Representational Elements of Nature's Effect on Seniors' Self-Perceived Well-Being

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In a fast paced world driven by success, full of work demands, with too many time constraints and too much stress, the importance of human well-being can not be emphasized enough. Likewise, the synthetic environment in which we spend our time has distanced us from the natural world and we have forgotten the importance of nature in our daily lives.

By contrast, older adults live a slower paced lifestyle, and sadly, they are often not appreciated in our culture because of it. The stereotype that older adults are undervalued reminds me of a story about an older man going to visit his doctor. When the man explained that he was having pain in his right leg, the doctor replied, "Well what do you expect, you are 80 years old?," to which the old man replied, "Well my left leg is 80 years old too, and it doesn't have any pain!" If our goal is not for optimal health, then have we got it all wrong? This thesis aims to call attention to the opportunity and the responsibility we have as designers to improve well-being for an aging America.

I found comfort in my adviser and committee having an understanding of the importance of well-being, design's ability to impact well-being, and the importance of the senior housing market. Thank you for allowing me to explore the research area I feel most passionate about and supporting me throughout the long process of writing my thesis. Furthermore, thank you to my family and friends for their love and support, even though they may not have always understood the purpose of my research goals. Lastly, thank you to Presbyterian Homes & Services, and the staff at Johanna Shores for their assistance during the process of interviewing residents.

ABSTRACT

Humans evolved in a natural habitat, and thus, have an innate preference for nature, as stated by the biophilia hypothesis (Wilson, E.O., 1984). Attention Restoration Theory stresses nature's incredible ability to restore ones' mind (Kaplan, S., 1995). Consequently, spending time in nature improves humans' well-being. It is reasonable to assume that nature's benefits could be extended to viewing nature in interior space, referred to as biophilic design (Kellert, 2008). Incorporating nature into interior space is critical for older adults who may no longer be able to experience the outdoors. This study examined the possible effects on seniors from their observation of representational elements of nature (REN) in the interior of senior living communities to determine if they would strengthen their self-perceived connectedness to nature, and therefore, support their self-perceived well-being. This exploratory mixed methods study surveyed 20 residents at a market rate independent senior living community. Individually, participants viewed four pairs of photographs of senior living communities' main public lounges. The four REN variables reviewed were water, fire, natural materials, and botanical motifs. It was found that natural materials, followed by fire, had the most significant influence on seniors' well-being. Findings related to botanical motifs and water's influence on well-being is less clear. Plants, color, and nature-based artwork were also identified as design elements that influenced participants' preference for the lounges shown in the photographs, though not REN variables measured in this study. This exploratory research lays a foundation for future researchers to examine the significance of incorporating REN into interior space occupied by seniors in independent living communities.

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CHAPTER 1. INTRODUCTION

Purpose of the Study

There are three research foci of this exploratory study. First, to determine if incorporating representative elements of nature (REN) in senior living environments has an influence on seniors' self-perceived well-being. Second, to determine which REN variables specifically are contributing to seniors' self-perceived well-being. Third, to identify which REN variables have the most significant influence on seniors' self-perceived well-being. Four REN variables: water, fire, natural materials, and botanical motifs were reviewed to determine which, if any, representational element of nature has the most significant influence on seniors' well-being.

Background

The human/nature connection will be explained broadly first, then as it applies to older adults, and finally as it relates to the built environment. An overview of the built environment, focusing on healthcare and senior living settings will follow.

The Human/Nature Connection

People currently experience nature less than our ancestors because modern culture requires that the majority of peoples' time be spent indoors (Cramer & Browing, 2008; Joye, 2006b). Today's society spends more than 90% of their time in artificial, human-designed indoor spaces (Cramer & Browning, 2008; Kellert, 2012; Mayer & Frantz, 2005). This phenomenon has been raised as a concern by researchers. Gullone (2000) asserted, "Given that our modern ways of living, as prescribed by Western industrialized culture, stand in stark contrast to our evolutionary history, it is proposed that we may

currently be witnessing the beginnings of significant adverse outcomes for the human psyche" (p. 293).

Furthermore, as noted by Joye, Willems, Brengman, and Wolf (2009), "With increasing population levels and urbanization, this alienation from nature could become further exacerbated, with the result that an increasing number of individuals will lose the opportunity to experience nature as a source of psychological and physiological health and enjoyment" (p. 58). It is interesting that, "For the first time in human history a majority of the world's population, now reside in a city or suburb, generally the most environmentally transformed and degraded of all human environments, where separation from nature has become normal" (Kellert, 2012, p. 157).

Further, rapid change has occurred due to technology. Benyus' (2008) argument is fundamental, "The more technological we become, the more we have to remind ourselves of the bodies that we inhabit and the biological communities to which we belong" (p. 30). The advancement of technology has become the focus in our modern world and the importance of nature is forgotten (Louv, 2011). Kellert (2012) remarked,

> Many people today view society, far from depending on nature, as having overcome reliance on the natural world through the wonders of science, engineering, and mass production…We have deluded ourselves into associating human progress and civilization with the dominance, transformation, and transcendence of nature. (p. ix-xi)

Gullone (2000) pointed out, "We go on advancing with the blind assumption that the human species has an unlimited capacity to adapt to the environment, no matter how far removed it is from that in which we evolved" (p. 294). Kellert (2012) highlighted this

viewpoint best, "What we require now is a new realization of how much our health and well-being continue to rely on being a part of rather than apart from nature" (Kellert, 2012, p. xi).

Older adults and the human/nature connection. Sugiyama and Thompson's (2007) literature review determined that there are both physiological and psychological benefits relating to well-being for older adults who spend time outdoors. However, despite the apparent benefits nature offers, it is difficult for aging adults with health concerns or mobility challenges to physically interact with nature in an outdoor setting as they have in the past (Sugiyama & Thompson, 2007). Not surprisingly, "Many activities associated with moving around and enjoying the outdoors require a certain level of strength, agility, and stamina, the qualities that many older people are in the process of losing as ageing advances" (Sugiyama & Thompson, 2007, p. 1943).

There is a positive, supportive, relationship between spending time in nature and physical fitness as both encourage one to do the other. "When we connect with nature, we are also more likely to engage in physical activity and other behaviors that improve our health" (Hansen-Ketchum et al., 2009, p. 1528). Research shows that regular exercise is beneficial to people of all ages, including older adults (Sugiyama & Thompson, 2007). Leading a physically active lifestyle helps older adults remain independent, retain memory, maintain cognitive performance, decrease depression, and increase social interaction (Sugiyama & Thompson, 2007). According to the American Academy for Family Physicians (AAFP), the overwhelming majority of seniors do not exercise the recommended amount of 150 minutes of moderate-intensity aerobic activity, 75 minutes

of vigorous-intensity aerobic exercise, and two strength training workouts weekly, and "28 to 34 percent of adults 65 to 74 years of age are inactive" (2010, p. 1).

Opportunity to experience nature indoors. Because the senior population has little opportunity to foster the human/nature connection in an outdoor setting, bringing aspects of the natural world indoors is crucial; therefore, the indoor environment should aim to support the human/nature connection. "Our physical and mental health, productivity, and well-being continue to rely on our connections to nature, even as our world becomes increasing fabricated and constructed" (Kellert, 2012, p. ix). Therefore, it is problematic that the design of the built environment does not support the human/nature connection.

The use of artificial finishes and materials, electrical lighting over natural light, and HVAC systems over fresh air creates interior environments of a synthetic design; interiors have little resemblance of the natural environment in which humans have evolved (Joye, 2006b; Kellert, 2005). Kellert (2012) remarked, "We cannot flourish as individuals or as a species absent a benign and benevolent relationship to the world beyond ourselves of which we are a part" (p. xiv). Subsequently, the built environment should uphold the circle of life between humans and our natural habitat (Berkebile, Fox, & Harley, 2008).

The built environment is minimalist compared to the sensory rich and constantly changing natural environments in which humans evolved (Joye, 2006b). There is an understanding that zoo environments should be designed to mimic animals' natural habitat instead of living in a cage, but this concept has not translated to human habitats. Humans essentially have designed themselves into cages of the former zoo model

(Kellert, 2005, 2012). "Among the greatest challenges of our time is to create good habitat for people in our cities and other designed environments that satisfies our inherent need for beneficial contact with the natural world" (Kellert, 2012, p.157). Furthermore, Huelat (2008) professed, "Designing with nature can restore balance and harmony within the environment" (p. 23).

Built Environment

In this segment, the relationship between the built environment and well-being will be established first. Then, background information about healthcare environments will be discussed, including the identification of design elements in healthcare environments. Senior living environments will be presented last, including an overview of the history and the importance of well-being in senior living environments.

This segment will focus on the connection between design of the built environment and its effect on well-being. Well-being, "Refers to contentment, satisfaction, or happiness derived from optimal functioning" (McDowell, 2010, p. 70). Well-being is often used interchangeably in the literature with the terms wellness, welfare, quality of life, and healthy.

The relationship between the design of the built interior environment and its influence on users' well-being has been recognized. Designing space to support wellness is not a new concept. The healing capabilities of color were recognized by the ancient Egyptians; they designed the rooms in the temple for the sick to capture the sun's rays into various colors of the spectrum (Schweitzer, Gilpin, & Frampton, 2004). Ancient Greek temples housed sick patients and were designed to promote healing through using nature, music, and art (Caspari, 2010; Scheitzer et al., 2004). In the 18th-and 19th-

centuries, color was used as an aid in treating smallpox and behavioral problems (Schweitzer et al., 2004). In the 19th-century, Florence Nightingale observed the difference in the survival rate among patients at different medical facilities and determined that the facilities' designs were the cause for the variance (Schweitzer et al., 2004). The ability of the design of the built environment to have an effect on humans has long been acknowledged.

Different settings have the ability to affect humans in different ways. The field of environmental psychology focuses on the effect space can have on humans. "One of the central issues of environmental psychology is how different types of settings can trigger different affective states in individuals" (Joye, 2007, p. 306). The psychological response to perceiving environments can be cognitive and/or emotional (Dijkstra, Pieterse, and Pruyn, 2006). For example, in 2001, spa resorts were visited by 156 million Americans seeking to positively affect their state of mind through the spa's healing environment, which was created through the proper application of lighting, finishes, and acoustics (Frost, 2004) in combination with available spa treatments. Examples in healthcare settings will be reviewed next, followed by senior living environments.

Healthcare environments. The importance of well-being within the interior environment is recognized in healthcare design. In fact, the majority of research on the influence of the interior environment on human well-being is in healthcare applications and focuses on how design can promote healing. "The physical environment is one of seven key indicators for the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS), the first national, standardized, publicly reported survey of patients' perspectives on and satisfaction with hospital care" (Wu et al., 2013, p. 48). This is a

testament of the importance of design in the healthcare environment because of its impact on satisfaction.

Furthermore, the design of the interior environment is one of the 10 core components of the Planetree philosophy of care for hospitals, because the organization recognizes the environment's role in personalizing, humanizing, and demystifying the patient experience (Planetree, 2014). One of the principles of the Planetree hospital model, a nonprofit organization established in 1978, is to support the human/nature connection (Planetree, 2014).

The design of hospitals initially aimed to create a hospitality feel, then in the 1930s, the focus shifted from design to technology, and consequently, the institutional hospital model was formed (Wu, Robson, & Hollis, 2013). Hospitals are once again embracing a hospitality aesthetic, especially in the lobby, to increase patient satisfaction and be competitive in today's market (Wu et al., 2013). Design characteristics used to create the hospitality aesthetic include attention to lighting, use of noise-reducing finishes, use of carpeting, decentralized supplies, and nursing floor layout (Wu et al., 2013). Some of the hospitality inspired amenities include private rooms and family-friendly rooms, as well as rooms with windows to provide daylight and views of nature (Wu et al., 2013). Additionally, some healthcare environments are incorporating upscale dining options, and spas and wellness centers as amenities (Wu et al., 2013). The Henry Ford West Bloomfield Hospital took their amenities a step further by creating an atrium that has a meditation garden with live trees and is so impressive that it is used for weddings (Wu et al., 2013).

Caspari, Eriksson, and Naden's (2010) qualitative study concluded that the design of hospitals is important for patients' well-being and can create positive or negative psychological responses in the users of the space. "Aesthetics are important because of the power to promote health and wellness" (Caspari et al., 2010, p. 141). As acknowledged in a statement from a pediatric specialty hospital that was remodeled to create a hospitality-like environment, "With the new design, our facility became almost a member of our care team" (Wu et al., 2013, p. 62).

Arneill and Devlin's (2002) study of patients' perceptions in waiting rooms found that people have a greater perceived quality of care and comfort level in waiting room environments that are more attractive (i.e., furnished nicely, well-illuminated, warm color palette, and contain artwork).

> The most obvious explanation for these findings is that when patients perceive that a physician (or someone connected to him or her) has put time, thought, and care into the environment of the waiting room, it suggests that the physician must put the same quality into the care that is given to patients. (Arneill & Devlin, 2002, p. 355-356)

It has also been found that the design of acute psychiatric wards has the ability to increase socialization, reduce violence, and reduce length of patient stay (Vaaler, Morken, & Linaker, 2005). "In a recent survey by the CABE/ICM in Great Britain, 91% of nurses and 100% of directors of nursing believe that a well-designed environment is significantly related to patient recovery rates" (Schweitzer et al., 2004, p. S-79).

Design elements. While many studies claim that the design of healthcare environments influences patients' well-being, the specific design elements attributed to

their positive affect on well-being is less evident and difficult to apply to all healthcare settings, although researchers are beginning to investigate the connections (Dijkstra et al., 2006). For instance, a literature review on healthcare settings by Scheitzer et al. (2004) asserted that smell, sound, temperature, ventilation, light, color, viewing nature, and artwork all influence the behaviors, action, and interactions of people in the interior space. Also, across healthcare studies rooms that have plants, daylight, and views of nature were preferred by users of healthcare environments and spaces that are designed to encourage physical activity and promote social interaction may reduce depression and improve the user's well-being (Schweitzer et al., 2004).

A literature review conducted by Dijkstra et al. (2006) found that 1) sunlight, windows, odor, and seating arrangements had an influence on patients' well-being in healthcare settings; 2) patients with depression had a lower mortality rate and shorter length of stay in rooms with sunlight; 3) patients had reduced delirium, improved sleep, and reduced length of stay in rooms with windows and a natural view; 4) women had less anxiety and improved mood in waiting rooms with the ambient odor of orange essential oil; and 5) furniture layouts encouraged social interaction between men in a hospital psychiatric units.

In another study by Caspari et al. (2010), when 16 participants (8 men and 8 women) who were considered experienced professionals in an aesthetic related field, were asked about what they preferred in the design of hospitals in Norway, they cited spacious rooms, a home-like feel, a clean and properly maintained building, the presence of nature (flowers, plants, trees), an exterior nature view, daylight, sufficient lighting but not too bright, reduced noise and smells, and soft and clean colors. Participants also

preferred art that created a sense of peace, lightness, and was uncomplicated (Caspari et al., 2010).

Evidence is emerging that connects healing to the design of the environment. The implementation of this evidence has great potential to improve healthcare design as well as influence healthcare expenditures.

Senior living environments. Throughout the history of senior living communities, models of care have changed greatly over the years. A review of the history of senior living environments will be followed by a discussion of the importance of well-being in senior living environments.

History. Prior to the 1970s, nursing homes were medically focused and solely concerned with the residents' physical safety (Brawley, 2006). Slowly, senior living is shifting from the acute hospital care model to a more holistic care model (Brawley, 2006). "Long-term care is now seen less as a medical experience and more as a lifestyle experience" (Chapman, 2008, p .59). The new model is directed at person-centered care to maximize the residents' amount of independence, dignity, choice, and decision-making control (Brawley, 2006). This results in smaller, more intimate settings to encourage socialization.

Demographic changes in the senior population such as smaller families due to a fewer number of children and higher divorce rate, more educated, more experienced travelers, and longer life expectancy, calls for change in the senior living housing market (Brawley, 2006). The baby boomer generation, who may be looking at senior living options for their parents or themselves, have different expectations which also necessitates change (Brawley, 2006; Chapman, 2008). This generation is more outspoken

and looking for a more meaningful life through opportunities for personal growth and a greater connection to the community (Brawley, 2006; Chapman, 2008). Additional amenities driven by the baby boomers include onsite health spas, fitness centers with indoor pools, daycare, retail spaces, Internet cafes, and indoor gardens in atriums (Brawley, 2006; Chapman, 2008).

There is beginning to be a shift to building senior living communities in more urban locations, as well as a shift towards designing buildings to be more integrated with the surroundings (Chapman, 2008). Senior living communities have become a hybrid between healthcare and residential living and hospitality design (Chapman, 2008).

