lighting, flooring, acoustics, and furniture layout. Each of these features had either positive or negative effect on autistic clients’ behaviors and activities (Table 4-8).

Interior acoustics

From the interview analysis (Table 4-8), twenty-two comments were related to acoustics conditions at the COVE center. Of these comments, 17 comments were positive, 3 were negative, one neutral, and one recommendation on acoustics of the building. Only one comment described a positive relationship between the acoustics

and the clients' behavior at the COVE. The caregiver E said, "It might provide the auditory needs to the client, so she doesn't scream much when she's inside of the COVE". Also according to caregiver A, well insulated [COVE] building helps clients to focus more on activities and also does not allow clients interfere with others which can cause their behaviors. The researcher often observed that the client 8 screamed regularly outside the center. But when she entered the center, she screamed less. In addition, when she screamed in the main hall, she actually paid attention to her echoes.

Lighting and color

A total number of 10 comments (21%) were made on overall lighting conditions of the COVE building. Only one comment was positive and the rest of the comments were negative, all pertaining to bathroom lighting (Table 4-8). The designer installed energy-saving light bulbs to save more the environment in restrooms. The designer implemented color-changing LED COVE lighting and a single-color LED lighting in the main hall.

Caregivers viewed sequentially changing LED lights as positively engaging the autistic clients. The caregiver D said, "When the light color changes, clients notice them and they get more excited." When client 8 entered the space, it was clear that she watched the changes of the LED light colors…she paid more attentions to the lights and got quieter. According to caregiver F, changing light makes clients upset. Several times, the caregivers turned off all lights except the light generated by Snoezelen equipment. Some clients (1, 5, and 9) enjoyed this atmosphere while others (clients 3, 4, 10, and 11) prefer that a small amount of overhead light be left on.

From the content analysis of interviews (Table 4-8), 12% of the comments (n=6) were related to colors of the interior space of the COVE building. Two positive

comments were on holistic views of the color, which is generalized on overall positive impacts of color. But three negative comments were concerning the degree of saturation of colors in the main hall and one neutral comment. The caregivers expressed the clients like brighter and more vibrant colors especially in the main hall.

The paint colors used in the quiet room (the pink room) were a Heats delight, (7.5R 8/4) and Ying yang (2.5PB 5/4). Three walls were painted in pastel pink with pastel blue outlined circles and one wall was accent painted in pastel blue with pastel pink outlined circles.

Flooring

From the interview (Table 4-8), 17% (n=8) responded to the flooring, only one comment was positive and the rest of them (n=7) were negative comments. Caregivers favored vinyl tile flooring over the cork flooring because of durability and ease of maintenance. The staff A said, “Carpet would be better, cork flooring is not warm and inviting.

Transitioning from one space to others was differentiated though flooring materials and colors. VCT flooring materials have produced a level of complexity for patchwork of geometric shapes and patterns. According to the caregiver L, client 11 is obsessed with lines, and the tile patterns on the floor exasperate his repetitive behaviors of walking back and forth around the lines on the floor.

Furniture layout

Only 4% responded to the furniture layout. There were two negative comments regarding furniture made by caregiver J: “Furniture is not comfortable [chairs and tables] and clients are not enjoying them. The COVE center placed light- weighted chairs and tables throughout the center. These light-weight stackable chairs give flexibility to

rearrange based on the activities. But these plastic chairs are not very comfortable and the researcher observed that many clients preferred using the beanbag chairs instead of it.

Research Question #3: How Have the Snoezelen Equipment Integrated into the COVE Center Influenced Autistic Clients (Visual, Auditory, Tactile)

To answer this research question, the data from the interviews (Table 4-7) and participatory observations (Table 4-8) were analyzed. In this study, three sensory types were carefully examined: visual, auditory, and tactile.

To provide a stress free environment, a variety of sensory stations exploring sounds, textures, colors and lights were created at the COVE center applying Snoezelen equipment. Majority of the Snoezelen equipment is located in the main hall and the designer carefully selected the locations of these devices. The quiet room has some Snoezelen equipment. In this enclosed space, clients can taste a controlled sensory experience.

From the interview data, a total of 22 comments were made on Snoezelen intervention (Table 4-7). First, equipment for visual stimulation includes four multi-colored bubble tubes, two fiber optic comb light curtains, two color wheel projectors, a diamond bubble wall, and a bubble water panel. From the interviews a total number of 15 comments out 22 (68%) were made on visual stimuli Snoezelen equipment. Fourteen were positive and one was negative comment.

In this study, 87% (n=13) of the autistic clients were hypo-visual, who need more visual stimuli in their sensory system. As can be seen in Table 4-7, the researcher observed that this group of autistic clients frequently (n=9) used the visual stimuli equipment at the center. Multi-color bubble tubes were used the most frequently by

autistic clients. Caregiver A reported, “These bubble tubes are calming to client”. Only one negative comment was given. The caregiver C mentioned, “Changing light makes the client get a little upset…client 2 does not like to be in the COVE center… when he is in the COVE center, he grinds his teeth and clinches up”. Second, the Giant 8 Gone Drum classified as auditory stimulated equipment. The findings from the interviews and observations showed there was no association between this equipment and clients’ behavioral changes.

Lastly, the tactile stimuli equipment includes, two vibro-music beanbag chairs, two sensory weighted blankets, three fiber-optic comb light curtains, and a gel set were place in the COVE building. Out of 22 comments, 7 of them were focusing on the tactile Snoezelen equipment and all of them were positive comments. Also 93% (n=14) of the participants for this study were hypo-tactile clients. The observation findings show that hypo-tactile stimulated Snoezelen equipment was frequently used by hypo-tactile clients (Table 4-10). From observations, the researcher discovered that vibro music beanbag chairs seems to be the most frequently used Snoezelen equipment in the center. There are two vibro music beanbag chairs at the COVE center: one in the main hall and the other one in the quiet room. Even though it is the same chair, clients used them slightly differently depends on the location of the chair. It was observed that clients spent more time sitting on the chair in the quiet room than the one in the main hall. In both cases, clients enjoyed the experience. But the researcher observed that, when clients are sitting on the chair in the quiet room, clients were more relaxed and often they fall asleep.

The researcher observed that client 3 loved the vibro music beanbag chair. Every time client 3 came to the center, he took the chair and played with the optic lights in the main hall. Also the client enjoyed sitting on the beanbag chair while listening to music. Client 14 used a sensory-weighted blanket whenever he came to the center. His assigned caregiver R said, “It creates a sense of security for the client…he [client 14] often touches surfaces of bubble tubes. Touching it offers them an instant tactile feedback through a vibrating shiver in his hands”.

Overall, there were far more positive comments on the Snoezelen equipment than criticisms. For examples, caregiver R said, “He [client 3] loves the vibrating [Vibro music beanbag] chair and likes to be in the quiet room with fiber optic lights on.”; caregiver J mentioned, “He [client 5] enjoys the COVE and he was interested in colors. It was the first time to see him socializing with other clients in the COVE. As long as he has something to play with, he will stay there for a long time.” In the COVE center, clients’ favorite Snoezelen equipment was a beanbag chair with lights and music on.

Research Question #4: How Built Environment Impact Clients with Different Types of Sensory Profiles (Hyper vs. Hypo-sensitive)

The COVE center’s research participants are composed of clients and staff members. These clients have different sensory profiles such as different sensory thresholds. The following findings show how the each space of the COVE center was used by hyper and hypo-sensitive clients.

Autistic participants’ profiles of the COVE center were as follow: Hypo-visual (n=13, 87%), hypo-auditory (n=11, 73%), and hypo-tactile (n=14, 93%) clients were predominate in the COVE center than hyper-visual (n=2, 13%), hyper-auditory (n=4, 27%), and hyper-tactile (n=1, 7%) clients (Table 4-2).