The new, adapted language of senior living terminology parallels the person-centered approach: *long-term living* or *continuing care retirement communities* (CCRC) instead of *nursing homes*, senior living *community* instead of senior living *facility*, and resident *apartments* instead of *units*.

The level of care options have expanded from skilled nursing care to include independent living, assisted living, and skilled care (American Association of Retired Persons, 2014). CCRCs offer a variety of services to accommodate the aging process (American Association of Retired Persons, 2014; Chapman, 2008). As a resident's care needs progress, they are able to get additional services and move to different areas of the CCRC (American Association of Retired Persons, 2014; Chapman, 2008).

Independent living residents require little to no outside care. Assisted living residents receive some nursing care assistance with activities of daily living (ADLs); an average of 4.4 ADLs on a 0-6 scale, with "0" meaning dependent and "6" meaning independent (Brawley, 2006; Family Practice Notebook, 2014). The typical assisted

living resident is a woman age 85-89 (Chapman, 2008). ADLs are defined as, "Everyday tasks that are required for people to live on their own, such as the abilities to feed oneself, go to the toilet, take a bath, and get out of bed" (Moody & Sasser, 2012, p. 521). As the most advanced level of care, skilled care communities offer 24 hour nursing medical care (Chapman, 2008). Additionally, CCRCs often have an area specific to residents who require memory care services (Chapman, 2008). The focus of this study is on independent living environments.

Well-being. The study of older adults within their settings/environments has been termed "environmental gerontology" (Sugiyama & Thompson, 2007, p. 1943). Researchers exploring this relationship have found that the design of the senior living environment contributes to seniors' well-being (Cutler, Kane, Degenholtz, Miller, & Grant, 2006).

A study by Parker et al. (2004) found that the design of senior living environments influences older adults' quality of life and well-being; the impact is especially noteworthy because they spend the majority of their time at home. This, "Places an obligation on designers and care providers to maximize the residents' quality of life by close attention to the design features of the environment" (Parker et al., 2004, p. 960).

Designing the interior environment with consideration for the aging body and mind can help minimize older adults' limitations resulting from the aging process.

> Much research evidence points to a link between activity levels and well-being in older people, and our findings demonstrate higher activity levels in care homes

> which offer their residents continued social integration and the maintenance of existing social networks through design features. (Parker et al., 2004, p.957)

Furthermore, a literature review of architectural and psychological aspects of senior living communities' building layout and amount of sensory stimulation and privacy, indicated that the design of senior living interior settings have an influence on residents' well-being (Barnes, 2002). Likewise, Verbeek et al. (2010) compared small-scale, home-like facilities to the traditional dementia nursing home and found that the residents living in the small-scale, home-like facility had better cognition and were more independent when doing activities of daily life.

Reimer, Slaughter, Donaldson, Currie, and Eliasziw (2004) compared the traditional institutional facilities to the new, specialized care facilities that place more importance on the design and aim to create a home-like, comfortable environment. Their results showed that residents with dementia had an improved quality of life in the new model, better function for activities of daily life, and less anxiety. Also, behavior issues evident in 90% of memory care residents were found to be diminished in the new model of the interior environment (Reimer et al., 2004).

The importance of senior living *design* is evident through the inclusion of design measures within facility evaluations. In the United Kingdom, the *Sheffield Care Environment Assessment Matrix* (SCREAM) tool developed by Parker et al. (2004) found that the interior environment can positively influence senior residents' quality of life. Also, development of The Multiphasic Environmental Assessment Procedure (MEAP) included "architectural features" as one of the five categories for evaluation (Barnes, 2002).

Rationale for the Study

Indentifying the design elements that influence seniors' well-being will help designers create spaces that support their well-being (Dijkstra et al., 2006). However, based on a literature review conducted March 2013, it was determined that research about designing senior living facilities to support the well-being of residents is limited (Barnes, 2002; Cutler et al., 2006; Dijkstra et al., 2006; Sugiyama & Thompson, 2007), with perhaps the exception of lighting and wayfinding research (Barnes, 2002). Many studies on the elements of interior space that influence well-being did not measure the individual variables (i.e., design elements) that influence well-being (Dijkstra et al., 2006). In this way, knowledge about the influence of design elements on seniors' well-being is limited, as compared to the body of knowledge about the influence of design elements on occupants of healthcare facilities.

Significance of Senior Living Environments and Well-Being

Supporting seniors' well-being is an imperative research area because the senior population is an important market sector. The baby boomers are starting to retire and the senior market is growing exponentially (World Health Organization, 2013; Hu, Wei, Schlais, & Yeh, 2008). According the United States Census Bureau's (2008-2012) survey of a 5-year estimate, the population of Americas age 65 and over is nearly 41 million (13%), 56.8% female and 43.2% male, and the median age is 74 years. By 2020, there will be 94.9 million Americans who are age 55 and older, and by 2050 the number will grow to 104.3 million, equating to one-third of the U.S. population (Hu et al., 2008). Globally, there will 2 billion people over the age of 60 by 2050 (World Health

Organization, 2013). “Baby boomers are turning 50 at the rate of one every ten seconds. This figure equates to more than 12,000 a day and over four million a year for the next decade” (Patterson & Pegg, 2009, p. 258). Part of the growth of the older adult population is due to the increase in life expectancy; the average American life expectancy has risen by about 60% since the 1930s (Brawley, 2006). According the United States Census Bureau (2012), the projected American life expectancy for 2015 is 78.9 years of age, 81.4 years old for females and 76.4 years old for males.

The increase in the senior population requires an increase in senior housing. In 2010, there were 31,100 assisted living facilities housing nearly two million residents in the United States (National Center for Assisted Living, 2014). The top 80 senior living providers in 2013 account for a total resident capacity of 528,099, or 239,145 in independent living alone (Assisted Living Federation of America, 2014). In 2011, there were 19,000 new senior living units constructed nationwide (Assisted Living Federation of America, 2012). The overall dollar volume of senior housing equated to $11 billion in the United States and Canada in 2013 (Assisted Living Federation of America, 2014).

The more senior living sites available, the more selective and discerning prospective residents can be, requiring senior living communities to be competitive. Sadly, while Americans are living longer, they are not living in better health (Brawley, 2006). Fortunately, 70% of health decline is related to factors that can be improved (Brawley, 2006). Designing senior living communities that support the well-being of residents will give developers a market advantage.

Problem Statement

There is insufficient knowledge about 1) how to enhance seniors' well-being through the design of the environment and 2) which design elements incorporated into senior living environments contribute to seniors' well-being. The beneficial connection between humans and the natural environment is understood (Kaplan, 1995; Kellert, 2008; Louv, 2011; Ulrich, 1984).

However, an examination of the decline of the human/nature connection and its influence on humans' well-being can illustrate the importance of this relationship to seniors' well-being. The diminishing amount of time people spend outside in nature, especially the senior population, has led to a society that is disconnected from nature (Louv, 2011).

Research Questions

Based on the understanding of the benefits of the human/nature connection and the need to foster that relationship as well as the gap of knowledge regarding how to improve seniors' well-being through the design of interior space, four research questions emerged:

1) Can a human/nature connection influence seniors' self-perceived well-being?

2) Do seniors prefer environments with REN variables over environments without REN variables?

3) Will seniors' self-perceived well-being be affected by observing REN in the interiors of senior living facilities?

4) Which REN variables have the most significant influence on seniors' well-being?

The first research question focuses on the natural environment's influence on seniors' self-perceived well-being. For the remaining three research questions, the natural environment inspires the incorporation of REN variables into the designed environment and then it is anticipated that the designed environment influences seniors' self-perceived well-being.

Significance of the Study

Well-being is increasingly becoming acknowledged as a critical subject. The senior living industry is beginning to realize the importance of psychological health and well-being in addition to physical health (Reimer et al., 2004). "Emphasis of care should change from emphasizing medical and physical care needs to being more focused on physical and emotional comfort and resident choice" (Reimer et al., 2004, p. 1085). The designed environment/well-being connection is critical for seniors and much more knowledge is needed to equip designers to create environments supportive of optimal well-being. Decreasing the morbidity rate is the key focus when discussing the older generations' happiness.

> There has been a shift in focus away from increasing the length of someone's life to increasing its quality. Because of this there is interest in how older people's happiness, wellbeing or quality of life can be optimized through the built environment. (Burton, 2012,, p. 161)

This study aims to 1) determine if a human/nature connection has influence on seniors' self-perceived well-being, 2) investigate the influence of incorporating REN into the interiors of senior living communities on seniors' self-perceived well-being, and 3) explore which REN variables contribute to seniors' well-being the most. This exploratory study will provide a foundation for future research studies.

Summary

An introduction into the human/nature connection and its key relation to older adults was reviewed and the opportunity to foster the human/nature connection in the built environment was described. The majority of research on the built environment's ability to improve well-being focuses on healthcare settings, although there is some research specific to senior living environments. More research is needed on preferred design elements to increase well-being in senior living environments because seniors are a key market sector.

CHAPTER 2. LITERATURE REVIEW

In this literature review, an overview of the human/nature connection will be discussed first, followed by the two types of interaction with nature, active interaction and passive interaction. Active interaction with nature involves research about the benefits of *interacting* with nature in an *exterior* environment. Passive interaction with nature involves research about the benefits of *observing* nature or representative elements of nature in an *interior* environment. Much of the prominent theoretical exploration addresses active interaction with nature and includes the biophilia hypothesis, attention restoration theory (ART), and stress reduction theory. Horticulture therapy and connectedness to nature and well-being will also be discussed under active interaction. The topics that will be discussed relating to passive interaction include window view, biophilic design, and optimal healing environments.

Next, environmental preference will be discussed as it is the origin of support for this study, followed by a discussion of the importance of the lounge space in senior living communities. Then, the human ecosystem theory will be presented as the study's theoretical framework, followed by the four variables that will be explored as representation elements of nature (REN). Lastly, well-being will be comprehensively defined.

Human/Nature Connection

Because humans evolved in a natural world, they were strongly dependent on nature; moreover, they had a deep respect and appreciation for nature. The human/nature connection describes the human desire to feel, "A sense of belonging to something larger

than themselves and that this need may be fulfilled through a sense of belonging or connectedness to the natural world" (Mayer et al., 2009, p. 635). In modern times, however, less importance is placed on the relationship between humans and nature. "Moreover, our physical and mental health, productivity, and well-being continue to rely on our connections to nature, even as our world becomes increasing fabricated and constructed" (Kellert, 2012, p. ix). It is of little wonder that humans' change in lifestyle has a negative impact on well-being (Mayer et al., 2009).

This is unfortunate because "Understanding the vital capacity of the natural environment can make a substantial difference in bringing out the best in people" (Kaplan & Kaplan, 2011). The problem lies in the missed opportunities for improvement for humans to benefit from nature and nature to benefit from humans, for true integration of culture and ecology is "The point where nature and humanity are positively transformed and mutually enriched by their association" (Kellert, 2008, p. 12). Both nature and humans can benefit and prosper from the other. Kellert and Heerwagen (2008) commented about the relationship between humans and the natural environment, "It is about humanity's place in nature, and the natural world's place in human society, a space where mutuality, respect, and enriching relation can and should exist at all levels and emerge as the norm rather than the exception" (p. vii).

Active Interaction with Nature

When participants at a workshop about healing environments were asked to take a minute to imagine a "special place" that they find enjoyable, nine out of ten people imagined a place that was outdoors (Huelat, 2008). Furthermore, 97% of adults claimed

the outdoors was their most important environment during childhood (Kellert, 2005). It is unfortunate that people spend most of their time in the built environment, yet the overwhelming majority identifies a connection to a space in the natural environment (Huelat, 2008). The preference for natural settings over built environments is more than just aesthetic attraction (Kaplan & Kaplan, 1989). According to Huelat (2008), "People intuitively know that nature provides a meaningful and pleasurable part of our lives" (p. 24). This intuitive affinity for the natural environment is explained by the biophilia hypothesis.

Biophilia Hypothesis

The biophilia hypothesis is the innate connection humans have with nature (Wilson, E.O., 1984). "The literal translation of the Latin word biophilia is love of life" (Kellert, 2012, p. xii), although it is informally described as "love of the living world" (Huelat, 2008, p. 23). Humans evolved in a natural world and have retained some of their natural inclinations to gravitate towards life-like elements. Huelat (2008) explained the biophilia hypothesis as, "Our ancestors honored nature as a ubiquitous force in their lives" (p. 24). Likewise, Kellert (2008) described it as "The inherent human inclination to affiliate with natural systems and processes, especially life and life-like features of the nonhuman environment" (p. 3).

Humans' love of life and lifelike forms is evident in the participation of activities such as gardening, hiking, camping, visiting zoos, photography, and owning pets (Nisbet, Zelenski, & Murphy, 2009). North Americans make more visits to zoos than all other major sporting events combined (Gullone, 2000). It is common for families to own pets; there are 40 million cat owners and 55 million dog owners in America (Gullone, 2000).

There are eight core ways the natural world shapes humans' values: attraction, reason, aversion, exploitation, affection, dominion, spirituality, and symbolism. Attraction means humans' ability to appreciate beauty, reason refers to the human desire to understand the world, aversion signifies humans' ability to fear nature, and exploitation is defined as, "The desire to utilize and materially exploit the natural world" (Kellert, 2012, p. xii). Affection references humans' ability to be emotionally attached, dominion represents the human inclination to control nature, spirituality refers to the human pursuit of meaning through connection to something greater than oneself, and symbolism means the symbolic representation of nature (Kellert, 2012).

In the context of this connection however, Western civilization does not recognize humans' connection with nature as profoundly as some cultures. The principals of Feng Shui that the Far Eastern peoples developed and still employ aim to create a balance between the natural and built environments; likewise, the Zen philosophy, also concentrated in the Far Eastern region, focuses on a healthy relationship between nature and humans (Huelat, 2008). Additionally, nature has a central role in both Native American culture and among the Aboriginal people in Australia (Huelat, 2008). Huelat (2008) reflected, "What strikes me in both of theses cultures is that the human experience is not *in* nature but recognized *as* nature" (p. 30).

Research is also discovering hard-wired cognitive connections to nature. There are certain neural areas in the human brain that are responsible for recognizing parts of the natural world (Joye, 2006a). Furthermore, there is a commonality among all humans in how the brain responds to nature. Different cultures, both in the Western and non-

Western hemispheres, classify animals and plants in similar ways (Joye, 2006a; Joye, 2007).

It is evident from these findings, that satisfying a person's attraction to nature provides a sense of restoration for that person. There are two theories that have been formed about restorative environments, both stemming from the biophilia hypothesis: attention restoration theory (ART) and nature-based stress-reduction theory. Each is described below.

Attention Restoration Theory (ART)

Attention restoration theory (ART) proposes that restorative properties of the natural environment improve humans' ability for directed attention (Kaplan, S., 1995). ART focuses on the psychological impact nature has on humans. There are two types of attention, *directed* attention and *involuntary* attention.

Directed attention refers to tasks that take effort and concentration to observe that leads to mental fatigue (Kaplan, R., 2001). It is also referred to as "hard" fascination because it has a strong, and perhaps overwhelming, amount of stimulus (Kaplan, & Kaplan, 2011). Directed attention uses the prefrontal cortex part of the human brain that is responsible for mental functioning (Kaplan, S., 1995). With directed attention, a person is making a choice to pay attention to a particular task for a certain time period (Kaplan, S., 1995). Fatigue from work will occur even if it is a subject area that is enjoyed and is considered a personal strength (Kaplan, S., 1995).

In contrast, involuntary attention means a person is able to observe effortlessly, which helps restore the mind (Kaplan, R., 2001). It is also referred to as "soft" fascination because a person is not overwhelmed by the amount of stimulus, which allows a person's

mind to wander (Kaplan, & Kaplan, 2011). Observing nature is innately fascinating and, thus, only requires humans' involuntary attention. It could be dangerous if nature required humans' directed attention because they could be unaware of approaching threats. For that reason, it is perhaps an evolutionary advantage that nature requires humans' involuntary attention (Kaplan, S., 1995).

There are four interrelated components to create a restorative environment, 1) being away, 2) fascination, 3) extent, and 4) compatibility (Kaplan & Kaplan, 1989):

1) Being away: signifies changing mental activity from directed attention to involuntary attention (Kaplan, S., 1995). It can involve changing a person's physical environmental setting, but it is not required. Natural settings are usually preferred when changing the physical environment (Kaplan, S., 1995).

2) Fascination: represents the many, inherently captivating elements in nature that people can observe effortlessly; explaining why nature does not require directed attention and therefore does not lead to fatigue (Kaplan, S., 1995). Natural environments are restorative because they get a person's attention "modestly," while urban environments seize attention "dramatically" (Berman, Jonides, & Kaplan, 2008). "Soft" fascination, such as looking at clouds, sunsets, or falling snow is more restorative because it allows the mind to reflect or wander while observing nature's wonders (Kaplan, S., 1995).

3) Extent: refers to the scope of the restorative environment being an engaging experience that takes over a person's thoughts (Kaplan, S., 1995).

4) Compatibility: explains people's and the environment's ability to fit each others' purposes and demands. Even though people are more familiar with built

environments, they are more compatible with natural environments (Kaplan, S., 1995).

It is likely that the four components that help create a restorative environment also are key factors in increasing a person's connectedness to nature (Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009). However, nature's restorative benefits are not limited to the stunning, picturesque views of nature, but include the monotonous, ordinary nature (Kaplan, & Kaplan, 2011). For example, it a person's experience is not limited to a peaceful walk along the beach at sunset, but rather the trees and small pond you walk by everyday is still a restorative experience.

There is a significant amount of research to support ART. In a study involving recent breast cancer survivors, participants were instructed to do three restorative activities weekly, such as walking or gardening for 20 minutes each (Kaplan, S., 1995). The restorative group showed higher improvement in ability for directed attention than the control group. Furthermore, the restorative group was more likely to return to former activities, such as going to work full time. They also started new projects, such as learning to play music or volunteering, whereas the control group did not (Kaplan, S., 1995).

Another study examined directed attention by measuring participants' ability to proof read. There were three groups in the study. The wilderness vacationer group scored higher on the proof-reading test than the group of urban vacationers, or the non-vacationing group (Kaplan, S., 1995). Likewise, participants in the group that walked 40 minutes in a natural setting scored higher on a proof-reading test than the group that

walked in an urban environment or listened to music and read magazines (Kaplan, S., 1995).

Berman et al. (2008) did a study to compare natural environments' verses urban environments' affect on students' moods. Students took a mood assessment test prior to taking a 2.8 mile walk in either the arboretum nature park or the city's urban downtown. The walk was followed by a second mood assessment. A week later, the same participants had their mood assessed again then walked the opposing route that they walked the prior week. The before and after mood assessments were compared for the nature and urban walking routes; both weeks, students' mood assessments showed improvements in positive mood after the walk through the arboretum (Berman et al., 2008). A second study by Berman et al. (2008) was conducted using 50 photos of nature scenes and urban views, each. Students had cognitive improvements from viewing the nature photographs and liked the nature scenes over the urban views (Berman et al., 2008). However, this second study by Berman et al. (2008) is an example of viewing nature through photographs, which are considered passive interaction with nature, like viewing nature through a window. This type of interaction will be discussed later.

Stress Reduction Theory

While ART principally addresses active interaction with nature, some of the examples included for stress reduction theory include passive interaction with nature as well. In addition to nature's restorative benefits, its ability to reduce humans' stress levels has been recognized. During ancient times, the Romans recognized the role nature plays in providing recovery from city stressors such as noise and congestion (Ulrich et al., 1991). In 1865, the landscape architect Frederick Law Olmsted recognized the need for

recovery among city residents and wrote about nature's ability to restore them from stress in cities (Kaplan, 1995; Ulrich et al., 1991).

Stress reduction theory suggests that nature offers health benefits through its ability to reduce humans' stress levels (Ulrich, 1984). Ulrich (2008) defined stress as, "A process of responding to events, environmental features, or situations that are challenging, exceed coping resources, or threaten well-being" (p. 88).

Stress has psychological, physiological, and behavioral responses. Psychological effects of stress include fear, anger, anxiety, sadness, and helplessness (Ulrich, 2008; Ulrich et al., 1991). Physiological responses to stress affect the cardiovascular, skeletomuscular, and neuroendocrine systems in the body, meaning one has high blood pressure, increased heart rate, and increased amounts of the steroid cortisol and the stress hormone epinephrine in the body (Ulrich, 2008; Ulrich et al., 1991). "Behavioral effects of stress range from social withdrawal, verbal outburst, and sleeplessness to a failure to take medications" (Ulrich, 2008, p. 89). Other behavior effects can include alcohol or cigarette use and reduced cognitive performance (Ulrich et al., 1991).

Stress recovery, also known as restoration, involves improved cognitive performance, decreased feelings of fear, and an increase in positive feelings (Ulrich et al., 1991). Humans have an almost immediate response to the natural environment; stress recovery occurs within minutes of being in nature (Ulrich et al., 1991). Ulrich et al. (1991) characterized a natural setting as content that is primarily vegetation and/or water, and urban settings as human-made content such as buildings and cars.

There are many studies that support stress reduction theory. Participants (22 males) in Lee, Park, Tsunetsugu, Kagawa, and Miyazaki's (2009) study who viewed the

forest had lower stress levels, diastolic blood pressure, and pulse rate, than the participants who viewed the urban environment (participants were physically seated in each type of environment). In addition to the physiological responses, participants who viewed the forest experienced psychological benefits including feeling more comfortable, calm, and rejuvenated (Park et al., 2009).

All participants in Ulrich et al.'s (1991) study watched a stressful film about work accidents followed by a 10 minute videotape of nature or an urban environment. Participants who watched the nature film recovered faster compared to those who watched the urban film (Ulrich et al., 1991). In a second similar study, participants viewed a film that would cause them to feel fearful and therefore feelings of stress; then, some participants were randomly selected to watch a nature film of water. The group that watched the film of water was able to recover from their stress in only 20 seconds (Ulrich, 2008). Again, stress reduction achieved via viewing videos or photographs of nature, activities that are deemed to be passive interaction with nature, which will be discussed later.

Horticulture Therapy

Understanding horticulture therapy is also important when looking at the effect of nature on people. The principles of horticultural therapy have long been practiced. Interaction with plants is an intuitive experience, and has occurred organically for centuries (Haller & Kramer, 2006; Simson & Straus, 1998). During ancient times, people made the pilgrimage to the Hanging Gardens of Babylon because they recognized the healing benefits of observing the plants and flowers (Schweitzer et al., 2004). Ancient

cultures such as the Egyptians, Persians, and Chinese grew expansive gardens adjacent to their homes to feel connected to nature (Gullone, 2000).

Despite horticultural therapy's long existence in practice, the profession was established in 1973 (Haller & Kramer, 2006; Simson & Straus, 1998; Soderback, Soderstrom, & Schalander, 2004). Horticultural therapists recognize the health benefits of spending time in nature and aim to enhance humans' well-being through structured interaction with plants and gardens (Soderback et al., 2004; Wichrowski, Whiteson, Hass, Mola, & Rey, 2005). Wichrowski et al. (2005) defined the profession, "Horticultural therapy (HT) is a process through which plants, gardening activities, and innate closeness to nature are used as vehicles in therapy and rehabilitation programs" (p. 271). HT differs from gardening or the practice of horticulture because the focus with HT is on the person's *experience* with nature, rather than the garden's appearance as an end product (Simson & Straus, 1998).

Historically, the focus of horticultural therapists has been to improve the well-being of mental health patients (Soderback et al., 2004); however, the profession has expanded to include a variety of patients, including individuals with physical disabilities, senior citizens, memory care patients, children with impairments, and patients with other behavior disorders (Soderback et al., 2004). HT research mainly focuses on healthcare settings (Soderback et al., 2004; Wichrowski et. al, 2005), although there is some HT research on senior living environments.

Horticulture therapists have found that wandering gardens are beneficial to residents in memory care facilities (Relf, 2005). Additionally, a group of nursing home residents who were responsible for caring for the plants in the common area had higher

well-being measures than the group of residents who lived in a nursing home where the plants were cared for by the staff (Bates & Marquit, 2011). Furthermore, Sugiyama and Thompson's (2007) review of literature about the quality of life for residents of long-term care facilities produced two conclusions that relate to this study. First, residents lived longer in senior living facilities that offered a nearby green space for residents to walk; benefiting perhaps from both the opportunity to exercise, as well as spending time outdoors (Sugiyama & Thompson, 2007). Secondly, they found that residents who were in horticulture programs increased their psychological well-being, possibly from contact with nature as well as from the social interaction during participation (Sugiyama & Thompson, 2007).

Connectedness to Nature and Well-being

There is a relationship between a person feeling connected to nature and well-being. Mayer & Frantz (2004) explained the meaning of connectedness to nature, "Feeling a sense of community, kinship, egalitarianism, embeddedness, and belongingness to nature are all aspects of a broader sense of feeling connected to it" (p. 512).

Mayer & Frantz (2004) developed a scale to measure ones' connectedness to nature, and then conducted five studies to test the scale's validity and reliability. In the studies they found that the more time a person spends in nature, the higher his/her score on the connectedness to nature scale and that "Personal well-being is linked to a sense of feeling connected to nature" (Mayer & Frantz, 2004, p. 512). Research studies support the link between connectedness to nature and well-being.

In the first part of a three part study by Mayer et al. (2009), college students were divided into two groups, one that visited a nature preserve and one that visited an urban area for a 15 minute walk. The researchers found that the group who spent time in nature had increased connectedness to nature, and a greater ability to reflect on a life issue. The researchers then repeated the study a second time, dividing the participants into two groups that viewed videotapes; one group experienced a virtual nature walk, and the other group experienced a virtual urban walk (Mayer et al., 2009). Again, the results showed that the virtual nature walk group was more connected to nature and more able to reflect on a life issue than the virtual urban walk group (Mayer et al., 2009).

The study was repeated for a third time using a videotape of a virtual nature walk versus an actual nature preserve walk. The actual nature walk offered more psychological benefits than virtual nature walk. Participants were better able to connect to nature in the nature environment, as compared to the virtual nature setting (Mayer et al., 2009). However, the researchers concluded that in the case when spending time in nature is not feasible, spending time in a virtual nature environment is a rewarding option because it does offer some psychological benefits (Mayer et al., 2009). These three studies by Mayer et al. (2009) supported the researchers' hypothesis that the more exposure one has to nature, the stronger a person's connection to nature becomes; furthermore, the more connected to nature a person feels, the more nature improves a person's well-being. The researchers used an adaptation of Mayer & Frantz's (2005) connectedness to nature scale (Mayer et al., 2009).

A parallel exists between connectedness to nature, attention restoration theory, and stress reduction theory. In all instances, spending time in nature allows a person to

relieve stress and focus better. Moreover, in the case of connectedness to nature and attention restoration theory, both have apparent benefits for active interaction in nature, yet still have benefits for passive interaction of nature, although to a lesser degree.

While tools have been developed to measure the effectiveness of meeting older adults' personal care assistance needs, there are not sufficient tools to measure an outdoor environment's ability to meet older adults' needs (Sugiyama & Thompson, 2007). Despite the lack of research on the benefits of nature specific to the older population, it is likely that nature's restorative properties transcend all ages (Sugiyama & Thompson, 2007). Kaplan and Kaplan's (2011) perspective is that nature is beneficial to all, "These strong positive influences afforded by access to nearby nature have been shown across the age spectrum, for many nationalities, and regardless of economic means" (p. 317).

Passive Interaction with Nature

As previously stated, passive interaction with nature is the observation of nature or representative elements of nature in an interior environment. Spending time in nature is a multi-sensory experience; however, the most dominate sense is vision (Velarde, Fry, & Tveit, 2007). Therefore, a person does not need to actually spend time outside to experience the value of nature; simply viewing nature is beneficial to human well-being (Velarde et al., 2007).

Window View

Many studies have been conducted about the positive effects of having window views and daylight (Ulrich, 2008). From 1972-1981 Ulrich (1984) conducted a seminal study at a Pennsylvania hospital comparing window views from one side of a wing that

included trees, to the view from the opposite side of the wing that had a window view of a brick wall. The rooms are almost the same foot print with the same furniture plan and patients had the same nurses (Ulrich, 1984). Ulrich (1984) discovered that patients recovered faster and needed less pain medication in the rooms that had a view of nature than those in rooms with a view of a brick wall. "Because most natural views apparently elicit positive feelings, reduce fear in stressed subjects, hold interest, and may block or reduce stressful thoughts, they might also foster restoration from anxiety or stress" (Ulrich, 1984, p. 420).

Viewing nature through a window is considered passive observation of nature (Bates & Marquit, 2011; Ulrich, 2008). It can cause restoration in a similar way to being outdoors in nature as both conditions allow the mind to rest (Kaplan, R., 2001). A window view attracts a person's attention and momentarily restores the mind because it allows a person to escape the task at hand (Kaplan, R., 2001).

> Just looking out into the world beyond the glass encourages the mind to wander. In other words, there are many ways in which the view from the window can be conceptually engaging, thus providing restorative moments…Window viewing does not "count" as an activity. Yet window viewing can fulfill many of the same functions as more acknowledged forms of recreation. (Kaplan, R., 2001, p. 540)

Therefore, a window view is critical for older adults who may no longer be physically able to participate in enjoyable outdoor activities. Older adults living in long-term care communities value having a window view of nature (Ulrich, 2008). "Given the multitude of cultural and commercial forces that reduce the likelihood of many people's connection

with the natural environment, cultivating the window view as a source of pleasure and restoration is worth both further study and appropriate action" (Kaplan, R., 2001, p. 540).

Studies of occupants in other building types also provide evidence to the benefits of a window view. Office spaces with windows have been shown to have more productive employees (Kaplan, R., 2001). The type of window view also has a significant impact. Employees with a view of nature out of their office window have increased well-being evident by a reduction in reports of being sick and higher job satisfaction scores (Kaplan, R., 2001). Also, prisoners in a correctional facility who had window views of the farm fields used health services less than the prisoners who had cells facing the internal courtyard (Kaplan, R., 2001; Ulrich et al., 1991). Likewise, students with a window view of nature were better able to concentrate on studying (Kaplan, R., 2001).

Additionally, residents of apartment buildings who had a window view of nature had greater well-being (Kaplan, R., 2001). Residents preferred nature scenes of relatively unmanaged woods over photos of managed natural spaces or built spaces (Kaplan, R., 2001). Participants reported that having a view of trees was important to a sense of feeling relaxed and those who had a view of trees reported feeling less forgetful and disorganized (Kaplan, R., 2001).

Culter et al. (2006) recognized the importance of nature because in their evaluation of the physical environment of nearly 2,000 resident rooms at 40 skilled care facilities they included questions in their checklist about whether or not resident rooms had a window view and direct access to the outdoors. And finally, in a study about personalization of workspace, researchers found more nature-oriented materials are used to decorate a person's workspace than non-nature-oriented materials. Additionally,

employees who did not have a window view used three times as much nature-oriented material to decorate their workspace than employees who had a window (Bates & Marquit, 2011). “It seems that humans will, at times, create artificial contact with nature when real contact is not possible” (Bates & Marquit, 2011, p. 520).

Biophilic Design

Biophilic design requires a change in designers’ viewpoint from striving to control nature, to aiming to work with nature (Cramer & Browning, 2008). It is a strategy to design for optimal well-being by fostering the human/nature connection in the built environment (Kellert, 2012). Biophilic design was defined by Kellert and Heerwagen (2008) as, “The expression of the inherent human need to affiliate with nature in the design of the built environment” (p. viii).

Biophilic design is a return to the way humans used to intuitively inhabit space. After all, “We were biomimics and biophilics long before there were names for these affections” (Benyus, 2008, p. 41). Furthermore, “Throughout most of human history, forms of shelter were in balance with the natural environment” (Berkebile, Fox, & Harley, 2008, p. 351).

Biophilic design incorporates elements of the natural environment into the built environment (Kellert, 2008). Incorporating elements of nature does not necessarily need to be literal, they can also be representational within architectural design (Joye, 2006b, 2007). Also, there are varying degrees to which a representational element of nature can be abstracted.

Biophilic design classification system. Kellert (2008) used a classification system to help define biophilic design. First, it was categorized into two basic

dimensions, then it was classified into six key elements, and from there it was broken down into 70 biophilic design attributes. While not all 70 will be listed here, the two basic dimensions and the six elements will be reviewed to achieve a deeper understanding of biophilic design. Additionally, the four variables for the study are derived from this list of 70 biophilic design attributes. The two basic dimensions are organic or naturalistic and place-based or vernacular.

The first dimension, *organic or naturalistic*, covers the three ways humans can experience nature in interior space: direct, indirect, and symbolic (Kellert, 2008). Direct experience means relatively unstructured contact with nature in a literal sense that is self-sustaining such as actual plants, animals, water, views to outside, or daylight (Kellert, 2008, 2012). To date, the majority of research studies on biophilic design fall under the direct experience category. Likewise, direct experience is often the only way biophilic design elements are recognized by designers (Kellert, 2012). Indirect experience describes a partial contact with nature because a person is experiencing a modified form of nature, exemplified by a potted plant or a fish aquarium. Symbolic experience refers to representational elements of nature encountered through an image or picture, rather than actual nature itself (Kellert, 2008, 2012).