The observations showed that hypo-visual, hyper-auditory, and hypo-tactile clients were mainly used the primary spaces than the hyper-visual, hypo-auditory, and hyper-tactile clients. The three most frequently used spaces by the clients were the main hall (n=69, 56%), outdoor (n=24, 20%), the computer room (n=21, 17%), and the quiet room (n=9, 7%).

First, hypo-tactile clients used the main hall the most (n=22, 32%), followed by hypo-visual (n=21, 30%), hypo-auditory (n=16, 23%), hyper-auditory (n=7, 11%), hyper-visual (n=2, 3%), and hyper-tactile (n=1, 1%). Second, the outdoor space was used by hypo-visual and hypo-tactile the most (n=8, 33%), and hypo-auditory clients (n=5, 21%). Hyper-auditory (n=3, 13%), hyper-visual and hyper-tactile clients did not walk outdoor during the span of seven weeks of observations.

Third, hypo-visual and hypo-tactile clients observed using the computer room the most (n= 7, 33%), hypo-auditory (n=5, 21%), and hyper-auditory (n=1, 5%) clients. Hyper-visual and hyper-tactile did not use this space during the observations. Lastly, the quiet room is frequently used by hypo-visual and hypo-tactile clients (n=3, 33%). Hyper-auditory (n=2, 22%), and hypo-auditory (n=1, 12%) clients used the space. Hyper-tactile clients did not use the quiet room during the observations.

Research Question #5: What Are the Environmental Needs and Preferences for Staff Members to Perform Their Jobs in Relation to Assisting Their Clients at the COVE Center?

Staff members' goal is to assist clients to engage in the community and provide them to have a self-directed life style. Staff members' responses from the interviews and the researcher's observations were recorded and analyzed to find out the environmental needs and preferences to assist the clients.

Table 4-11 indicates three main issues, which merged from the interviews. Staff addressed the following concerns: Bathroom lighting, flooring, and spatial layout. The finding of interviews show there were nine negative comments on bathroom lightings. Staff A mentioned, “The bathroom lights turn on very slowly, it causes more trouble than good. Also it’s hard to see when we help clients at the bathroom because I can’t see a thing”.

Also eight comments were made on the flooring (Table 4-11), and it was one positive, and seven negative comments. Staff C responded “ Maintenance wise, I will never put a floor like this, [it] cannot get wet.” The cork flooring is hard for staff members to clean it.

The main hall has substantial problem in spatial layout for staff to work with clients at the center. There were 9 suggested comments on the spatial layout of the center (Table 4-11) based on the staff members’ experiences. Many staff recommended having more dividers or separate rooms if possible to break up clients into smaller groups for each activity.

During the observations, there were eight movie activity sessions. Meanwhile, the researcher noticed that autistic clients were not paying attention to the movie on a projected screen. In each session, only two clients were interested in the movies but their attention spans were short. The rest of them were not watching the movies at all and doing other stuff, which made hard for staff to control them. But interviews with staff members indicate that clients were paying more attention to the movies when it played on the textured wall.

Summary

Different sensory sensitive autistic clients occupied in the COVE center as a daycare center. Each space in the COVE center affects the clients differently. The findings show that computer room and quiet room positively support the autistic clients' behaviors. But the main hall was affecting the clients in negative way.

To analyze the finding of relationship between interior design features and the client's behaviors were tricky. There were no clear findings on how the color and lightings impacts the client's behavior. And tile patterns on the floor were triggering the client's repetitive behaviors. Interior acoustics were supporting the client's behavior in positive way but not the furniture in the COVE center.

Snoezelen equipment totally influenced clients' behaviors in positive way. There were far more positive than the negative comments on the Snoezelen instruments. Also it was observed that hypo-visual clients were using visual Snoezelen equipment and hypo-tactile clients were using tactile Snoezelen equipment.

Also, the primary spaces of the COVE center were used predominately by hypo-visual and hypo-tactile clients. Hyper-auditory and hypo-auditory clients were using the COVE about the same amount of time. Hyper-visual and hyper-tactile clients were infrequently used the center during the observations.

Staff members were recommending dividers in the main hall and brining in natural elements in the COVE center. Also better bathroom lightings are needed to serve the client better in urgent situations. Also staff members observed to prefer to watch movies on projector screen rather than the textured-wall. Staff members were recommending dividers in the main hall and brining in natural elements in the COVE center. Also better bathroom lightings are needed to serve the client better in urgent

situations. Also staff members observed to prefer to watch movies on projector screen rather than the textured-wall.

Table 4-1. Autistic participants' profiles

ID	Gender		Age	Conserved		Living in residential community	
				Yes	No	Yes	No
1	M		60		X	X	
2	M		60's*	X		X	
3	M		43		X	X	
4	M		22	X			X
5	M		36	X		X	
6	M		30	X		X	
7	F		46		X	X	
8	F		34	X		X	
9	M		30	X		X	
10	M		25		X	X	
11	M		23	X		X	
12	M		30	X		X	
13	M		29		X	X	
14	M		22	X		X	
15	M		20's*	X			X
Total (n)	13	2	N/A	10	5	13	2
Total (%)	87%	13%	N/A	67%	33%	87%	13%

*Estimated age due to no information available from the profile.

Table 4-2. Autistic participants' sensory profiles

	Sensory Issues					
	Visual		Auditory		Tactile	
ID	Hyper	Hypo	Hyper	Hypo	Hyper	Hypo
1		X	X		X	
2	X			X		X
3		X	X			X
4		X	X			X
5		X		X		X
6		X	X			X
7		X		X		X
8		X		X		X
9		X		X		X
10		X		X		X
11	X			X		X
12		X		X		X
13		X		X		X
14		X		X		X
15		X	X			X
Total (n)	2	13	4	11	1	14
Total (%)	13%	87%	27%	73%	7%	93%

Table 4-3. Characteristics of the staff and caregiver participants

Characteristics	*n*	*%*
Gender		
Male	7	50%
Female	7	50%
Total	14	100%
Age		
21-30 years	5	35%
31-40 years	4	29%
41-50 years	0	0%
51-65 years	4	29%
Over 65 years	1	7%
Total	14	100%
Ethnicity		
Caucasian American	10	72%
Native American	1	7%
African American	1	7%
No response	2	14%
Total	14	100%
Education Level		
High School degree	1	7%
Some College	9	64%
College degree	4	29%
Total	14	100%
Working Hours		
Less than 10hrs	2	14%
11-20 hours	0	0%
21-30 hours	0	0%
31-40hrs	6	43%
More than 40hrs	6	43%

Table 4-4. Autistic clients paired with caregivers

Autistic Client ID	Caregivers' ID
1	C
2	C
3	J
4	K
5	N
6	M
7	D
8	C
9	E
10	I
11	M
12	J
13	J
14	A
15	H

Table 4-5. Number of comments on spaces from interviews

Space		Comments				Total	
		Positive		Negative			
		n	*%*	*n*	*%*	*n*	*%*
Primary Space	Main Hall	2	14%	12	86%	14	24%
	Quiet Room	15	75%	5	25%	20	36%
	Computer Room	8	80%	2	20%	10	18%
Secondary Space	Bathroom	0	0%	9	100%	9	16%
	Kitchen	0	0%	2	100%	2	4%
	Entrance	0	0%	0	0%	0	0%
	Staff office	0	0%	1	100%	1	2%
	Total	25	45%	31	55%	56	100%