The second basic dimension, *place-based or vernacular dimension*, integrates the local culture and geographical terrain into the building design to attach meaning to establish sense of place and place attachment (Kellert, 2008). This study addresses the first dimension, the organic or naturalistic dimension, because the study focuses on representational elements of nature that are considered indirect and symbolic experiences of nature.

Formed from both of the basic dimensions, the six biophilic design elements are: environmental features, natural shapes and forms, natural patterns and processes, light and space, place-based relationships, and evolved human-nature relationships (Kellert, 2008; Kellert 2012).

The first design element, environmental features, is the most obvious and well-recognized because it includes direct experience attributes such as water, natural materials, fire, natural colors, fresh air, sunlight, plants, animals, exterior views, façade greening, or compatibility with the landscape and local habitat (Kellert, 2008, 2012). The second design element, natural shapes and forms, include representational attributes of nature that simulate nature's shapes and forms such as botanical motifs, animal motifs, biomorphy, or biomimicry (Kellert, 2008, 2012).

The third design element, natural patterns and processes, refers to attributes that stimulate the human senses and emulate growth and the aging process (Kellert, 2008, 2012). The fourth design element, a sense of being in a natural environment can be created through the proper use of light and space. Light's qualities include natural light, diffused light, light and shadow, and reflected light; spatial relationship qualities include a sense of openness, variability, mass, and harmony (Kellert, 2008, 2012).

The fifth element, place-based relationships, is part of the *place-based or vernacular dimension* and focuses on the connection between people and place including geographic, historic, ecological, cultural, connection to place (Kellert, 2008, 2012). Lastly, the sixth element, evolved human-nature relationships relates directly back to the biophilia hypothesis by signifying a person's affinity for nature through the following

attributes: prospect and refuge, order and complexity, curiosity, attachment, aesthetic attraction, exploration, fear, and spirituality (Kellert, 2008, 2012).

The four biophilic design attributes that were examined in this study were water, fire, natural materials, and botanical motifs. The first three attributes (water, fire, and natural materials) are considered environmental features; the botanical motifs attribute falls under the natural shapes and forms design element (Kellert, 2008, 2012).

The researcher engaged in a systematic process to select the four biophilic design attributes examined in this study. First, only the biophilic design attributes that related to interior features were considered. For example, exterior features such as exterior views, façade greening, or compatibility with the landscape and local habitat are outside of the domain of this study.

Furthermore, only the biophilic design attributes that fall within an interior designer's professional practice domain were considered. For example, fresh air is the mechanical engineer's responsibility to consider, and on large team projects, often the architect takes the lead in determining whether or not to optimize window views and space plan rooms to allow sunlight to filter into the space, though often with input by the interior designer. The interior designer does lead decision-making regarding window treatments for the windows.

Therefore, window views and plants were excluded from this study as REN variables, because research regarding these design attributes/features is fairly abundant; instead, the researcher focused on an exploratory approach to measure biophilic design attributes as described in the literature on that topic, which is fairly scarce. Also, color

was excluded as a REN variable as the research on the impact of color and color preference is quite extensive in the literature.

Ultimately, the four biophilic design attributes, water, fire, natural materials, and botanical motifs were selected for this exploratory study. These four biophilic design attributes that operate as independent variables in this study are further described in Chapter 3.

Optimal Healing Environments

Another application of passive interaction with nature can be found in healthcare environments. Optimal healing environments are healthcare interiors that have been designed to support patients' well-being and promote healing (Dijkstra et al., 2008). The model of optimal healing environments is founded on the belief that the interior environment influences human well-being (Dijkstra et al., 2008). Optimal healing environments focus on reducing patient recovery time; they aim to be psychologically supportive in hopes of lowering anxiety and blood pressure and minimizing the use of medication (Dijkstra et al., 2006).

Nature's contributions in creating optimal healing environments has been recognized, "The belief that viewing vegetation, water and other natural elements can ameliorate stress and is beneficial for patients in healthcare environments dates as far back as the earliest large cities in Persia, China and Greece" (Velarde et al., 2007, p. 200). The relationship between nature and well-being is a topic that has resurfaced in the last 25 years (Velarde et al., 2007). The incorporation of plants and nature-based artwork are two ways the healthcare industry is aiming to create optimal healing environments. Each is discussed below.

Plants. The benefits of plants in interior space have long been recognized because ancient cultures, such as the Egyptians and settlers in the city of Pompeii, brought plants indoors. From an evolutionary perspective, plants offer food, medicine, shelter, and protection (Joye et al., 2009). Plants also have psychological benefits because they help reduce stress (Bringslimark, Hartig, & Patil, 2009; Dijkstra et al., 2008) and perceived pain levels (Bringslimark et al., 2009). Plants also improve the indoor air quality by reducing carbon dioxide, nitrogen dioxide, formaldehyde, benzene, and dust levels (Ferguson, 2010). There is much research to support the benefits of plants in interior space. Also, the previous addition of plants to a hospital reception area positively changed users' perception of the space; it was found to be more ornate, interesting, cheerful, welcoming, relaxing, less stressful, tidier, and quieter (Ferguson, 2010).

In a study of indoor plants' effect on human stress levels in a healthcare setting by Dijkstra et al. (2008), photos of hospital rooms were shown to participants. One group viewed a photo of a room with an indoor plant and the control group viewed a photo of a room with a painting on the wall of an urban setting. The group's participants that viewed the hospital room with the plant had lower self-perceived stress levels than the participants of the group that viewed the urban landscape painting. The presence of plants made the hospital room seem more attractive (Dijkstra et al., 2008).

The effect of the presence of plants in retail environments has also been studied. In a study by Joye et al. (2009), the presence of plants increased consumer ratings, improved perception of visual quality, and increased perceived price point of goods. Additionally, participants reported that they would be more likely to travel further to visit the store, stay in the store longer, and visit the store more frequently (Joye et al., 2009).

In summary, the literature supports the use of plants in interior space to increase the users' well-being, "Designing with plants is one of the easiest ways to support healing in a manmade environment. They accent any design or style" (Huelat, 2008).

Nature-based artwork. Sometimes actual views of nature are not feasible in an interior space. Nature-based art, according to Eisen, Ulrich, Shelpey, Varni, and Sherman (2008), "Refers to art images dominated by natural vegetation, flowers or water" (p. 173). Studies show that nature-based artwork is beneficial to human well-being, regardless of cultural background (Ulrich, 2008; Wilson, A., 2008).

According to a literature review by Velarde et al. (2007), viewing nature, whether it is actually being outdoors, viewing from a window, viewing an image of nature, or viewing an element of nature indoors (such as plants), improves the physical well-being of older adults. A mountain scene followed by a savannah scene were preferred over abstract art or no artwork in a study with a simulated space-station (Bates & Marquit, 2011). Furthermore in a study of children from 5 to 17 years of age, Eisen et al. (2008) found that representational nature artwork had stress-reducing properties and was preferred over abstract or impressionistic art.

Nanda, Eisen, Zadeh, and Owen (2011) found that artwork of realistic nature scenes as compared to abstract artwork, abstract representational artwork, or no artwork (control), reduced anxiety and agitation in healthcare patients, therefore improving patients' well-being. Patients actually took less medication on the days that nature-based artwork was hung in the room compared to the days the abstract artwork or no art was present, saving money for both the patient and hospital (Nanda et al., 2011). The nature-

based artwork was preferred for its calming effect and participants felt that they could relate to it.

In addition, the use of nature-based art has been shown to elicit a calming effect in people. Memory care residents showed reduced aggression in shower rooms that had large nature-based art pieces and sounds of nature playing (Ulrich, 2008). A hospital emergency waiting room that was known for being a stressful, hostile environment with a high level of aggression shown by patients towards staff was transformed using biophilic design principles (Kellert, 2012). The windowless space with white walls was replaced with a colorful mural of nature including images of plants and animals, new carpet and furniture with organic elements, and plants were added (Kellert, 2012). With the exception of the plants, the changes were representative elements of nature (Kellert, 2012). The results showed a decrease in stress, hostility, and aggression in the waiting room (Kellert, 2012). The literature suggests that the use of nature-based artwork, a form of passive interaction with nature in interior space improves humans' well-being.

Biophilic design summary. The benefits that biophilic design offers are apparent through the examples previously presented, such as improved ability to concentrate, reduction in stress, increased connection to nature, and improved well-being (Kellert, 2012; Wilson, A., 2008). Biophilic design takes sustainability a step further by addressing the two-way relationship of nature and humans. A reflection by Wilson, A. (2008) is thought provoking, "Given the magnitude of the benefits that can be realized through biophilic design, especially the healing benefits, it is remarkable that there hasn't been more interest in carrying out research to prove such associations" (p. 332). The term

biophilic design holds a promising future and perhaps will become the next design industry "buzz word" to achieve true sustainability for humans and nature.

Biophilic design is aligned with the goals of evidence-based design in that it strives to yield measureable results from the influence of incorporating representative elements of nature into interior space. Wilson, E.O. (2008) claimed, "If architecture and design are ever to become science as well as art, it will be through scholarship of the kind exemplified by the contributions to *Biophilic Design*" (p. 25). Berkebile et al. (2008) observed, "While few people may consciously understand or fully recognize architects' efforts to master biophilic design, they will respond to environments that employ these principles" (p. 350). In contrast, researchers warn that the consequences of the lack of employing biophilic design principles will become more evident as society becomes more distant from the natural world from which humans evolved (Joye, 2006b).

Environmental Preference

Environmental preference explains the human inclination to gravitate towards natural environments over built environments (Kaplan & Kaplan, 2011). Humans' innate preference for environments is based on survival (Benyus, 2008; Hildebrand, 2008; Joye, 2006a, 2007). Wilson, E.O. (2008) pointed out that all animal species have an innate ability to select the habitat that ensures the best rate of survival, so it is logical to assume that trait also exists in humans. Natural selection favored the characteristics that held a survival advantage (Gullone, 2000).

The types of natural habitats preferred by people have been studied (Kaplan & Kaplan, 2011). A great portion of the species' evolutionary history was spent in savanna

landscapes (Gullone, 2000; Joye, 2007). A savanna is a grassy field with trees in groupings (Joye, 2007). Savannas were the preferred landscape because of the food sources available, and the protection provided by the amount of openness to see an approaching threat (Gullone, 2000).

There are three environmental features that humans innately prefer, whether they actually hold a survival advantage or are purely aesthetic preference: 1) people like to be on higher ground to have a clear view of below, 2) humans like to settle on open savannas with some trees, 3) people like to be near a water source (Wilson, E.O., 2008).

Environmental preference is significant to this study because it is the foundation of the four REN variables. The two areas that will be discussed include innate preferences and design based on evolution.

Innate Preferences

The concept of biophilic design may seem forward thinking, but in reality it is a return to our beginnings (Kellert, 2012). The majority of human history has been spent in the natural environments, making it relevant to the character of the human species. Humans' sense of aesthetic was formed in a natural environment. "Our senses, our emotions, our intellect, and even our culture developed in close association with, and in adaptive response to, the nonhuman world" (Kellert, 2012, p. ix). However, to date, there is little research about humans' innate aesthetic preferences (Wilson, E.O., 2008). Berkebile et al. (2008) remarked, "The natural world has imprinted on us, biologically and psychologically, certain affinities and aversions that we are only just beginning to understand with our conscious minds" (p. 347). Designers are challenged with the task to

study humans' innate preferences and apply those principles to the interior environment (Heerwagen & Gregory, 2008).

Humans have a preference for designs based on nature because they used to hold a survival advantage (Benyus, 2008; Hildebrand, 2008; Joye, 2006a, 2007). "It is likely that we are still innately drawn to settings whose characteristics hold some survival advantage, even though that survival advantage may no longer have any practical value for us" (Hildebrand, 2008, p. 263).

Humans' preference for the savanna terrain can be further illustrated by Appleton's (1975) prospect-refuge theory. The prospect-refuge theory explains why humans prefer to see without being seen (Hase & Heerwagen, 2000). Refuge is an enclosure that provides shelter or protection, while prospect is visual access to distant, approaching threats (Hase & Heerwagen, 2000; Hildebrand, 2008). Refuge could be considered a cave, while prospect could be thought of as a meadow (Heerwagen & Gregory, 2008). People tend to prefer refuge when they are not feeling well or seeking restoration (Heerwagen & Gregory, 2008). Interestingly, there is a biological gender preference; men tend to seek prospect, while women prefer refuge (Heerwagen & Gregory, 2008).

Appleton's theory (1975) has been applied to the design of the interior environment. According to Heerwagen and Gregory (2008), it is ideal to reside in a setting that provides both prospect and refuge; therefore, interior environments should be designed with a combination of prospect and refuge spaces to accommodate all users. These two types of spaces must be adjacent so one is easily visible and accessible to the other (Heerwagen & Gregory, 2008). Progression through a building should be from

prospect to refuge so that one can feel a sense of security in being able to see before being seen (Heerwagen & Gregory, 2008). A sense of prospect and refuge can be created through the use of "Materials, light, openings, screenings, gaps, peepholes, changes in height, overhangs, implied horizons, and borrowed elements from external prospects, such as views of a tower or hilltop" (Heerwagen & Gregory, 2008). Additionally, Joye (2007) recommended incorporating photographs of savannas into a building's design as a reminder of humans' evolutionary heritage.

Design Based on Evolution

While the understanding of the prospect-refuge theory (Appleton, 1975) brings great insights about humans' relationship to nature, there is more left to be understood about humans' innate preferences based on evolution and greater opportunity to improve the design of modern habitats. Designers need to identify the qualities the natural world offers that impact people's well-being so those characteristics can be incorporated into spaces of habitation (Hildebrand, 2008). In the case of senior living communities, it is beneficial to explore nature's healing properties because it could provide some relief to seniors with declining health (Hildebrand, 2008; Wilson, A., 2008) and provide them with a greater sense of well-being (Heerwagen & Gregory, 2008).

Considering the influence of environmental preference, it is anticipated that the principles of biophilic design can be achieved by incorporating representational elements of nature (REN) into interior design. Incorporating REN into interior environments has the power to, "Harness therapeutic responses and influences that are carryovers from evolution, resulting in more restorative and healing patient care settings" (Ulrich, 2008, p. 90). Humans' preference for REN can be explained by reflecting upon the species'

evolutionary heritage, regardless of cultural or socioeconomic background (Benyus, 2008; Hase & Heerwagen, 2000; Kellert, 2008; Ulrich, 2008, Wilson, E.O., 2008). Throughout evolution there have been human survival advantages of the four REN variables being explored in this study: water, fire, natural materials, and botanical motifs.

Lounge Space in Seniors Living Communities

Senior living communities should include a gathering lounge space that is designed to encourage participation and a sense of community (Perkins, Hoglund, King, & Cohen, 2004). The main public lounge is a primary socialization space in senior living communities, so it is critical that the setting supports the well-being of older adults (Brawley, 2006). Typically, the design goal when designing public lounges is to create a comfortable, homelike environment to attract residents and encourage them to spend time in the space, thereby encouraging social interaction (Brawley, 2006). Social interaction is encouraged because it has been shown to improve a person's health, specifically it can reduce depression and decrease risk of dementia (Brawley, 2006; Sugiyama & Thompson, 2007).

In a CCRC, the lounge is usually part of the common area and is an average of about 1,200 sq ft. (Perkins et al., 2004) serving primarily as a place to gather. The types of social interaction that occur in senior living community's main public lounge include primarily conversation, playing cards, working on puzzles, and/or watching television. REN should be incorporated into interior settings in a way that encourages social interaction among residents (Bates & Marquit, 2011); subsequently, incorporation of REN into the lounge could have meaningful benefits.

Theoretical Framework

The theoretical underpinning of this study examines the relationship of the natural environment and design environment as they relate to each other and to humans. First the human ecosystem theory will be reviewed in its original format, and then an adaption of the model will be presented as it relates to this study. Lastly, a third model will be discussed that has been adapted to address the effects of REN on seniors' perceptions.

Human Ecosystem Theory

The human ecosystem theory was adopted from the other science fields and introduced by Guerin (1992) as a theoretical framework to be used for research related to interior design. It describes the interconnected relationship between humans and three environments: the natural environment (NE), the social environment (SE), and the designed environment (DE) (Guerin, 1992). The theory explains how three separate environments can be integrated as a whole into a well-organized system (Guerin, 1992).

The human ecosystem model (see Figure 1) is a visual representation of the human ecosystem theory (Guerin, 1992). In this model, the three outside circles that form a triangle are the three types of environments (NE, SE, DE) and the fourth circle in the middle represents the human organism (HO). The interconnected relationship means that all three types of environments influence each other, all three environments influence humans, and likewise, humans influence all three types of environments (Guerin, 1992). This interaction is visually represented by the multidirectional lines connecting the circles to each other. "A unique concept of this systems perspective is the ability to study several interactions or effects simultaneously, indicating that a human is not completely isolated

but interdependent with other parts of the system, the environments" (Guerin, Yust & Coopet, 2000, p. 55).

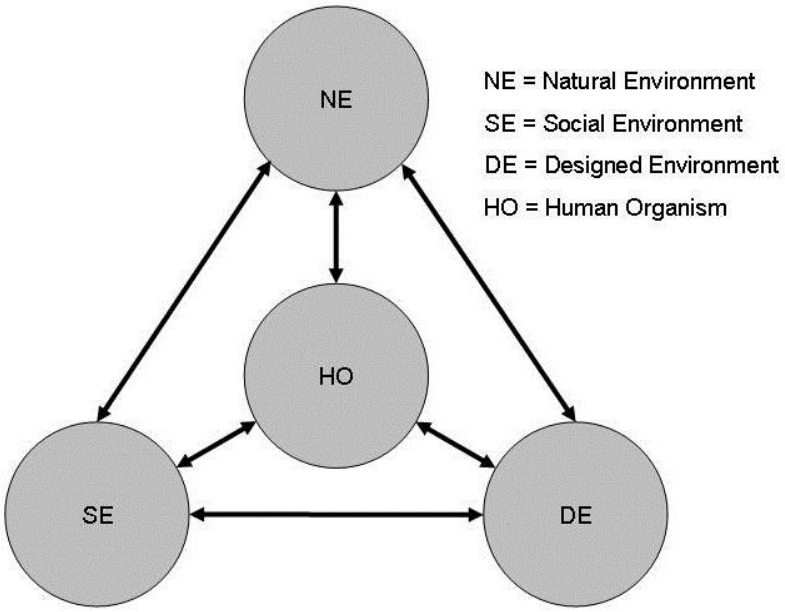

Figure 1. Guerin's (1992) human ecosystem theory model

In the present study, the NE is defined as the exterior, natural habitat and the DE is the human-made interior environment. The interior environment is defined as, "The fixed, semifixed, and unfixed components of the physical structure, and the furnishings, fixtures, décor, and equipment" (Cutler et al., 2006, p. 44). Specifically, in this study the interior environment is the main public lounge in senior independent living care communities (see Figure 2).

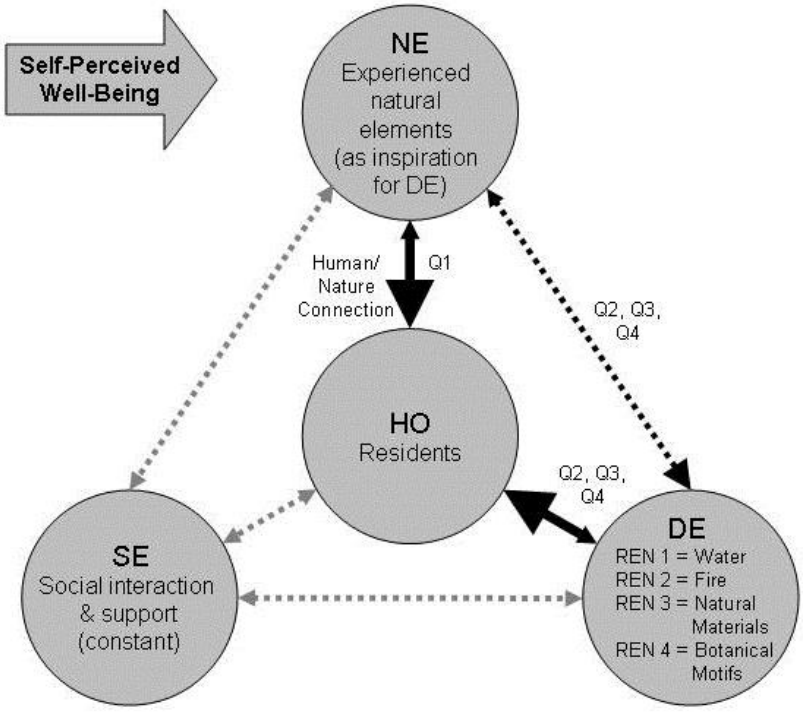

Figure 2. Adaptation of Guerin's (1992) human ecosystem theory model to examine seniors' self-perceived well-being

This study identifies the HO as the senior residents of independent living communities. This research study focuses on how 1) the NE can influence the HO's self-perceived well-being and 2) how the NE inspires the design of REN variables incorporated into the DE, then subsequently how the DE influences the HO's self-perceived well-being. The focus is visually represented by the larger bold arrows. In the human ecosystem model, the SE is defined as, "The psychological and social behaviors of the occupants" (Guerin et al., 2000, p. 56). In this study, social interaction (SE) is not measured but considered a constant variable.

The relationship of the constructs (HO, NE, DE, SE) to the four research questions are noted on the model. Research question 1 asked, "Can a human/nature

connection influence seniors' self-perceived well-being?" It focuses on the influence of the NE on the HO's self-perceived well-being. Research questions 2, 3, and 4 have parallel relationships between the NE, DE, and HO. The second research question asked, "Do seniors prefer environments with REN variables over environments without REN variables?" Research question 3 asked, "Will seniors' self-perceived well-being be affected by observing representative elements of nature (REN) in the interiors of senior living facilities?" The fourth research question asked, "Which REN variables have the most significant influence on seniors' well-being?" For these last three research questions, the NE inspires the design of REN variables incorporated into the DE, then the DE influences the HO's self-perceived well-being.

Incorporating Representational Elements of Nature (REN)

A natural element is defined as "Any design element that has a basis in nature" (Bates & Marquit, 2011, p. 519). The REN are defined as any aspect of the exterior natural world that can be incorporated into the interior environment. They are not limited to a literal representation, rather they can be understood as abstract interpretations as well (Joye, 2006b). The REN to be examined in this study as variables include: 1) water, 2) fire, 3) natural materials, and 4) botanical motifs selected from the list of 70 biophilic design attributes identified by Kellert (2008). While there is theoretical reasoning to support the benefits offered by these four variables, at this time there is insufficient research with empirical data available. Therefore, they were included in the present study to further explore their relationship to self-perceived well-being.

In this study, nature is visually represented via incorporating the REN into the designed environment of senior living communities' main public lounges in independent living care communities to increase seniors' human/nature connection, and thereby improve seniors' well-being.

Figure 3 illustrates in further detail the relationships between the variables of the NE, DE, and HO constructs in this study. The NE and DE comprise the independent variables. First, the NE inspires the design of the four REN variables incorporated into the DE of the senior living community lounge space. Then, the DE lounge space with REN variables increases the HO's (residents') human/nature connection, which in turn improves the HO's self-perceived well-being (dependent variable). Following the model (Figure 3), each of the REN variables will be discussed.

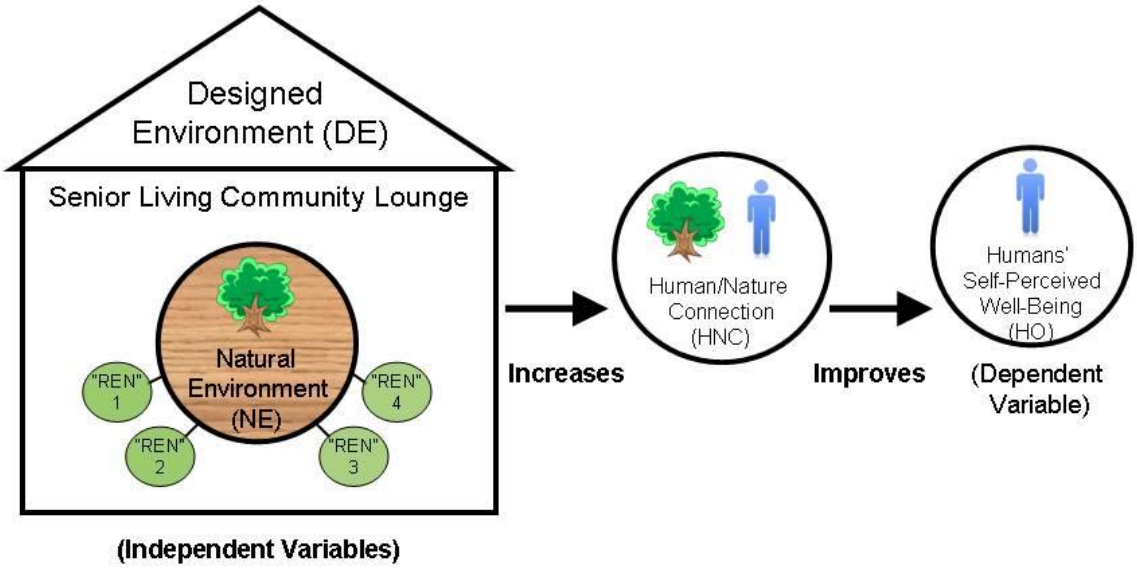

Figure 3. Model of the influence of the human/nature connection on the relationship between the variables

Water

The first REN variable, water, typically takes the form of a waterfall, fountain, aquarium, pool of water, or views of water (Kellert, 2008, 2012; Mador, 2008). According to Mador (2008), fountains are the most common way of bringing water into an interior space whereas aquariums have the addition of animals and plants, further increasing the amount of biophilic design elements brought indoors. Likewise, waterfalls often have vegetation and/or natural materials such as stone or rock surrounding the water feature (Mador, 2008).

Our predecessors instinctively chose to settle by a water source (Mador, 2008). Throughout history, cultures have battled over land that has access to water as it is essential to sustaining life (Huelat, 2008). Moreover, 75% of the human body is water (Huelat, 2008) and 70% of the surface of the globe is water; it plays an essential role in uniting land masses, while providing defined boundaries among landscapes (Mador, 2008). Living by a water source also helped humans find food because animals gather around water and plants need water to survive (Gullone, 2000).

Ninety-seven percent of the world's water is salt water, and in biophilic terms it primarily offers aesthetic value to humans, indicating that aesthetic value plays a critical role in human well-being (Mador, 2008). Also, hotels and houses with an oceanfront view or lakefront property are priced higher because people prefer to view bodies of water (Cramer & Browning, 2008).

Water has the ability to improve people physically, mentally, spiritually, and emotionally (Frost, 2004; Huelat, 2008; Velarde et al., 2007). Europeans and Asians have been visiting mineral springs and spas for their healing powers throughout history (Frost,

2004; Mador, 2008). Spas have also been historically popular in the United States; Saratoga Springs, NY had 10,000 hotel beds by the 1900s for people seeking restoration through their mineral spring baths (Mador, 2008). It is evident that water's value has long been recognized because the root of the word *spa* means: "health through water" (Frost, 2004, p. S-85). German health insurance companies recognize water's healing properties and have been covering spa costs since the 1960s (Frost, 2004).

Water's relationship to movement and sound has been recognized as a source of human attraction. Water has sensory variability because it evokes a person's sense of sight through the rippling motion, sound through hearing trickling water, and touch in the case of being able to interact with the water feature (Kellert, 2008). The sound of moving water has variation (Mador, 2008) and creates a calming sense of rejuvenation (Huelat, 2008). Furthermore, water's meandering nature creates gentle curvilinear lines, and its motion and sound has animistic traits (Mador, 2008). Additionally, water is fascinating in its ability to be reflective, interact with sunlight, and affect the texture of natural materials (Mador, 2008).

Participants in a study by Caspari et al. (2010) commented on the importance of incorporating water elements in interior hospital environments because the sound and observation of water is relaxing. Observing fish in an aquarium can be attention holding (Heerwagen & Gregory, 2008) and decreases ones' stress level (Joye, 2006a).

Mador (2008) claimed that the under utilization of water's restorative capabilities within the interior environment is a lost opportunity to increase the human/nature connection and thereby improve human well-being. Mador (2008) continues by suggesting that designers should seek ways to incorporate water into the interior of

buildings. Furthermore, "As our knowledge of biophilic theory and practice grows, and our efforts to value water as a biophilic, natural, and life-sustaining resource continue to increase, we come to see water as an integral component of the built environment" (Mador, 2008, p. 56).

Fire

Fire, represented as a fireplace or candles, is the second REN variable (Kellert, 2008, 2012). Humans have a preference for fireplaces because they associate it with warmth and cooking food, both essential to survival (Kellert, 2008). Fire also has sensory variability because it stimulates a person's sense of sight by observing the flickering light, sound through hearing the crackling fire, and touch through feeling the warmth of the fire (Kellert, 2008).

While fireplaces provide physical warmth, they also confer emotional warmth (Brawley, 2006). The fireplace hearth is more than an aesthetic preference; historically, it has cultural meaning as the gathering space (Zukowski, 2008). It is considered the "heart of the house," because it is the central gathering space that creates a sense of togetherness (Brawley, 2006). Historically, people gathered around the hearth to entertain guests, read out loud, play games, and smoke (Zukowski, 2008). Offering an abbreviated history of humans' connection with the fireplace, Castella (2003) notes,

> From the distant past, the fireplace has been the center of people's existence…At first it was there to give warmth, and to provide a cooking hearth. As it evolved, and houses expanded to have multiple rooms, the need to use it for heating water and food in the main living area became less important…Decoration came to the fore, and the heat and pleasure taken from gathering around a handsome, and

sometimes awe-inspiring fireplace, became a delight and source of contentment. (p. 6)

It is interesting that fireplaces began as element that was built outdoors into the earth, then with building improvements came cast iron stoves to heat houses. Now with modern central heating, neither the fireplace nor stove is needed, yet there is a return to incorporating fireplaces into both our homes and interior lounge spaces in senior living environments as well as gathering spaces in other types of facilities, usually as the focal point.

Furthermore, a longitudinal study by Culter & Kane (2009) that used post-occupancy evaluation methods to assess the environment of the Green House senior living model, required that all Green House buildings have a fireplace in the lounge space because the hearth 1) brings warmth to the space, 2) creates a home-like environment, and 3) presents a place for residents to gather around, creating a sense of community and encouraging social interaction.

The fireplace has become a universal symbol of home and comfort for people (Castella, 2003). Fireplaces are fascinating in that, "No other invention in all of human history combines utility and comfort in quite the same way" (Castella, 2003, p. 1).

Natural Materials

Natural materials is the third REN variable and it includes stone, slate, marble, granite, or wood (Kellert, 2008, 2012). Natural materials cultivate attachment to place because people feel more connected to a space where local materials are used, especially if they have a historical or cultural significance to the area (Wilson, A., 2008). Also, the use of local, natural materials can help foster the geographic or ecological connection to

place through evoking feelings of familiarity and predictability and can have historical meaning or cultural significance which help convey the passage of time and continuity with the past (Kellert, 2008, 2012). The use of wood offers additional benefits of comfort and security because it reminds people of the forest that offered protection from predators (Joye, 2006b).

The variation of pattern and texture found in natural materials with the harmonized balance between order and complexity imparts an artistic quality that is aesthetically pleasing (Joye, 2006a). Additionally, natural materials have information richness because the amount of detail and the variety of color and texture evoke a sense of curiosity and exploration (Kellert, 2008). Natural materials create a sense of warmth in a space over refined metals of cool colors (Caspari et al., 2010).

"Honest" or authentic materials that show the natural texture of materials and wear as they age are preferred and admired for their beauty (Berkebile et al., 2008; Cramer & Browning, 2008; Kellert, 2008). Natural materials resonate age, change, and the passage of time (Kellert, 2008, 2012). Humans also process natural materials through their sense of touch as they come into contact with furniture, handrails, and interior detailing (Huelat, 2008).

However, authentic natural materials may not always been appropriate for the function of the space due to lack of durability, fading in sunlight, or amount of pattern. In these cases, synthetic materials that represent natural materials could be used. According to Huelat (2008), people prefer wood furniture over any other material, even if it is a 'fake' wood material, as they offer a biophilic benefit, even if to a lesser degree (Wilson, A., 2008).

Botanical Motifs

The fourth REN variable, botanical motifs, refers to plant shapes and forms including leaves, tree branches, flowers, fruits, and nuts (Kellert, 2008, 2012). Humans evolved in an environment full of vegetation because it offered shelter and protection. Leaf forms and tree branches have evolutionary importance because they symbolize the trees that offered shelter and safety (Joye, 2006b). Likewise, flowers and fruit motifs have significance because our ancestors studied the differences among plant variations to determine whether or not they were safe to consume (Heerwagen & Gregory, 2008; Joye, 2006b).