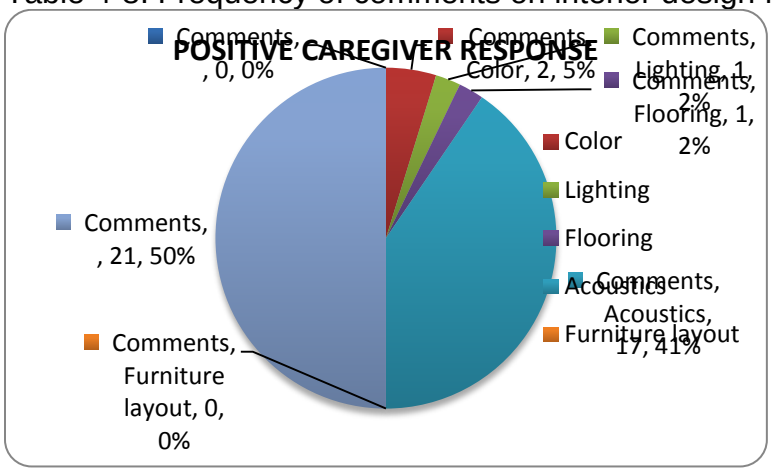
Table 4-6. Observation frequency for space usage by clients' sensory profile

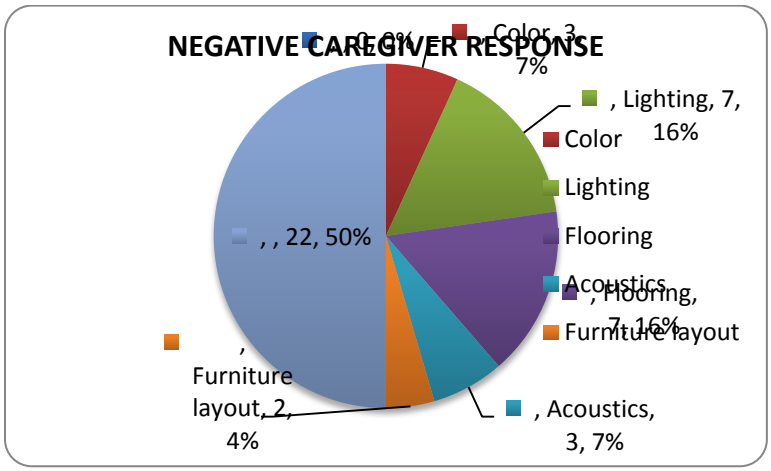
	Visual		Auditory		Tactile		Total (n)	Total (%)
	Hyper	Hypo	Hyper	Hypo	Hyper	Hypo		
Main Hall	2	21	7	16	1	22	69	56%
Quiet Room	0	3	2	1	0	3	9	7%
Computer Room	0	7	6	1	0	7	21	17%
Outdoor	0	8	3	5	0	8	24	20%
Total (n)	2	39	18	23	1	40	123	100%
Total (%)	2%	32%	15%	19%	1%	33%	100%	

Table 4-7. Frequency distributions from observations for spaces

Space		Visual		Auditory		Tactile		Total
		Hyper	Hypo	Hyper	Hypo	Hyper	Hypo	
Main Hall	n	2	21	7	16	1	22	69
	%	3%	30%	11%	23%	1%	32%	100%
Quiet Room	n	0	3	2	1	0	3	9
	%	0	33%	22%	12%	0	33%	100%
Computer Room	n	0	7	6	1	0	7	21
	%	0	33%	29%	5%	0	33%	100%
Outdoor	n	0	8	3	5	0	8	24
	%	0	33%	13%	21%	0	33%	100%

Table 4-8. Frequency of comments on interior design features





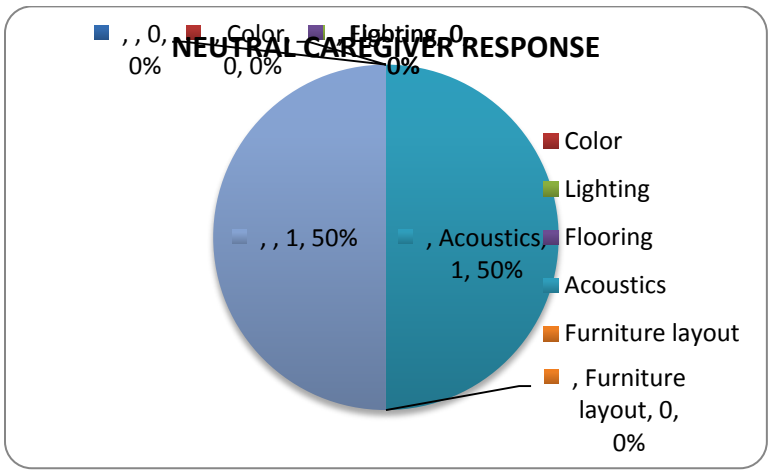


Table 4-9. Interview data: comments on Snoezelen equipment

Snoezelen Equipment	Comments				
	Positive	Negative	Neutral	*n*	%
Visual stimulated	14	1	0	15	68%
Auditory stimulated	0	0	0	0	0%
Tactile stimulated	7	0	0	7	32%
Total	21	1	0	22	100%

Table 4-10. Observations on Snoezelen equipment

	Visual		Auditory		Tactile	
	Hyper	Hypo	Hyper	Hypo	Hyper	Hypo
Visual equipment	-	9	-	-	-	-
Auditory equipment	-	-	-	-	-	-
Tactile equipment	-	-	-	-	-	10
Total	0	9	0	0	0	10

Table 4-11. Comments on environmental needs to assist clients from interviews

	Spatial layout of Main Hall	Flooring	Bathroom Lighting
n	9	8	9
%	36	32	32

CHAPTER 5
DISCUSSION

To understand how the interior environment supports autistic clients' behaviors and activities at the COVE center, primary and secondary spaces were evaluated. Based on the findings, clients' behaviors and activities were heavily impacted by three primary areas of the COVE center: the main hall, the quiet room, and the computer room. Further discussion of these three spaces is in the following section.

Research Question #1: How Does the Interior Environment Support or Not Support the Autistic Clients' Behaviors and Activities at the COVE Center?

To understand how the interior environment supports autistic clients' behaviors and activities at the COVE center, primary and secondary spaces were evaluated. Based on the findings, clients' behaviors and activities were heavily impacted by three primary areas of the COVE center: the main hall, the quiet room, and the computer room. Further discussion of these three spaces is in the following section.

Main Hall

The findings indicate that the main hall does not positively influence client behavioral changes. Even though 60% (n=9) of clients preferred the main hall to other spaces, the majority of participants had negative comments on this area: the spatial layout of the main hall was a major problem for existing spatial layout. It also contradicts findings from observations, which show clients used the main hall the most (n=69) out of all the spaces. Since many activities of the COVE center were held in the main hall, and when clients were observed, the researcher started from the main hall and tracked client's behaviors throughout the center. These could be potential bias in data collection.

The main hall was designed to serve two purposes: 1) to have group activities 2) for the individual activities. But too many clients in a large open space can cause distractions and unexpected behaviors, and these behaviors can be contagious between clients (Beaver, 2003). For example, board games and arts-and-crafts activities were happening at the same time for two different groups of clients, these clients seemed distracted by each other and some started to have moment-to-moment behaviors.

Many staff members suggested dividers and/or partitions to compartmentalize the main hall to for different activities. Limiting clients' visual accessibility to each other helps clients to be more attentive and focused. This finding aligns with studies by Richer and Nicoll (1971), and Mostafa (2008). The Richer and Nicoll study (1971) suggests subdividing an open space to limit the interactions between clients to minimize distractions. Also, Mostafa (2008) states that visual compartments help to reduce the frequency of unexpected behaviors and multi-functional spaces should be avoided in the space for the autism to reduce sensory confusion. Results from the interviews and observations clearly support this statement. Therefore, room dividers or partitions are strongly suggested in the main hall. But busy patterns on dividers should be avoided because it could act as negative visual stimulators for some clients, which would distract them during activities and induce autistic behaviors.