Botanical motifs have been used in ornamentation in architectural details throughout history (Cramer & Browning, 2008; Joye, 2006a). Nature-related motifs have been present in design details and decoration for centuries and were revered as ultimate beauty (Whiton & Abercrombie, 2002), as is evident in Greek and Roman architectural history. For example, many of the Greek architectural moldings have botanical motifs such as the anthemion motif, though there is debate about whether it is based on the honeysuckle leaves and flower, the palm branch, or the lotus (Whiton, & Abercrombie, 2002). Also, plants were used for inspiration for the rosettes and garlands (Whiton, & Abercrombie, 2002). The Romans adapted the Greek motifs and made minor modifications and foliage was used in the form of the acanthus leaf and anthemion (Whiton, & Abercrombie, 2002). In more modern times, Frank Lloyd Wright advocated incorporating natural forms and shapes into architectural designs and referred to it as "organic architecture" (Huelat, 2008).

Botanical motifs can also be represented in an interior environment through patterns and prints in materials. The orderly variation of pattern is known as fractals (Kellert, 2008). Fractals can be defined as "Complex geometric shapes that appear to repeat at finer scales; such shapes are often found in nature and can be defined mathematically" (Wilson, A., 2008, p. 332). Fractals can be referred to as nature's fingerprints; each tree is similar yet different and similar patterns repeat themselves at a variation of scales (Heerwagen & Gregory, 2008; Huelat, 2008; Joye, 2006a, 2006b, 2007). Leaves, snowflakes, or other such natural elements may be similar but are not exact copies of each other (Kellert, 2008). The variation yet similarity among botanical motifs are the appeal and beauty of these natural elements (Heerwagen & Gregory, 2008). An overwhelming majority of people prefer fractal patterns over non-fractal patterns (Joye, 2007). Designers should select interior finish materials that resemble fractal patterns found in nature to appeal to humans' innate preferences (Wilson, A., 2008).

Well-Being

Well-being is a broad topic, gaining attention at this time. This segment will generally define well-being and then discuss it in context with seniors specifically.

Defining Well-Being

Seniors' self-perceived well-being is the dependent variable in this study. Well-being is often used interchangeably with the term welfare (Guerin & Martin, 2010). Merriam-Webster defines welfare as, "The state of doing well especially in respect to good fortune, happiness, well-being, or prosperity" (Welfare, 2013). Likewise, well-

being is defined as, “The state of being happy, healthy, or prosperous: welfare” (Well-being, 2013). Barnes (2002) defined quality of life as, “A multidimensional construct, containing domains of physical health, psychological wellbeing, social relationships and the physical environment” (p. 778). McDowell (2010) stated that well-being “Refers to contentment, satisfaction, or happiness derived from optimal functioning” (p. 70). Also, well-being is individually assessed, and therefore, can be interpreted differently by each person:

> Wellbeing describes a state of wellness of body, mind and soul, where all are in a state of health, the individual is happy and prospering. Wellbeing is not available by prescription, there is no one path and many different roads can be taken to arrive there. (Well-being Spot, 2012)

Furthermore, the University of Minnesota’s Center for Spirituality & Healing has created a model for well-being. Six interconnected dimensions of well-being are identified including community, environment, health, relationships, security, and purpose. “These take into account our interconnectedness and interdependence with our friends, families, and communities, as well as the personal and global environment we live in” (Center for Spirituality & Healing, 2013, p. 1). Their well-being model can be understood and applied at different levels, from the individual to a community at large. In summary, numerous terms are used to define well-being including doing well, good fortune, happiness, prosperity, healthy, wellness, satisfaction, and contentment.

Supporting humans’ well-being is the central objective in the interior design profession. Guerin and Martin (2010) developed a definition of welfare as related to interior design practice that states, “Interior designers create interior environments that

support people's physical, psychological, social, and spiritual well-being; and assist with or contribute to their financial or economic management, success, and responsibility" (p. 111).

In a study by Ferri, James, and Pruchno (2009) about the meaning of successful aging, about one-third of participants aged 60 or older mentioned "psychological health" when asked to define "successful aging." The term well-being is commonly used in national public aging organizations' mission statements, several are reviewed below:

- The National Institute on Aging's (2013) mission is to lead "The federal government in conducting and supporting research on aging and the *health* and *well-being* of older people."
- The American Society on Aging's (2013) goal is "To support the commitment and enhance the knowledge and skills of those who seek to improve the *quality of life* of older adults and their families" by supporting all aspects of a person as they age.
- "The American Geriatrics Society (AGS) (2013) is a not-for-profit organization of over 6,000 health professionals devoted to improving the *health*, independence and *quality of life* of all older people."
- The Alzheimer's Foundation of America's (2013) mission is "To provide optimal care and services to individuals confronting dementia, and to their caregivers and families—through member organizations dedicated to improving *quality of life*.
- Advancing Excellence in America's Nursing Homes (2013) "Assists all stakeholders of long term care supports and services to achieve the highest

practicable level of physical, mental, and psychosocial *well-being* for all individuals receiving long term care services."

- The mission of the American Association of Retired Persons (AARP) (2013) is "A nonprofit, nonpartisan organization that helps people 50 and holder improve the *quality of their lives.*"
- The Leadership Council of Aging Organizations (2013) is "Dedicated to preserving and strengthening the *well-being* of America's older population."
- At the state level, the University of Minnesota's Center on Aging's (2013) mission is "To serve as a statewide resource center on the *health* and *welfare* of older Minnesotans by providing information to students, professionals, and the community."

The importance of well-being is exemplified through the frequent use of the term in mission statements for organizations central to aging. Well-being is clearly a main focus for older adults and the organizations that serve them. Since America's population is aging exponentially (World Health Organization, 2013), aging is a key topic, further emphasizing the importance of well-being.

Self-Perceived Well-Being

Well-being is a subjective concept because it is evaluated based on a person's personal feelings and aspirations, i.e., internal measures; therefore, in this study *self-perceived* well-being will be evaluated. "Subjective measures of well-being have long been appreciated in the gerontological literature as powerful predictors of objective outcomes" (Ferri et al., 2009, p. 380). Self-perceived well-being is a reliable predictor of a person's health condition, even more so than disease or disability. On a related note,

Ferri et al. (2009) found that, "Participants' *perception* of their health status is more related to successful aging than their *actual* physical health status" (p. 385-386).

Measures of Well-Being

Due to the reliability of self-perceived well-being as a measure for a person's health, it was used in this study as the dependent variable. This study evaluated REN incorporated into interior space, which is considered passive interaction with nature. Several studies that measured well-being will be reviewed, although only one study was specifically used for the measurement basis of this study.

Reimer et al. (2004) compared the quality of life of 62 dementia residents at specialized senior living communities that have a homelike environment and follow the person-centered care model to 123 dementia residents at traditional institutional facilities. The study was conducted on a quarterly basis over a one year period. Residents' stage of dementia was assessed with the Global Deterioration Scale. Subjective and objective components of quality of life were measured. Behavioral function was measured with the Cohen-Mansfield Agitation Inventory and Pleasant Events Scale. Cognition was measured with the Brief Cognitive Rating Scale and ADLs were measured using the Functional Assessment Staging. Since the dementia residents could not self-report their self-perceived quality of life, the Apparent Affect Rating Scale and the Multidimensional Observation Scale of Elderly Subjects were used as instruments. The instruments used in the study by Reimer et al. (2004) are not as applicable to participants in this research study because independent living residents have a higher cognitive function.

A study by Parker et al. (2004) measured the quality of life of 452 residents at one of 38 senior living communities. The facilities were divided into three groups: small (less

than 31 beds), medium (31-40 beds), and large (41 or more beds). The instrument used was the Sheffield Care Environment Assessment Matrix (SCEAM) which measured physical and cognitive states, as well as universal needs such as privacy, personalization of environment, choice and control, and connection to the community. Since this study is only looking at cognitive self-perceived measures, the SCEAM tool was not appropriate to use as an instrument.

Ferri et al. (2009) measured successful aging for 53 older adults who lived in one of four senior living communities in New Jersey. There were 45 female participants and only 8 males. A survey used a questionnaire that was distributed in a group setting. The questionnaire assessed physical health, functional health, mental health, satisfaction with life, and level of social support. Additionally, the questionnaire asked participants to define successful aging in their own words as an open-ended question, and to rate how successfully they are aging on a 4-point scale. To measure physical health, participants were asked to complete an illness checklist of 17 common illnesses for older adults, as well as give a self-rated health indicator. Functional health was measured by asking participants questions about ADLs. Mental health was measured by a self report of depressive symptoms. The instruments used by Ferri et al. (2009) are not relevant to use in this study since they only measured seniors' self-perceived well-being.

Kaplan, R. (2001) measured apartment residents' well-being and satisfaction based on viewing 40 black and white photographs of window views of natural landscapes and urban settings. Residents experienced increased well-being and satisfaction when viewing a window scene that included nature (Kaplan, R., 2001). Kaplan, R. (2001) measured three categories of well-being based on previous studies, 1) effective

functioning, 2) at peace, and 3) distracted. Effective functioning was a subjective, broad term used to describe overall well-being. At peace referred to a "calm, tranquil state of mind" (Kaplan, R., 2001, p. 524). Distracted was defined as items that cause directed attention and therefore fatigue (Kaplan, R., 2001). Items used to measure well-being included the following descriptors:

1) Effective Functioning:

- Energetic and excited about what you are doing
- Life is interesting and challenging
- On top of the world
- Focused
- Effective
- Positive
- Able to get really absorbed in a task
- Alert
- Satisfied with how things have been going lately
- You have a good sense of where you're going
- Competent
- Attentive
- You can keep your mind on what you are doing

2) At peace:

- Relaxed
- Comfortable
- Irritable
- Everything was an effort
- Harried
- Patient

3) Distracted:

- Forgetful
- Disorganized
- You were losing or misplacing things
- It's difficult to finish things you have started
- Making decisions is difficult
- It's hard to make up your mind
- You were making mistakes (p. 526)

This instrument formed the basis of words that were selected to be used within the survey instrument for this study to measure participants' self-perceived well-being. The

cognitive abilities of senior residents in independent living communities will enable this level of interaction and responses to questions posed in the survey instrument.

Summary

The literature review in Chapter 2 reviewed the human/nature connection followed by active interaction including the biophilia hypothesis, attention restoration theory, and stress reduction theory, horticulture therapy, and connectedness to nature and well-being. Also reviewed was passive interaction, including window view, biophilic design, and optimal healing environments with a focus on plants and artwork. Next, environmental preference, the lounge space in senior living communities, the human ecosystem theory as the study's theoretical framework, the four REN variables, and the definition of well-being were discussed.

The purpose of this study is to explore if observing REN in the interior of the senior living facility's main public lounge strengthened seniors' self-perceived connectedness to nature, and therefore, support their self-perceived well-being.

CHAPTER 3. METHOD

There are three main purposes of this study, to 1) explore the influence the human/nature connection has on seniors' self-perceived well-being, 2) evaluate the impact that incorporating REN into the main public lounge of senior living communities has on seniors' self-perceived well-being and 3) identify which REN variables have the most significant influence on seniors' well-being.

While much has been written about biophilic design, few research studies have been conducted to support the biophilic design approach. The studies that have been conducted focused on window views (Kaplan, R., 2001; Ulrich; 1984; Ulrich, 2008), plants (Bringslimark et al., 2009; Dijkstra et al., 2008; Ferguson, 2010; Huelat, 2008), and artwork (Bates & Marquit, 2011; Nanda et al., 2011; Ulrich, 2008; Wilson, A., 2008), not the four REN variables that have been discussed. This research study is exploratory in nature and a mixed methods approach was used.

Population and Sample

The researcher obtained the sample population from one of Presbyterian Homes & Services' independent living senior living sites. Presbyterian Homes & Services owns and manages 40 senior living communities in the Midwest (Presbyterian Homes & Services, 2013). In 2013, a team of 5,807 employees and 3,680 volunteers served 24,000 older adults; 12,149 of those older adults are residents of a Presbyterian Homes' owned community and the remainder receives delivered meals or care services in their own houses (Presbyterian Staff, 2013). Overall occupancy rate for all Presbyterian Homes' sites was 95% for 2013 (Presbyterian Staff, 2013).

Presbyterian Homes & Services is a non-profit organization governed by a board of directors (Presbyterian Homes & Services, 2013). The company's mission is "To enrich the lives of older adults through services and communities that reflect the love of God" (Presbyterian Homes & Services, 2013). One of their six core values is "Growth & Innovation," which is defined as, "Exploring and creating new approaches to improving the quality of life for older adults" (Presbyterian Homes & Services, 2013).

This study's focus to understand the influence of REN on the well-being of older adults is aligned with Presbyterian Homes & Services' goals to improve quality of life. The company is a Presbyterian, faith-based organization (Presbyterian Homes & Services, 2013). While staff and residents are not required to be of any specific faith, spiritual individuals are likely more attracted to the organization. Spirituality may or may not play a role in how participants responded to the connectedness to nature section of the questionnaire.

Research Design Process

The interviews were conducted at Johanna Shores senior living community. Johanna Shores is located on 27 acres of land in Arden Hills, Minnesota, a suburb of Minneapolis and St. Paul (Johanna Shores, 2013). The semi-circle shaped building is oriented around the lakefront of Lake Johanna (Johanna Shores, 2013). The site plan is shown in Figure 4. It is a continuing care community offering a variety of living options, depending on a person's needed level of care service and the facility consists of independent living senior apartments, assisted living, memory care, and a care center (Johanna Shores, 2013). Johanna Shores was the first community built by Presbyterian

Homes & Services in 1955 (Presbyterian Homes & Services, 2013). The community was redeveloped in 2012-2013 (i.e., the new building was built next to the old one, then the old building was torn down), with the exception of the care center, and currently has 54 independent living apartments, 72 assisted living apartments, and 36 memory care apartments (Presbyterian Homes & Services, 2013). The 305,000 square foot building has 38,000 square feet of public space, known as the *Town Center* (Pope Architects, 2013; Presbyterian Homes & Services, 2013). Some of the amenities offered in the Town Center include an aquatic center, fitness center, beauty salon/barber, gift shop, movie theater, medical and dental care, conservatory, library, billiards room, and a chapel (Johanna Shores, 2013). The architecture is late 1800's shingle style and the interior design style resembles an elegant lake home (Pope Architects, 2013). See Figure 5 for a photograph of an exterior view of the front of the building. There are many landscaped walking paths along the lake; however, there are no designated areas available for residents to participate in gardening activities. Figure 6 is a photograph of an exterior view of the back the building, including the lakefront and outdoor chapel.

Figure 4. Johanna Shores site plan

Figure 5. Exterior view of Johanna Shore's lakefront

Figure 6. Exterior view of Johanna Shore's front entrance

Presbyterian Homes & Services' branded name for independent living senior apartments is the *Terrace* (Johanna Shores, 2013). As of November 2013, all 54 Terrace

apartments were filled with a total of 74 residents; there are 20 couples who share an apartment. The ratio of women to men is 3:2. There are both one and two bedroom apartments that range in size from 773 square feet to 1,949 square feet. A one bedroom apartment ranging from 773 to 981 square feet has a monthly rental rate of $1,651 to $1,895, while a two bedroom apartment ranging from 1,295 to 1,332 square feet has a monthly rental rate of $2,536 to $2,695. The market rate rental cost at Johanna Shores Terrace independent living is one of the top five highest markets within the Presbyterian Homes & Services' communities. When comparing Johanna Shores to its top three competitors outside Presbyterian Homes & Services, it has the most expensive independent living apartment rental rate (Johanna Shores, 2013). A senior living location that requires a higher socioeconomic background was selected because it generally attracts residents who are able to be selective in deciding which senior living community to move into as they likely had the economic freedom in the past to be selective in buying their previous homes.

Pets are allowed at Johanna Shores Terrace apartments if it is a cat or dog weighs less than 20 pounds, with the exception of therapy dogs (Johanna Shores, 2013). Residents may be attracted to Johanna Shores because they are pet owners; furthermore, it is possible that people who are fond of animals have a stronger connection to nature (Salingaros & Masden, 2008).

Sample Selection

The study's population was a convenience sample with 20 participants. To obtain study participants, the researcher posted an informational flyer at a central bulletin board

location at Johanna Shores. A beverage and snack was offered during the interview as an incentive for participating. The interviews took place in a conference room at Johanna Shores for the participants' convenience. Interviews were conducted individually. About four interviews were scheduled on a given day for 45 minute time slots, which allowed the researcher time between interviews for note taking. Participants' answers were audio recorded. Interviews took place between November 25th, 2013 and December 22nd, 2013.