The main hall has two textured-walls to stimuli clients' tactile needs. Also it can provide visual stimulation for clients when movies are projected on this wall instead of a projector screen. Caregivers commented that clients' attention spans were longer when movies were played on the textured wall instead of the projector screen. Hypo-visual

and hypo-tactile clients obtain their sensory needs thru this feature. Clients often walk up to the textured wall to touch it during movie projections. This supports Mostafa's study (2008) of using rough textures to stimulate those with hypo-tactile autism. This finding indicates that autistic clients enjoy watching movies on the textured-wall, which the images are provide the perception of three-dimensional images. Thus, it is recommended that applying more tactile stimuli elements to a space will provide adequate sensory needs to hypo-tactile clients. However, despite the awareness of the textured-wall's advantage on client sensory needs, it was observed that caregivers did not fully utilize the textured-walls in the center. This will be discussed in a later section.

A sculpted metal water fountain in the middle of the hall was another issue. The water fountain was installed to help autistic clients relax by listening to the sound of water in the center. It also provides additional seating. According to the staff, it should be a focal point of the COVE center. However, the fountain was not working during the observations for this study. Staff members complained that the water fountain was just blocking the view from the left side of the main hall to the right side. The researcher observed that the gigantic water fountain was only used as a seating area.

The observation findings show that many clients prefer to stay outside, which may be influenced by the time of the data collection during the summer. The lifestyle of individuals with autism is quite different than non-autistic individuals. Their time and mobility are limited, thus their need for outdoor activities are limited. People with autism spend the majority of their time indoor since they have limited access to transportation. Incorporating the outdoor elements like water features in the center can help meet their

sensory needs. This explains why clients preferred outdoor activities and often stepped outside from the main hall of the COVE center.

Some clients started their stereotyped behaviors once staff forced them to move from outside to inside of the center. Some literature indicates that autistic clients favor the outdoor over Snoezelen spaces (Cuvo, 2001). Also the quality of outdoor stimulation is more effective on client's stereotypic behaviors than the stimulation from Snoezelen environments. For example, bringing in a sandbox to the COVE center, so clients can touch the texture of sand and play with it in the center. This will provide same effects as Snoezelen equipment. Hypo-tactile clients appear to be attracted to playing with sand or rocks. Stone veneer wall paneling could be a possible alternative. The role of nature in treating autistic clients is significant (Vincenta, 2011).

Quiet Room

Clients with autism exhibited more relaxation and decreased behavior in the quiet room than other spaces in the COVE center. It is a great place for clients experiencing tantrums or stress. The quiet room provides a cozy atmosphere to clients, making them feel comfortable. Most of time, the quiet room is dark with only the Snoezelen interactive bubble tube, two color wheel projectors, and two fiber optic light sets turned on. Blinds were closed and recessed down lighting as a general lighting was turned off in this room. Also, the quiet room has a defined sense of enclosure, which promotes a feeling of security. Perhaps that explains why clients fall asleep during Snoezelen sessions in this room.

According to staff members, some clients use this room as their 'escape' space. Especially for Client 6, when he experiences autistic behavior, he runs into this room and calms himself down. This supports that the quiet room helps clients to control

undesirable behaviors to expand to other clients, which can be a contagious within clients. Beaver's 2003 study suggests the importance of providing "quiet rooms" where users can be calm when they are stressed, or having a tantrum. Also findings by Khare and Mullick (2008, 2009), and Mostafa (2008) support this as well.

The findings from interviews show, hypo-visual and hypo-tactile clients use the quiet room the most frequently. Hyper-visual clients avoided entering this room. According to several staff members, this room is too overwhelming for the hyper-visual group of clients. There are too many things going on in the enclosed space. Hyper-visual clients could find the space more inviting if visually stimulating equipment were removed. Alternatively, having two quiet Rooms for two different visual groups of clients would accommodate needs better globally. Since there is no auditory stimulated equipment in this room, those with auditory sensitivity have no preference either way.

Computer Room

The computer room was found to positively support clients' behavior. This room provides technology and visual stimulations thru computer games and activities. The computer room is the biggest enclosed room in the COVE center. This room does not have any Snoezelen equipment and is purely used for the technology enhancement purposes. The design of a linear arrangement of computers on a countertop was successful. Individuals with autism are easily distracted by their surroundings and regaining the attention of the autistic individuals is difficult once they get distracted (Dunn, 2001). These linear placements of computers against walls help the clients stay focused on their work by minimizing visual accessibility to other clients. Thus, the computer room helps clients develop their computer skills to create community-related brochures and flyers.

The researcher noticed twice that a client was looking thru a window in computer room to look outside. The COVE center generally lacks windows. There are two windows in the Quiet Room, which are covered by blinds, and one in the kitchen, which has limited access to clients. The window in the computer room was the only accessible window by the clients to see the outside of the COVE center. It was not clear whether the clients were seeking for natural light or the view outside the window. The secondary spaces, which include the entrance, kitchen, and office, did not produce significant findings to support or disprove effects on autistic behaviors.

Research Question #2: How Have the Intentionally Designed Interiors Features Influenced Autistic Clients' Behaviors and Activities?

To facilitate autistic clients' behaviors and activities in the COVE center, the interior designer has intentionally incorporated five interior design features: color, lighting, flooring, acoustics, and furniture layout.

Interior Color and lightings

From interviews with COVE center staff, the interior colors of the COVE did not significantly impact client behavior. Staff members expressed that more vibrant and bright colors are needed in the main hall though it contradicts with Myler et al.'s (2003) study that bright and diverse color palettes of wall color and geometric shapes and patterns could create a visual complexity to the autistic clients. The recommendation from their study was "muted, subdued palette—pastel colors, neutral beiges and browns—and plain, unpainted finishes are the sensible choices for autistic clients". Additionally, Clay's (2004) study found that a subdued and neutral color scheme is necessary as most children with ASD negatively responded to primary colors. Could using a more vibrant color palette produce positive results for adults with ASD?

According to Schauss' study (1979), pink helps to reduce aggressive behaviors, it is also the most calming, "tranquilizing" color (Morton, 1998). The designer of the COVE building applied this concept in the Quiet Room. Although color preferences vary from individuals, studies have shown that many autistic clients favor pale pink (Paron-Wides, 2002). After Schauss' color study, Pellegrini (1981) painted with hot pink in the stripe search room (SSR) from pale blue to investigate in decline of aggressive behaviors. A strip search room is where searching a person for weapons or other contraband suspected of being hidden on their body or inside their clothing. Overall there was no indication of aggression-reduction attributable to hot pink. This indicates that a specific shade and value of pink color is needed to understand the "Tranquilizing" effects on aggressive behaviors.

Findings from interviews with staff show that the Quiet Room makes clients relaxed and calm. Clients who use this room frequently show a reduction in unexpected and self-abusive behavior. It is not clear whether clients use this room because of the color or the atmosphere of this room. But previous studies support these findings of color to support positive behavioral changes. Physiologically, blue is a calming and tranquil color and the tranquilizing effect of color reduces aggressive behavior (Walker, 1991). According to Schauss (1997), a specific shade of pink color helps to promote relaxation. Soft shades of colors are more soothing and can create a tranquilizing effect on individuals with autism (Schauss, 1979). Based on the findings and literature review, exploring the pink and blue colors in other areas of the COVE center is needed. Selecting appropriate use of color is important in environment for individuals with autism. Gaines and Carry (2011) concluded in their study that over-stimulation thru

color creates sensory overload for autistic people, but an under-stimulating environment can be as harmful as over-stimulating environment. Since there is no clear answer to the influence of colors in the COVE center, further investigation is needed in a future study.

Three different light sources were installed in the COVE center: color-changing LED lights, six track-mounted 150W halogens, and recessed lights throughout the building. Fluorescent lights trigger behaviors for people with autism (Myler et al., 2005) and were intentionally not integrated in the COVE center. Most lighting fixtures in the COVE center were designed to be friendly for autistic users except the bathroom lighting, which used energy-saving light bulbs. It takes a longer time to sufficiently light the bathroom. This is problematic as the bathroom is the space where clients require the most urgent assistance. This finding suggests that an instant-on and fully lighted system should be installed in the bathroom.

From the researcher's observation, the COVE building lacks natural light. Clients look out the windows of the computer room. Perhaps clients are stimulated by scenery or seeking natural light. The cause of the client's behavior is unknown. But MacKenzie's (2008) study shows that the use of natural light is encouraging for autistic individuals.

Flooring

The cork flooring in the COVE center appeared to be problematic. Its maintenance requires special cleaning supplies and leaves a strong chemical odor. Installing hardwood or linoleum flooring is recommended for its ease of maintenance. However, hard surface materials can act as an auditory sensory trigger for hyper-auditory clients (Shabha, 2006), which should be avoided. Considering acoustic necessities, carpet flooring could be another option for individuals with auditory

sensitivities. The bathroom tile flooring was slippery after showers and impromptu laundering from mishaps. By applying a non-skid sticker in the shower area or treating the existing tile with a non-slip solution can easily solve the problem.

Acoustics

Mostafa (2008) and Myler et al. (2003) suggest that acoustics is one of the most important features to consider for autistic individuals. The COVE building has well-insulated walls and is designed to be acoustically high performing. Based on observations, the acoustics of the COVE building positively support clients' behaviors. On the whole, they agreed with the COVE building as being well-insulated and sound proof. Many studies show that a fluorescent tube creates a flickering and buzzing sound and it can bother people with autism. As noted in the lighting section, the COVE center does not carry fluorescent lighting.

According to Shabha's study (2006), echoing sound can aggravate the behaviors of autistic clients. But in the COVE, Client E enjoyed listening to her echo, which seemed to stimulate her auditory needs. Shabha's study focused on hyper-auditory clients who are overwhelmed by surrounding noises. As individuals with autism are sensitive to sounds, hypo-auditory clients seek for noises to stimulate their sensory needs. Incorporating natural sound elements using a water feature or recorded bird sounds are possible alternatives.

Different spatial volumes may influence the way clients process their sensory environment. Ceiling height is one variable in controlling acoustics. The COVE has two different ceiling heights: 11 feet high for the main hall and 8 feet for the rest of the area. The high ceiling lets sounds transmit thru the space faster than a low ceiling in enclosed spaces and creates echoes. The enclosed space has smaller spatial volumes to help

the clients feel secure. Not only does the lower ceiling provide a protected feeling, it also creates an acoustically unobtrusive environment. Hypo-auditory clients scream to stimulate themselves. For them, providing enough auditory stimuli is necessary. But those who are hyper-auditory are overly sensitive to sounds and every noise tends to distract them. In this case, cork flooring works better than the tile or VCT in the main hall.

Furniture

The findings of furniture in the COVE center negatively impact client behaviors. There were two negative comments on furniture in the COVE center: Caregiver A mentioned, “Furniture are not comfortable and clients are not enjoy them [tables and chairs]. Tables and chairs throughout the center need to be more comfortable. In, Kennedy’s study (2008), upholstered seats and backrests tend to reduce fatigue and physical distractions in learning environments. Therefore, selecting more comfortable furniture can assist clients better in the COVE center.

Research Question #3: How Have the Snoezelen Equipment Integrated into the COVE Center Influenced Autistic Clients (Visual, Tactile, Auditory)

To accommodate different sensory needs, Snoezelen equipment are placed throughout the COVE center. Visually stimulating equipment includes several multi-colored bubble tubes, fiber-optic curtains, wheel projectors, diamond bubble wall mirrors, and a bubbling water panel. Tactile-stimulating equipment includes vibro music bean bag chairs, sensory weighted blanket, fiber-optic light curtains, and gel set. A Giant 8 Gone Drum is categorized in auditory stimulated equipment.

There were two types of bubble tubes: one with fish fixtures moving up and down called an “aquarium” and another one is a tube with an interactive light switch box. All

visually stimulating equipment, except the bubbling water panel, requires some sort of interaction between the user and the equipment.

The first tube has additional visual stimulation and allows tracking practice for the users. The other tube allows users take control over the tube simply by pressing buttons on the switchbox to change colors of the bubbles. The client noticed constant light color changes of LED lights. The array of changing LED light colors and moving bubbles users' attention and creates a relaxing atmosphere.

Mostafa (2007) suggests that autistic behaviors could be altered by sensory environment. Her research has shown a fifty percent reduction in distress and stereotypical behavior, and seventy-five percent less aggression and self-injury in the Snoezelen environment. The findings of this study supported Mostafa's study. Especially, visual and tactile stimulated equipment have great impact on hypo-sensitive client behaviors. Hypo-tactile autistic clients may stimulate themselves by self-injury and banging their heads against walls. Providing tactile Snoezelen equipment for those can reduce their stereotypical behaviors and a weighted blanket can give them a feeling of security.

There was no comment on the auditory equipment of the Giant 8 Gone Drum which is the most expensive Snoezelen equipment in the COVE center. It was observed that this drum was not properly used. Caregivers did not incorporate the drum into client activities and it was just used as a table for a remote control. These findings show that understanding the proper way of using all Snoezelen equipment is necessary, especially for the caregivers. Over 70% of clients were categorized into hypo-auditory in

the COVE center. This shows that more auditory stimulations are needed for those clients from a surrounded environment.

Given that each individual with ASD has different sensory sensitivities, creating an environment for all users is challenging. The individuals with ASD experience difficulty in managing the sensory environments due to their stereotypical behaviors. To provide their different sensory needs, the COVE offers a variety of Snoezelen equipment. Snoezelen environments are known to decrease self-injury and challenging behaviors of individuals with ASD. The Snoezelen equipment in the COVE center was purchased from Flag House and this particular vendor report thousands of Snoezelen installations in over 30 countries, with 700 in North America. According to Flag House's website, the Snoezelen center at Grove in Chattanooga, Tennessee conducted a case study. Their mission is to gather data, which can support the therapy benefits of Snoezelen. The result of this study showed, a young man with autism who had previously demonstrated limited social interaction and verbal skill is now more engaged with his peers and verbalizing (Flag house, 2013).

In comparing the main hall and the quiet room, which are two Snoezelen spaces, Snoezelen effects on the clients were significantly higher in the quiet room. The quiet room is a small, enclosed space, containing less Snoezelen equipment than the main hall, an expansive space. This could imply that enclosed spaces promote a feeling of security for the clients.

This study focuses on three senses: visual, tactile and auditory. Although there are variations between client profiles, their sensory profiles were categorized as hyper-sensitive or hypo-sensitive. No more than two autistic clients have the same patterns of

sensory perception, and each client reacts differently to sensory environments. In the COVE center, there are more hyposensitive than hypersensitive clients, indicating that most clients in the COVE center seek sensory stimulation. The COVE center has plenty of visual stimuli to excite hypo-visual clients, but it could be overwhelming effect for the hyper-visual clients.

This study suggests providing separate sensory spaces to properly serve those with either hyper or hypo sensitivities for each of the three senses (visual, auditory, and tactile). As the high cost may be a factor, designing a space with adequate sensory stimulations for hypersensitive clients first would be most effective specifically for the COVE center. Then, adding more sensory devices as needed for hyposensitive clients would be much easier. Individuals with a “more than others” sensory sensitivity pattern can benefit from eliminating distractions and adding support to help maintain focus. Creating organizational systems can be useful. Autistic behavior in individuals can be abated successfully when they participate in calm, repetitive, familiar, and consistent tasks and activities. Keeping in mind the balance between over and under stimulation is necessary in creating optimal environment for the individuals with autism.