Demographic information that was critical to inclusion/exclusion criteria was collected from Johanna Shore's administration prior to conducting the interviews to ensure the prospective residents met the criteria to be in the study.

The older adult population differs greatly between individuals when considering physical health, mental health, and lifestyle (Sugiyama & Thompson, 2007). Having an age requirement for the study helped define the population so the results can be more easily generalized to a specific segment of adults. Older adults in the study were defined as individuals over the age of 65 (Sugiyama & Thompson, 2007). They were also required to be residents of the Terrace independent living apartments. Additional demographic information was collected, including gender, length of residency at Johanna Shores, and whether participants lived alone or with a spouse, because people who live together influence each other.

Instrument

The researcher interviewed residents at a senior living community using a three part questionnaire. The questions were about photographs of senior living communities' main public lounges (at an independent living care community) in which REN variables

have or have not been integrated into the design. The second section measured seniors' self-perceived well-being in relation to the photographs. The third section measured seniors' self-perceived connectedness to nature. A pilot study was conducted prior to administering the study.

A mixed methods approach was the most appropriate research method for this study because it allowed the researcher to ask open-ended questions to gain an in-depth understanding of the participants' reaction to the lounges in the photographs. The interview format helped the researcher understand how the participants arrived at their viewpoint because it gave the researcher the opportunity to clarify responses. The ability of an interior space to affect a person's well-being is not always consciously recognized or understood by all; therefore, it may have been challenging for participants to fill out a self-directed questionnaire.

Institutional Review Board

The researcher obtained approval from the Institutional Review Board (IRB) at the University of Minnesota. All recruitment correspondence documents (i.e., an informational flyer, see Appendix A), the consent form, and the survey instrument were submitted for review. The researcher took all necessary precautions to protect the privacy rights of the study participants and informed participants that their information was confidential and that their involvement was voluntary at all times. The researcher created a consent form that contained background information about the purpose of the study and included an explanation of what the participants would be asked to do, benefits, risks, compensation, confidentiality, and the voluntary nature of their consent (see Appendix B). The form also included the researcher's contact information in case any of the

participants had questions at a later date. Subjects were given a consent form to sign prior to beginning the study and they were offered a second copy to keep for themselves.

Photographs

Photographs (8) used were of the interior of senior living community's main public lounges. It is important to note that the researcher decided that none of the photographs would include people using the lounge space to eliminate their presence as a variable. Four of the photographs measured one of the four REN variables: water, fire, natural materials, and botanical motifs; they were paired with four corresponding control photographs without REN variables.

In evaluating the photographs, the researcher analyzed the photographs and coded them based on the following definitions of the four REN variables. In terms of water, it had to be actual moving water, not a photograph of water. For fire, a fire box without a flame visible was required.

In terms of natural materials, a higher level of visual texture was used so that natural materials would be an obvious feature; those natural materials also appear as more rustic in nature. In contrast, the other photograph in the pair has also includes natural materials; however, they are not the focus in the space since those natural materials are more refined and highly finished. This approach to coding natural materials was necessary as wood occurs in practically all designed environments. For botanical motifs, it was required that they be visible in the textiles in the space, typically incorporated as surface pattern/texture on upholstery or carpet.

As a complication, it was not always possible to find photographs showing only the REN variable being studied because of the way interior spaces are designed;

therefore, more than one REN variable was present in some photographs. For example, fire was present in both photographs of lounges measuring the natural materials, as well as the pair of photographs measuring botanical motifs. Because it was important to select lounge spaces that were similar in level of comfort (i.e., the same type of chairs in both photographs of the REN pair, such as a lounge chair versus a straight back chair), color schemes, or periods of design detailing (i.e., Victorian, Scandinavian, etc.), the selection of lounge photographs available were limiting. As a result, it would be correct that to some extent, these spaces are being evaluated as a 'visual composition' rather than as individual design elements (i.e. REN variables).

Additionally, prior to being shown the lounge photographs, there was a pair of garden photographs shown first as an example of what the participants would be asked to do with the following eight photographs. All participants viewed all 10 photos: one example pair, and then four pairs of lounges with REN and without (non-REN) variables, shown simultaneously. The order of showing the four pairs of photographs to participants was randomized from one participant to the next.

The researcher obtained the photographs from Presbyterian Homes & Services' existing senior living sites, with the exception of one photograph that was from an Internet search of senior living environments photographs. No photographs were from Johanna Shores to avoid possible bias, as it is possible that participants would prefer the photograph showing a space with which they were familiar. None of the photographs showed window views to the outside because the literature already clearly supports peoples' preference for window views (Kaplan, R., 2001; Ulrich; 1984; Ulrich, 2008).

The 8” x 10” color photographs were mounted on foam core for the participants viewing ease. Each photograph was numbered on the back for the researcher’s purposes.

Questionnaire

The questions included on the questionnaire were based on the literature review (see Appendix C). The questionnaire was ordered to limit the participants from knowing the intent of the study, which means it does not reflect the ordering of the four research questions. There were four segments in the questionnaire, demographic information and then three sections of questions for the participants related to well-being and preference. Section 1 of the questionnaire asked questions about the photographs of interior lounge spaces with and without the REN variables. Section 2 related the photographs of lounges to well-being. Then, Section 3 addressed participants’ connection to nature. Table 1 illustrates which sections of the questionnaire address which research questions, including the identification of the independent and dependent variables for each section; additionally, it describes how the theoretical constructs relate to the research questions and questionnaire.

Research Question	Theoretical Construct	Question (Measure) on questionnaire	Independent Variable	Dependent Variable
Q1	NE >>> HO	Section 3, Questions 1-6	Human/Nature Connection	Well-being
Q2	NE >>> DE >>> HO	Section 1, Questions 1-4	REN/non-REN	Preference
Q3	NE >>> DE >>> HO	Section 2, Questions 1-5; Section 3, Question 7	Design (REN/non-REN)	Well-being
Q4	NE >>> DE >>> HO	Section 2, Questions 1-5; Section 3, Question 7	REN	Well-being

Table 1. *Research Questions in Relation to Theoretical Constructs and Questionnaire*

The demographic information was collected prior to the beginning of interviews. The information was provided by staff at Johanna Shores from Presbyterian Home's records. It was listed first on the questionnaire and included gender, age, current resident location and type (independent living, assisted living, or skilled care), and length of time participants have lived at their current residence.

Section 1 of topical questions addressed research question 2, "Do seniors prefer environments with REN variables over environments without REN variables?" In research question 2, the NE inspires the design of REN variables incorporated into the DE, and then the DE influences the HO's self-perceived well-being. Section 1 of the questionnaire asked participants to choose which photograph of a senior living's main public lounge space they preferred and why. The REN and non-REN photographs were paired together and shown at the same time. The same sets of questions were asked for each pair of photographs (i.e., REN variable photo and the non-REN control photo). The order in which the photo pairs were shown was randomized for each participant.

Section 2 of the topical questions measured seniors' self-perceived well-being in relation to the four lounges that the participant preferred in Section 1. It addressed research questions 3 and 4. Research question 3 inquired, "Will seniors' self-perceived well-being be affected by observing representative elements of nature (REN) in the interiors of senior living facilities?" Research question 4 asked, "Which REN variables have the most significant influence on seniors' well-being?" In both research questions, the NE inspires the design of REN variables incorporated into the DE, and then the DE influences the HO's self-perceived well-being. The five questions were formatted as a semantic differential; the bipolar adjectives measured participants' feelings about the

lounges pictured in the photographs. The words for the semantic differentials were based on Rachel Kaplan's (2001) study on apartment residents' window views previously discussed. For example, "Would spending time in these spaces make you feel refreshed or exhausted?" Participants answered on a 5-point Likert-type scale with the following range as an example: very refreshed, somewhat refreshed, neutral, somewhat exhausted, or very exhausted. Other adjectives were used in a similar manner for the remaining questions (see Appendix C).

Section 3 questions measured the participants' self-perceived connection to nature. It addressed research question 1 that asked, "Can a human/nature connection influence seniors' self-perceived well-being?" Section 3 measured the NE influence on the HO's self-perceived well-being. The first five questions were on a 5-point Likert-type scale measuring participants' level of agreement and disagreement with statements. The questions were based on Mayer and Frantz's (2004) connectedness to nature scale, which they conducted five times to test the instrument, "Measuring the extent to which participants generally feel a part of the natural world" (Mayer & Frantz, 2004, p. 506). Then, a follow up question was asked about how much time the participants spend outside on an average day when it is warm or mild outside versus when it is cold outside and what kind of activities they usually perform when outside. The final question asked participants if they would feel connected to nature in any of the four spaces they preferred (as selected from the four pairs of photographs). The question was asked last to minimize participant bias.

Pilot Study

A pilot study was conducted prior to conducting the study's interviews to pretest the instrument and verify the interview duration relative to scheduling. Two females and one male over the age of 65 were interviewed. The interviews took 15-25 minutes. As a result of the pre-test, some changes were made to the questionnaire and some photographs were reselected.

For instance, relative to the questionnaire more verbal instructions were added to prompt the researcher to inform participants more thoroughly about what each section entailed, as the participants in the pilot were more comfortable when each section was introduced. In Section 2, the order of positive and negative words was randomized and a 5-point scale was added to get a more specific measure about participants' feelings relative to well-being. Also, the revised 5-point scale was used to be consistent with the 5-point scale in Section 3.

In addition, an adjustment was made in Section 3 to question 4. Participants had gotten confused about the meaning of the "web of life," which was the phrase used by Mayer & Frantz (2004) to determine a person's human/nature connection. The participants understood the concept of human/nature connection better when the wording was changed to "circle of life."

Furthermore, at the end of Section 3, when participants were asked about the amount of time they spend outside, participants offered separate answers for different seasons. This is not surprising when considering the extreme range of temperatures that occur in Minnesota, from snowy, -30F degrees days in the winter to sunny, 100F degree

days in the summer. Thus, the questionnaire was updated to ask two separate questions, one referring to warm/mild days and another about cool/cold days.

In terms of photos of senior living communities' main public lounges, the pilot study included seven pairs of photos, plus an example pair of photographs. The photograph pairs were narrowed down to one photo pair for each of the four REN variables, because it took too long and was exhausting for participants to view seven pairs of photographs of lounges.

The example pair of photographs were of two similar outdoor flower garden spaces (see Figure 7A and Figure 7B). There were no concerns with the example photographs in the pilot study so the same two photos were used again in the research study. The process of selecting the final four pairs will be explained next by each variable.

Figure 7A. Example A (iris) photograph

Figure 7B. Example B (tulip) photograph

There was one pair of photographs for the first variable, water. Both the REN variable photograph (see Figure 8A) and the control photograph (see Figure 8B) were reselected because the participants' felt that the water fountain (variable) and fish tank (control) were too different and difficult to compare. Participants did not recognize the water feature as being such, so it was pointed out to them. The presence of fish introduced another component of animals that could skew the results. Pilot participants voiced that the water fountain and sculpture were too contemporary in style and they were the only component in the photograph, making them appear less welcoming. The reselected photographs included soft seating in the photograph and other design elements such as cultured stone (see Figure 8C and Figure 8D).

Figure 8A. Photograph with water (pilot only)

Figure 8B. Photograph without water (pilot only)

Figure 8C. Photograph with water

Figure 8D. Photograph without water

The second REN variable, fire, had two pairs of photographs for the pilot study (see Figure 9A and Figure 9B), narrowed down to one pair for the research study. The television in this pair of photos without fire (see Figure 9B) introduced a new element that did not help to determine how nature in interior space influences humans. Consequently, the first pair was eliminated and the second pair of photographs (see Figure 910A and Figure 10B) was used for the research study.

Figure 9A. Photograph with fire (pilot only)

Figure 9B. Photograph without fire (pilot only)

Figure 10A. Photograph with fire

Figure 10B. Photograph without fire

Next, there were two pairs of photographs about natural materials, the third REN variable, which was narrowed down to one pair for the research study. In the first

photograph pair (see Figure 11A and Figure 11B), participants stated they chose the photograph without natural materials because the cultured stone in the photograph with the REN variable was too gray, dark, and contemporary to be appealing; additionally, there was too much cultured stone present. Therefore, the first photograph pair was eliminated. In the second photograph pair, the photograph with natural materials (see Figure 12A) was not preferred because participants noted that plants were not present, and the large amount of open space and the contemporary style did not make it feel cozy. There were no concerns about the photograph without natural materials (see Figure 12B). Therefore, a new photograph with natural materials was selected to be paired with the photograph without natural materials (see Figure 12B). The reselected variable photograph was more traditional in style, had warmth, looked cozy, and had plants present (see Figure 12C).

Figure 11A. Photograph with natural materials (pilot only)

Figure 11B. Photograph without natural materials (pilot only)

Figure 12A. Photograph with natural materials (pilot only)

Figure 12B. Photograph without natural materials

Figure 12C. Photograph with natural materials

For the fourth REN variable, botanical motifs, there were also two photograph pairs used in the pilot study, and then they were narrowed down to one pair for the research study. The first pair of photographs were too different in style from each other; the photograph without botanical motifs (see Figure 13B) being more contemporary and

simple than the photograph with botanical motifs present (see Figure 13A). There were no concerns with the second photograph pair (see Figure 14A and Figure 14B); therefore, it was used for the research study and the first pair of photos was eliminated.

Figure 13A. Photograph with botanical motifs (pilot only)

Figure 13B. Photograph without botanical motifs (pilot only)

Figure 14A. Photograph with botanical motifs

Figure 14B. Photograph without botanical motifs

In summary, the eight photograph pairs selected for use in the research study are shown below, per the findings of the pilot study. The figures have been re-numbered for clarity in the analysis and discussion that follows.

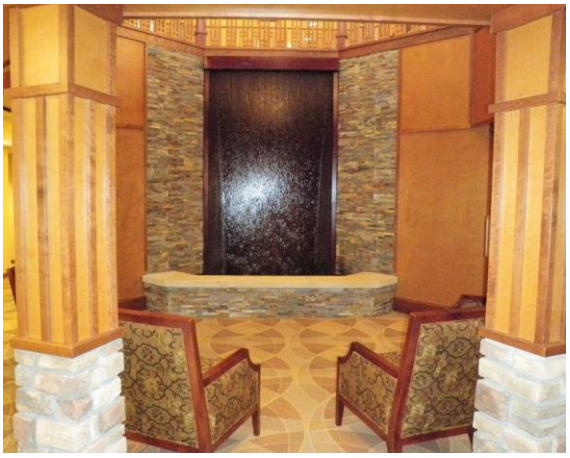

Figure 15A. Photo 1 with water

Figure 15B. Photo 2 without water

Figure 16A. Photo 3 with fire

Figure 16B. Photo 4 without fire

Figure 17A. Photo 5 with natural materials

Figure 17B. Photo 6 without natural materials

Figure 18A. Photo 7 with botanical motifs

Figure 18B. Photo 8 without botanical motifs

Analysis

The researcher reviewed the recorded information on the separate questionnaire forms used with each participant. Additionally, the researcher listened to the audio recording to see if there was any additional information that was not documented on paper and to ensure accuracy when quoting participants.

Demographic information about the sample will be presented first, including gender, age, and whether or not participants had spouses who also participated. Next, the data will be presented as it applies to the four research questions. Demographic information will be included in the analysis to identify the relationship between participants' responses to topical questions and gender, age, or spousal participation.

Research Question 1

Research question 1 asked, "Can a human/nature connection influence seniors' self-perceived well-being?" The first step in analysis of the findings is to report the results of participants' self-perceived connection to nature from Section 3 of the

questionnaire, questions 1-5. Participants were asked to indicate their level of agreement or disagreement on a 1-5 scale. Then a numeric value will be shown in a table to document the mean human/nature connection score for each participant, as well as the mean human/nature connection score for each of the 5 questions. The responses from question 6 in Section 3 regarding the amount of time participants spend outdoors will be documented in a table. The range of responses and the frequency of the responses will be noted. A separate table will illustrate the amount of time participants spend outside and the types of activities participants do outside. The response from question 6 will be an indication of the relationship participants have with nature.

Research Question 2

Research question 2 asked, "Do seniors prefer environments with REN variables over environments without REN variables?" The photographs of lounges each participant preferred from the four pairs from Section 1 of the questionnaire will be illustrated in a table to determine if participants preferred photographs of lounges with the REN variable over lounges without the REN variable. An additional table will document the reasons participants preferred the four photographs of lounges they selected and whether or not their preference was based on a nature-related element. A summary table will identify which comments were most frequent about design elements relating to nature to determine which REN variables had the most significant influence on participants' well-being.

Research Questions 3 and 4

Research question 3 asked, "Will seniors' self-perceived well-being be affected by observing REN in the interiors of senior living facilities?" Research question 4 asked, "Which REN variables have the most significant influence on seniors' well-being?"