Research Question #4: How Built Environment Impact Clients with Different Types of Sensory Profiles (Hyper and Hyposensitive)

The finding shows that the hypo-tactile clients preferred using the primary spaces (main hall, quiet room and computer room). These spaces were successively popular with hypo-visual clients. The hyper-tactile clients used the primary spaces the least. The COVE center is designed to be more suitable for hyposensitive autistic individuals by providing different sensory stimuli equipment and interior features that appeal to hypo-sensitive individuals. Staff members had negative comments on the COVE building as

being overwhelming for some hyper-tactile or hyper-visual clients. Despite the frequency of usage of each space, it is hard to conclude that the COVE center's environment positively or negatively impacts autistic clients with different sensory thresholds.

Research Question #5: What Are the Environmental Needs and Preferences for Staff Members to Perform Their Jobs in Relation to Assisting Their Clients at the COVE Center?

Most autistic clients enjoyed outdoor activities more than indoor activities and preferred to go outside than stay in the COVE center. However, they spend most of their time indoors. Often, clients get fascinated by riding a car and enjoy looking at scenery. Therefore, many staff members suggest bringing in outdoor features to the center from their experiences with clients. Why is it that the clients appear to prefer the outdoors over interacting with Snoezelen equipment? It could be that the outdoors provides a greater proportion of sensory reinforcement received from engaging in alternative behaviors. Compared to the indoor, autistic clients can involve themselves in activities that provide kinesthetic and vestibular reinforcement and the quality of stimulation outdoors is more related to the autistic individuals' stereotypic behaviors than the indoor.

Staff needs to provide physical assistance to in the bathroom. Waiting for bathroom lights to achieve sufficient lighting is a problem in urgent situations. According to staff, the cork flooring requires a special chemical to clean, and it smells unpleasant. Some suggest carpet or vinyl tile flooring in lieu of cork flooring. Since the main hall is a wide-open space for various activities, clients can easily distract each other.

From the interviews, staff members were aware of the effectiveness of playing movies on the textured wall instead of the projector screen. But during the observations, no one played movies on the textured wall. Despite the awareness of the textured wall's advantage on client sensory needs, caregivers neglected the design features of the center, which meant to serve as a movie screen. It was assumed that staff members preferred to watch movies on the screen to the textured-wall to serve their own needs over that of their clients. The images on the textured wall are visually distracting for non-autistic people. This indicates that an interior environment should be designed to accommodate all users of the space, which need further investigations

Conclusions

> I realize that I do not see the world as others do. Most people take the routines of life and day-to-day connections for granted. The fact that they can see, hear, smell, touch and relate to others is 'normal'. For me, these things are often painfully overwhelming, non-existent or just confusing (Shore, 2003, p.50)

The built environment can be confusing and threatening for individuals with ASD. (Granding, 1995; Harker & King, 2002; Lwson, 1998; Whitegurst, 2006a; Williams, 1996). Their senses are 1000 times more sensitive than how those without autism perceive reality according to Shore's (2003) study and these sensitive sensory issues area directly related to the built environment.

The purpose of this study is to evaluate the COVE building occupants' environmental sensory needs, how it affects their behavior. The findings of this study are preliminary at this stage. The findings reveal that the majority of the COVE clients seek greater sensory stimuli in the center and that the center's environment does have an impact on client behavior.

It is impossible to change all environments to accommodate both hypo- and hyper-sensitive clients simultaneously. This “one-size-fits-all” design solution is not working for autistic clients. Designing for a range of needs is important focusing on the most prevalent autistic sensory group. It will be impossible to customize the autism facilities to each user, but tailoring environments to groups of users with similar sensory needs would be beneficial, if possible.

The built environment can be designed by first focusing on hypersensitive group than hyposensitive group. Because it is easier to add sensory equipment as needed, it is necessary to select appropriate combination of stimulation for each individual. Also, offering activities depend on a client’s sensory needs and preference is strongly needed. Most previous studies did not consider each autistic client’s sensory profile and assumed that individuals with autism are hypersensitive to the environment and design the facility to their sensory needs only. The followings are the implications of this study, which will be beneficial to the future autism facility center:

- The spatial compartment is an important feature to consider. As Mostafa (2008) stated, it can help decrease distractions between clients and reduce disruptive behavior.
- Incorporating outdoor features are essential.
- Presenting an escape space for people with ASD is needed to provide stress relief.
- Appropriate lighting is necessary for different visual functions in each room.
- Selecting appropriate flooring materials should be considered for both the acoustic quality and the maintenance issues.
- It is important to eliminate the institutional feel of the facility and incorporate a homelike environment for the autistic clients.

Although this case study shows a strong association between built environment and autistic behavioral changes, further research is needed to better understand the relationship between interior environments and autistic behaviors.

APPENDIX A
DESIGNER'S PROFILE (Kijeong, Jeon)

TEACHING EXPERIENCE

2006 – present	Professor • Interior Design Program Coordinator Cal State University Chico, Department of Art and Art History, Chico, CA
2008, 2012 Summer	Visiting Professor • University of Georgia Cortona Italy Campus, Cortona, Italy
2010 Summer	Visiting Professor • New York School of Interior Design, New York, NY
1997 - 2006	Instructor • UC Berkeley Extension, Department of Interior Design, San Francisco, CA
2005 – 2006	Instructor • West Valley College, Saratoga, CA
2000- 2001	Adjunct Professor • California College of Arts, Department of Interior Architecture, San Francisco, CA
1996	Visiting Professor • Harare Polytechnic, Zimbabwe Department of Arts, Consulting and lecture on integrating technology with arts and design, grant funded by USIS(US Information Service)
1989 - 1996	Assistant Professor, Associate Professor • Virginia Commonwealth University. Department of Interior Design. Richmond, VA

PROFESSIONAL EXPERIENCE

2008 – Present	Owner/Designer • Kijeong Jeon Design, Chico, San Francisco, CA
2003 – 2006	Principal • Color Workshop, San Francisco, CA Color Consultation and Interior Design for Residential and Commercial Projects.
1996 -2003	Senior Designer • Delphi Productions, Alameda, CA Specialized in Exhibition Design, Environmental Design, Museum Design, Trade Show Design, and Environmental Graphics
1989 -1996	Freelance Designer • Kijeong Design Studio, Richmond, VA Interior Design, Graphic Design, and CAD services.
1988	Interior Designer • SRG Partnership PC, Portland, OR. Responsibilities included schematic design, programming, design development, specifying and construction documents.
1985-1986	Interior Designer • MWM Architects and Associates, Oakland, CA Responsibilities included programming, design development, space planning specifying, construction documents, and presentations.

EDUCATION

1989	MIARCH (Master of Interior Architecture) • University of Oregon, Eugene, OR
1986	Graduate Study in Landscape Architecture • University of Oregon, Eugene, OR
1984	BFA (Interior Architecture) • California College of Arts, San Francisco, CA

LICENSES

NCIDQ (National Council for Interior Design Qualification) Certified (#012953)
Licensed Contractor (CA Contractor's License #833705)

PROFESSIONAL AFFILIATIONS

Member of IDEC (Interior Design Educators Council)
Member of AAMSE (American Association of Multi Sensory Environments)

AWARDS, GRANTS, & HONORS

2012	Received CSU Chico Internal Research Grant for "Designing Interior Environment Adopting Multi Sensory Environment for Individuals with Autism"
2009	1st Place Award from IDEC Creative Scholarship Competition – "Reflection" Installation
2005	Recognition of Excellence in Service from FIDER (Foundation of Interior Design Education and Research)
2001	Best of the Show w/ Vari Lite Exhibition Design at LDI Annual Lighting Convention
1999	Published Novellus Product Showroom project in 'Critique' Autumn 99 issue 'Big Crit' Annual Design Award Environmental Design Category

1998	Published in “Digital Architecture: 3-D Computer Graphics from 50 Top Designers” by M.S. Uddin. published by MaGraw-HillUSIS (United States Information Service) grant to visit Zimbabwe for Consultation of Integration of Technology in Applied Arts.
1994	Nominated as candidate for ‘The future of Interior Design Focus Group’ by FIDER
1993	Received VCU Community Service Associates Grant This grant was for coordinating a homeless shelter design development project, Good Samaritan Inn. Coordinated for project collaboration between VCU interior design students and the members of the Philanthropy by Design group.
1992	Received *IES Summer Workshop for Teachers of Lighting Grant* from IESNA (Illuminating Engineering Society of North America) This grant was for a week long workshop in lighting design, and the grant covered tuition, travel, lodging, and food.

RECENT PROFESSIONAL PROJECTS

- California Vocations Inc. Office design – Paradise, CA
- The COVE, Paradise, CA – Multi Sensory Environment for individuals with Autism
- 'Reflection', Installation Project, Chico, CA
- 'Medtronics' Corporate Trade Show Exhibit
- 'Novellus' SemiCon Exhibits, San Francisco, CA
- 'Zhone Technology' Environmental Branding
- 'Apple Computer Inc.' Mac World Exhibits, San Francisco, CA
- 'IBM e-Business Launching event', San Francisco, CA
- 'Veri Light' LDI Lighting Exhibits, San Francisco, CA
- 'Center for the Arts' Media Cafe, San Francisco, CA
- 'Computown' Retail Store, San Francisco, CA
- 'Plan 9 Music' Retail Store, Harrisonburg, VA
- 'Bauer Residence', Mill valley, CA
- 'Clough Residence', San Francisco, CA
- 'Norris Residence', Berkeley, CA
- 'Stuart Residence', South San Francisco, CA

EXHIBITIONS

2010	‘Something Green’ Solo Exhibition at Humanity Center Gallery, CSU Chico, Chico, CA
2008	‘Reflection’ Installation project, CSU Chico Faculty show, Chico, CA
2008	‘Cortona Summer Night’, Mostra-Faculty Exhibition, Cortona, Italy
1995	Selected 4 Prints for Juried Exhibit at Shockoe Bottom Gallery, Richmond Va.
1993	Participated ‘VCU School of the Arts Biennial Faculty Show’, Anderson Gallery, Richmond, VA
1991	Participated ‘VCU School of the Arts Biennial Faculty Show’, Anderson Gallery, Richmond, VA
1989	Participated ‘VCU School of the Arts Biennial Faculty Show’, Anderson Gallery, Richmond, VA
1987	Selected for exhibit for ‘INTERNATIONAL FURNITURE DESIGN FAIR’, PORTLAND DESIGN CENTER, PORTLAND

APPENDIX B
PAINT SCHEDULE

P-1

P-2

P-3

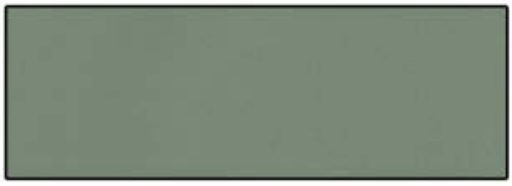
P-4

P-5

P-6

P-7

P-8



P-9

P-10

Code	Color	Manufacturer	Number	Munsell Match	Sheen
P-1	Standish White	Benjamin Moore	HC-32	10Y 9/2	Eggshell Overall Wall
P-2	Snowbound	Sherwin Williams	SW7004	10GY 9/2	Eggshell Ceiling Exterior Trim
P-3	Avant Garde	Benjamin Moore	272	5Y 7/4	Eggshell Entrance office side one wall
P-4	Mistletoe	Benjamin Moore	474	5GY 6/2	Eggshell Entrance right side and ceiling
P-5	Brewster Gray	Benjamin Moore	HC-162	10G 6/2	Eggshell Soffit
P-6	Rich coral	Benjamin Moore	028	5R 6/8	Eggshell Accent at office side
P-7	Dark Purple	Benjamin Moore	2073-10	7.5RP 2/2	Eggshell Column
P-8	Ying Yang	Benjamin Moore	824	2.5PB 5/4	Eggshell Quiet room/one wall
P-9	Adirondack Green	Benjamin Moore	453	7.5GY 6/2	Exterior Low sheen
P-10	Hearts Delight	Benjamin Moore	1283	7.5R 8/4	Eggshell Quiet room/3 walls

APPENDIX C
IRB APPROVAL

UF | Institutional Review Board
UNIVERSITY of FLORIDA

PO Box 112250
Gainesville, FL 32611-2250
352-392-0433 (Phone)
352-392-9234 (Fax)
irb2@ufl.edu

May 8, 2009

TO: Mina Bevan
1882 N. Prairie Dunes Ct.
Oviedo, FL 32765

FROM: Ira S. Fischler, PhD; Chair
University of Florida
Institutional Review Board 02

SUBJECT: **Exemption of Protocol #2009-U-0547**
Autistic Patients' Parents and Staff Members Interview Questionnaires

SPONSOR: None

The Board has determined that your protocol is exempt from review. This exemption is issued because this protocol does not involve the use of human participants in research in accordance with 45 CFR 46. Human participants are defined by the Federal Regulations as living individual(s) about whom an investigator conducting research obtains (1) data through intervention or interaction with the individual; or (2) identifiable private information.

Should the nature of your study change or if you need to revise this protocol in any manner, please contact this office before implementing the changes.

IF:dl

APPENDIX D
CERTIFICATION OF TB HEALTH REQUIREMENT

CERTIFICATION OF TB HEALTH REQUIREMENT
CHAPTER 65C- 22.004 F.A.C

Mina Bevan was administered a tuberculosis
NAME OF EMPLOYEE

test on 5-15-09. PPD (L) forearm
DATE

The results were positive_____ negative ✓ with redness

on 5-18-09.
DATE

TEL # 4076489383
Dr. SABIHA S. KHAN
218 LIME AVE
ORLANDO Fl - 32085

PHYSICIANS SIGNATURE

**** IF THE RESULTS OF THE TEST ARE POSITIVE, WRITTEN MEDICAL AUTHORIZATION TO WORK IN A CHILD CARE FACILITY IS REQUIRED.****

****A TB TEST IS VALID FOR TWO YEARS.****

This form must be completed by a licensed physician. The completed form must be in the employee's personnel file

revised 3/99

APPENDIX E
CONSENT LETTER

CONSENT LETTER

Dear participant:

As part of my thesis, I am conducting an interview to provide information and feedback for post-occupancy evaluation. The purpose of this study is to develop the interior design guidelines for an autism care facility by conducting the case study of the Cove,'autism center in Paradise, California.

This interview is expected to take no longer than an hour to complete. You are not obligated to answer any questions that you are uncomfortable with or do not wish to answer. There are no foreseeable risks in participating in this interview. Your identity will be kept confidential to the extent provided by law. The data collected in this study will only be analyzed and reported in aggregate form.

Your participation in this study is strictly voluntary. Refusal to participate will involve no penalty and you may discontinue participation at any time. There is no compensation for participating in this study. There are no direct benefits to you in completing this interview.

If you have any questions about this research project, please feel free to Mina Bevan, Graduate Student, at (407)694-1825 (exit2006@ufl.edu). For additional information regarding human participation in research, please contact the Campus Institutional Review Board (IRB) in the University of Florida Gainesville IRB Office at (352)392-0433.

By proceeding with the questionnaire and answering the questions, you give me permission to report your responses anonymously in the final manuscript to be submitted to my faculty supervisor as part of my course work.

Thank you and your participation is greatly appreciated.

Sincerely,

Mina Bevan
Exit2006@ufl.edu

I have read the above information and I voluntarily agree to participate in the interview.

Participant Signature: _____ _____Date: _____ _____

APPENDIX F
CONSENT LETTER TO CONSERVATOR

Mina Bevan
Graduate Student
University of Florida
Department of Interior design
444 P.O. Box 115705

Mina's cell: (407)694-1825
Mina's e-mail: exit2006@ufl.edu

Dear (name of conservator)

Re: (name of Consumer)

(Name of Consumer) participates in the COVE day program in Paradise, CA. The COVE, is an aspect of the day program which was designed by Professor Kijeon Jeon of the Interior design Department of California State University at Chico.

The design of the COVE is unique in that much research was involved in designing the interior of the building that would provide people with Autism an environment most conductive to learning.

My studies are in interior design and when I became aware of the COVE I was most interested in studying how interior design influences the behavior of individuals in the COVE day program. The purpose of my study is to develop the interior design guidelines with autism.

As part of my research, I am requesting access to (Name of Consumer)'s personal file located in the offices of the COVE day program located at 5645 Clark Road, Paradise, CA. The identity of (name of consumer) will be kept strictly confidential and the data collected will only be analyzed and reported in collective form without revealing the names of any consumer that is a part of the study.

Participation is strictly voluntary. There is no compensation for participating in this study. There are no direct benefits to you in providing the information.

Please consider authorizing my request to access (Name of Consumer)'s personal behavior archives for the research.

Your authorization would be greatly appreciated.

Also, you may wish to contact COVE and speak to the Director, Terry Kozloff at 530-877-0937 to confirm my study and its intent.

Thank you

CONSENT LETTER

I have read the information provided on the preceding page and I voluntarily **give permission to Mina Bevan to access the personal file of** (Consumer's Name) located at the COVE offices, 5645 Clark Road, Paradise, CA 95969. This is for research purposes only and (Consumer's Name) will be kept strictly confidential.

_____ -

_____

Conservator to (Consumer's Name) Date

☐ Check the box if you **DO NOT** want to give authorization to Mina Bevan to access the personal file of (Consumer's Name).

Please return this page (Consent letter) in the postage paid envelope.

APPENDIX G
CONSENT LETTER TO NON-CONSERVATOR

Mina Bevan
Graduate Student
University of Florida
Department of Interior design
444 P.O. Box 115705

Dear_____,

I am studying interior design and when I became aware of The COVE I was most interested in studying how interior design helps you learn. As part of my research, I am requesting access to your personal file located in the offices of the COVE day program located at 5645 Clark Road, Paradise, CA. Your identity will be kept strictly confidential.

Participation is strictly voluntary. There is no compensation for participating in this study. There are no direct benefits to you in providing the information.

Please consider authorizing my request to access your personal behavior archives for the research.

Your authorization would be greatly appreciated.

Also, you may wish to contact COVE and speak to the Director, Terry Kozloff at 530-877-0937 to confirm my study and its intent.

Thank you

CONSENT LETTER

I have read the information provided on the preceding page and I voluntarily **give permission to Mina Bevan to access my personal file** located at the COVE offices, 5645 Clark Road, Paradise, CA 95969. This is for research purposes only and your identity will be kept strictly confidential.

_____ -
_____
Name Date

APPENDIX H
OBSERVATION FORM

Record #: _____

Date: _____

Starting Time: _____

Ending Time: _____

Weather Condition:

Client's ID: _____; Age: _____; Gender: _____

Client's Profile on Sensory Issues							
Auditory		**Visual**		**Tactile**		**Olfactory**	
High	Low	High	Low	High	Low	High	Low

Setting: _____

Observation Form: depict diagrams/sketches using floor plans, elevations, sketchbook, & photos

1. What activity/task is the client doing? What is the client's Role? What the predominant behaviors are?

2. To/With Whom (Numbers of people/groupings with the client)?

3. How (with what objects)?

4. Where (exact location/setting)? What the major physical characteristics are?

5. When (time, frequency, duration)?

6. Does Architecture help or hinder the client's behavior? Why?

7. Could it be better designed for the client? How?

APPENDIX I
INTERVIEW INSTRUMENT

INTERVIEW SCRIPT

Client's Profile on Sensory Issues							
Auditory		Visual		Tactile		Olfactory	
High	Low	High	Low	High	Low	High	Low

Participant's Name:
Job title:

Client's ID: _____; Age: _____; Gender:

Staff members

Could you please describe your job title and responsibilities?

How many hours do you spend time with clients? What is your role?

How do you like to work in the COVE center?

What are the (client's name) *most/least favorite activities* in the COVE program?

How (client's name) react to this COVE center? Do you get any positive/negative feedbacks from them?

Which area in the COVE (client's name) like the best?

Do you think there are any clients' behavioral changes after moving into this COVE center? If yes, could you explain in details?

What is your perception/response to the interior design of this COVE center?

Do you see any relationship between (client's name)'s behavior and interior design features of this facility?

In general, what do you think would be the best space/environment for (client's name)?

In general, how satisfied or dissatisfied are you with this facility as an autism center for (client's name) in terms of programs & environment?

What is your overall impression of the COVE center?

What do you like/dislike about the design of the interior spaces within the COVE center? And what/how would you change?

What are your favorite space/features in this center? (most favorite/least favorite space/features) Could you explain why in details?

Is there any area in the COVE need to be improved in terms of architecture/design?

To Staff members: The following questions relate to the specific design solutions at the COVE center.

S1. Tactile
When you show movies on regular screen (smooth) vs. projection wall with texture to the clients, what are the clients' reactions between the two different types of projection?

S2. Lighting
1. What are the clients' reactions on the single color LED COVE lighting vs. sequential changing LED base COVE lighting?

S3. Sound: What is your opinion of acoustics quality of the COVE?

APPENDIX J
DEMOGRAPHIC SURVEY

1. Your Gender:
   a) Male b) Female

2. Your Age:
   a) 18-25 c) 31-40 e) 51-65
   b) 26-30 d) 41-50 f) Over 65

3. Please define your ethnic/racial identity:
   _____

4. Highest Education Level Completed:
   a) Some High School d) College Degree
   b) High School e) Post Graduate Degree
   c) Some College

5. Please describe your relationship to the client:
   _____

6. Is this the first treatment center for the client?
   a) Yes b) No
7. How long have you known this client?
   a) Less than 6 months d) 2 - 5years
   b) 7 months - 1 year e) 5 - 10 years
   c) 1 - 2 years f) More than 10 years

8. How long has the patient diagnosed with autism?
   a) Less than 6 months d) 2 - 5years
   b) 7 months - 1 year e) 5 - 10 years
   c) 1 - 2 years f) More than 10 years

9. How many hours do you spend time with client? (per week)
   a) less than 1 hour d) 11-20 hours/week
   b) 1-5 hours/week e) 21-40 hours/week
   c) 6-10 hours/week f) more than 40 hours

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BIOGRAPHICAL SKETCH

Mina Kim Bevan was born and raised in Korea and moved to the United States, when she was fifteen. Since she was a child, she has always been interested in art and space planning her future room. Mina Bevan received her Bachelor Science in molecular and microbiology from the University of Central Florida in 2006. With her degree, she worked for a year by spending a fair amount of time in the lab, hospital and doctor's office. She felt that those spaces need some love and attractiveness and decided to join the University of Florida to earn her Master of Interior Design. Her primary research interest focuses on the healthcare design.