The results of Section 2 of the questionnaire that measured participants' well-being on a scale of 1-5 in relation to the photographs of lounges will be reported in a table. The table will document if participants had a higher self-perceived well-being if they were to spend time in the lounge with a REN variable than if they were to spend time in a lounge without the REN variable. Each of the five questions will be charted separately. The results of the five tables will be summarized to document which question had the highest well-being score overall, as well as which photographs of lounges had the highest well-being results overall, determining which REN variables had the most significant influence on participants' well-being.

Section 3, question 7 asked participants if they would feel connected to nature in any of the lounges photographed; responses will be charted in a table illustrating in which photographed lounge participants would feel the most connected to nature. Participants' comments about why will be summarized in a separate table to indicate which REN variable is the most valued.

Limitations

There were multiple limitations of the research study related to population and sample, research design process, sample selection, and the instrument. Each is reviewed below.

Population and Sample

The first limitation is regarding the population and sample. Because Presbyterian Homes and Services is a faith-based organization, it may attract more faith-centered individuals. Consequently, it is possible that there is a positive correlation between a person's level of spirituality and a person's human/nature connection, especially when considering personal views on fitting into the world and having a greater sense of purpose. Therefore, spirituality may play a role in how participants responded to the connectedness to nature questions in Section 3 of the questionnaire.

The location of Johanna Shores could be a limitation. It is possible that the beautiful lakefront views and landscaped paths would attract residents who place a high value on nature that could cause them to score higher on the questions pertaining to the human/nature connection. Also, the pet policy at Johanna Shores is a possible limitation of this study. Because Johanna Shores allows pets, they may attract more pet owners. Since animals are a part of nature, pet owners could have a stronger human/nature connection (Salingaros & Masden, 2008). This would affect the results of Section 3 about connectedness to nature, especially question 2, which states, "I often feel a kinship with animals and plants."

Additionally, it is a limitation of this study that all participants were recruited from the same market rate senior living community. Moreover, the high rental cost at Johanna Shores Terrace as compared to other Presbyterian Homes & Services' communities and its top three outside competitors (Johanna Shores, 2013) is a limitation of the study. A senior living community with a different or wider socioeconomic

background may attract residents who respond to photographs of REN variables differently.

Research Design Process

There is a limitation regarding the research design process. The study was conducted in Minnesota during the cold and snowy months of November and December. This could lead participants to place a higher value on fireplaces. To the contrary, perhaps sitting by a waterfall would seem more appealing during the hot summer months.

Sample Selection

Perhaps the main limitation of the study is in the small sample size of only 20 participants. Also, including both single participants and couples could skew the findings as couples may influence each other's' views and they may have discussed the survey. Couples could have talked to each other between interviews, although members of a couple were interviewed on the same day. Additionally, any of the residents could have talked to their friends in-between being interviewed. However, the randomization of the order of the photographs of lounges with the REN variables may have helped reduce 'sharing of answers' between participants.

Instrument

There were limitations with the instrument in all three topical sections of the questionnaire. Only part of Kaplan, R's (2001) measures were used to measure well-being in Section 2, as it was a list of synonyms and the researcher needed to take into account the length of the interview and the participant's attention span and stamina. Likewise, only a part of Mayer & Frantz's (2005) scale was used to measure self-perceived connection to nature in Section 3 of the questionnaire.

There were two limitations related to the photographs of lounges. First, more than one REN variable was present in certain photographs. Because of the way interior spaces are designed, it was not always possible to find photographs showing only the REN variable being studied. Fire was present in both photographs of lounges measuring the natural materials (Figures 17A and 17B), as well as the pair of photographs measuring botanical motifs (Figures 18A and 18B). Natural materials were present in both photographs measuring water (Figures 15A and 15B) and both photographs measuring botanical motifs (Figures 18A and 18B). Except for photograph 8 (Figure 18B), all the photographs had botanical motifs in some aspect of the DE; some had an apparent presence of botanical motifs (e.g., Figure 18A) while others had a more interpretive version of botanical motifs in the room furnishings (e.g., Figure 17A).

Second, a primary limitation of the study is that the study used photographs of interior space, rather than the participants experiencing REN or non-REN variables in an actual interior space. This has several implications. First, participants viewing photographs of the waterfall (Figure 15A) do not get the experience being in a lounge with a waterfall. Watching the movement and listening to the sound of water can be appealing. Likewise, the fireplaces in the photographs (Figures 16A, 17A, 17B, 18A, and 18B) in the study were electric or gas, sometimes considered “fake” fireplaces. “Real” (wood burning) fireplaces are perceived to offer more visual interest and movement. Additionally, the crackling sound of a real fire can be pleasing. By only viewing photographs of natural materials, participants do not get to experience the natural weathering and aging of natural materials over time. Lastly, none of the plants were real

in any of the photographs. Consequently, participants do not experience the growth of plants over time or smell their fragrance.

CHAPTER 4. DATA ANALYSIS AND FINDINGS

This chapter starts with a description of the sample population of participants interviewed by the researcher. The findings from the exploratory interviews are reported next in the order of the research questions as they relate to the questionnaire. Addressing research question 2, the participants' comments on the four REN variables will be reviewed in detail.

Sample

Twenty subjects were interviewed at Johanna Shores senior living community. The interviews were conducted between November 25th and December 22nd, 2013. The mean length of individual interviews was about 24 minutes. There were twelve female and eight male participants (see Table 2). The gender ratio of participants (60% female, 40% male) matched the gender ratio of the Johanna Shores resident population. Participants' ages ranged from 77 to 92 with a mean of 83.3 years of age. Five couples (10 participants) volunteered to participate in the study. Both members of each couple were interviewed on the same day, which helped minimize the opportunity for participants to discuss the study. The average length of residency at Johanna Shores was just over a year, 13.7 months. All of the residents moved into the new, renovated Johanna Shores building, with the exception of one resident (participant 17) who previously lived in the old building.

Participant	Gender	Age	Spouse's Participant Number	Length of residency (months)
1	F	89		12
2	F	81	4	13
3	F	87		12
4	M	82	2	13
5	F	89		13
6	M	83	7	4
7	F	81	6	4
8	F	81		12
9	M	87		13
10	M	81	12	13
11	F	82		13
12	F	79	10	13
13	M	90	14	9
14	F	86	13	9
15	F	86		12
16	M	77		13
17	M	92		59
18	M	81	19	12
19	F	75	18	12
20	F	77		13
	Mean Age =	83.3	Mean Residency =	13.7

Table 2. *Demographic Characteristics of the Sample*

Findings of Exploratory Interviews

For clarity, the study's findings are reviewed in the order of the research questions, which is not the same order as the questionnaire. The questions in the survey instrument were ordered so that the participants' responses would not be skewed by knowing the intent of the study. As discussed in Chapter 3, of the topical questions Section 1 of the questionnaire asked questions about the photographs of lounges with the REN variables. Section 2 related the photographs of lounges to well-being. Then, the questions in Section 3 about connection to nature were asked last.

Research Question 1: Self-Perceived Connection to Nature

Research question 1, "Can a human/nature connection influence seniors' self-perceived well-being?" measured the participants' self-perceived connection to nature. Section 3 measured the NE influence on the HO's self-perceived well-being.

Five statements were read out loud to participants and they were asked to indicate the degree to which they agreed or disagreed with the statements on a 5-point Likert-type scale with the numbers meaning the following: strongly agree = 5, agree = 4, neutral = 3, disagree = 2, or strongly disagree = 1. Overall, participants agreed with statements. Table 3 indicates participants' responses and gender. Questions posed are noted as well.

Questions: 1. I think of the natural world as a community to which I belong.
2. I often feel a kinship with animals and plants.
3. I feel as though I belong to the Earth as equally as it belongs to me.
4. I often feel part of the circle of life.
5. I often feel disconnected from nature.

1 = Strongly disagree
2 = Disagree
3 = Neutral
4 = Agree
5 = Strongly Agree

		Question					
Participant	**Gender**	**1**	**2**	**3**	**4**	**5**	**Mean**
1	F	5	5	5	5	5	**5**
2	F	5	3	5	5	5	**4.6**
3	F	4	4	4	4	4	**4**
4	M	4	4	3	4	5	**4**
5	F	4	4	3	4	5	**4**
6	M	5	4	4	3	4	**4**
7	F	5	4	4	4	5	**4.4**
8	F	4	5	4	4	4	**4.2**
9	M	5	4	3	4	5	**4.2**
10	M	5	4	4	4	4	**4.2**
11	F	5	5	4	5	5	**4.8**
12	F	5	4	5	5	5	**4.8**
13	M	4	4	4	4	3	**3.8**
14	F	4	4	4	4	3	**3.8**
15	F	5	4	4	4	4	**4.2**
16	M	4	4	5	3	4	**4**
17	M	2	2	1	2	4	**2.2**
18	M	5	4	5	4	3	**4.2**
19	F	4	5	4	5	4	**4.4**
20	F	4	3	5	4	5	**4.2**
	Mean:	4.4	4.0	4.0	4.1	4.3	**4.2**
						Mean Male =	3.8
						Mean Female =	4.4

Table 3. *Self-Perceived Connection to Nature (Section 3, Questions 1-5)*

For questions 1-4, overall participants agreed with statements that indicated a personal connection with nature. However, one participant (17) consistently disagreed.

The last question (5) was worded negatively, "I often feel disconnected from nature." Participants uniformly disagreed with the statement, indicating that they do feel

connected to nature; their scores were converted to positive numbers to be consistent with the previous four questions to obtain a connected to nature score (4.3).

Participants' self-perceived connection to nature was also measured by question 6 in Section 3 of the questionnaire (see Table 4). It addressed participants' relationship with the outdoors, again focusing on the NE influence on the HO's self-perceived well-being.

Question 6 was a two-part question. The first part of the question asked participants how much time they spend outside on an average day when it is warm or mild outside, and then when it is cold outside. In the second part, participants were asked what type of activities they do outside.

Table 4 illustrates the average daily time spent outside when it is warm/mild or cool/cold outside. Most participants expressed interest in the outdoors and welcomed the opportunity to be outside. Some mentioned commitments to their daily walking rituals. The range of time spent outside when it is warm or mild weather varied from quite a lot of time to very little. Five participants (25%) responded that they get outside very little. The majority of participants responded that they get outside 1-2 hours a day. Some (3) expressed concern for when the weather is too hot.

Then, the participants were asked how much time they spend outside when the climate is cold. The majority of participants (75%) spends little to no time outside, and only are outside when it is necessary to get somewhere. Some participants (20%) still brave the cold and get outside for 20-50% of their time daily.

Question: How much time do you spend outside on an average day when it is warm or mild outside? How about when it is cold outside?		
Average Time Spent Outside (Daily)	**Warm Climate Qty of comments**	**Cold Climate Qty of comments**
As much as I can	3	
50%	1	2
30-40%	1	1
20%		1
5-6 hours (on golf days)	1	
1-2 hours	6	
1 hour	3	
10-30 minutes	1	
Little to no time	5	15
Varies	1	1

Table 4. *Time Spent Outside (Section 3, Question 6, Part 1)*

The second part of question 6 asked participants what kind of activities they do outside. Participants offered additional information about the types of outdoor activities they participated in the past. They also offered explanations for why they are experiencing a change in outdoor activity in their lives. Table 5 illustrates the types of outdoor activities in which participants currently engage and the types of outdoor activities they engaged in previously. Note that the list of activities the residents currently do outside are not necessarily new activities they just started doing recently, but rather they could be a continuation of the same activities done in the past.

Question: What kind of activities do you do (such as walking, gardening, watching animals)?		
	Current Participation	**Former Participation**
Type of Outdoor Activities	**Qty of Comments**	**Qty of Comments**
Active:		
Walking	13	1
Go to the park	2	
Golf	1	
Picnic	1	
Ride bike	1	
Ride scooter on the path	1	
Swim	1	
Yard work	1	3
Gardening		4
Boating		1
Downhill & cross country skiing		1
Observation:		
Watching birds & animals	5	
Sitting on the deck	3	
Looking at gardens	1	
Sitting & watching lake & sunsets	1	
Sleeping on screen porch	1	
Watching kids play	1	
Watching people going in & out	1	

Table 5. *Type of Outdoor Activities (Section 3, Question 6, Part 2)*

The types of activities participants currently do outside were split into two categories, "active" and "observation." For active types of outdoor activities, walking was the most common (13 participants), whereas only one participant identified walking as a former activity. Other outdoor active activities included going to the park, golfing, picnicking, biking, riding a scooter on the path, swimming, and doing yard work for children. The most common (5 participants) outdoor observation types of activities were watching birds and animals, followed by sitting on the deck (3 participants).

Many participants reflected on the types of activities they used to enjoy outside. Two residents even mentioned that they grew up on farms so they are used to being outside a lot. All of the comments on activities participants used to do were active types of activities. The most common outdoor activity that participants (4) used to do was gardening, followed by yard work (3 participants). Some participants mentioned outdoor recreational hobbies that once shaped their lifestyle such as boating and skiing.

In addition, participants offered explanations for why they have decreased outdoor activities in their lives (see Table 6). The most common reason was due to health complications limiting their abilities, both their own health (3 participants) and a spouse's health condition (1 participant). The unpredictability of the outdoors leads to a concern about falling (2 participants), especially in the winter when it is icy outside. Two participants attributed their change in outdoor activity citing that they can walk in the indoor corridors and have access to the indoor gym at the Johanna Shores facility. One resident asserted that she has done a lot more walking since she moved to Johanna Shores. Two other participants expressed interest in continuing to garden and work in the yard, but noted there is no access to these activities at Johanna Shores. One resident commented on how the outdoor area at Johanna Shores is all public space and she no longer has the option to wake up and spend time in a private backyard before getting ready for the day.

Reasons for Decreased Activity	Qty of Comments
Health complications limit ability	3
Avoid falling, especially on ice	2
Can walk down the indoor corridors	2
No access to garden	2
Access to indoor gym	1
Spouse's health complications	1
No access to do yard work	1
No private outdoor space	1

Table 6. *Reasons for Decreased Activity (Section 3, Question 6, Part 2)*

Research Question 2: Response to REN Variables

Research question 2,"Do seniors prefer environments in which REN variables are present over environments in which there are no REN variables?" measured the participants possible preference for REN variables in the main lounge of a senior living community. Section 1 of the questionnaire measured the NE's inspiration for the incorporation of REN variables into the DE, and then the DE's influence on the HO's self-perceived well-being.

The survey instrument included four pairs of photographs of a senior living community's main public lounge space. Each one of the four pairs of photographs of lounges measured a different one of the four REN variables: water, fire, natural materials, and botanical motifs. One photograph of each pair showed one lounge that had the variable present in the lounge, and the other photograph showed a lounge that did not have the variable present in the lounge space. Participants were asked the same question for each pair, "If you had to make a choice, which space would you prefer to spend time in?"

In Table 7, lounge photographs are numbered 1 through 8. Photographs of lounges preferred by each participant are indicated and totaled at the bottom of each column. For each photograph pair, the photograph of the lounge that the majority of participants preferred is underlined.

Question: If you had to make a choice, which space would you prefer to spend time in? Why?

		Lounge Photographs							
		Water		Fire		Natural Materials		Botanical Motifs	
		With	Without	With	Without	With	Without	With	Without
Participant	Gender	1	2	3	4	5	6	7	8
1	F		x		x		x	x	
2	F		x	x		x			x
3	F		x	x		x			x
4	M		x	x		x			x
5	F		x		x	x			x
6	M	x		x			x	x	
7	F		x		x		x	x	
8	F		x		x	x		x	
9	M		x	x		x			x
10	M	x		x		x			x
11	F	x		x			x	x	
12	F	x		x		x			x
13	M		x	x		x			x
14	F		x	x		x		x	
15	F	x		x			x		8
16	M	x		x		x			x
17	M		x	x		x		x	
18	M	x		x		5			x
19	F		x		x	x			x
20	F		x	x		x		x	
	Total #:	7	13	15	5	15	5	8	12
	Total %:	35%	65%	75%	25%	75%	25%	40%	60%

Table 7. *Participants' Preferences for Photographs of Lounges (Section 1 Questions)*

Responses to preference for the REN variables by the participants were mixed. For the first REN variable, water, the majority of participants (65%) preferred the photograph of the lounge without water (see Figure 4B). For both the second REN

variable, fire, and the third REN variable, natural materials, the majority (75%) of participants preferred the photograph of the lounges with the REN variables (for fire, see Figure 5A; for natural materials, see Figure 6A). For the fourth REN variable, botanical motifs, a majority of participants (60%) preferred the photograph of the lounge without botanical motifs (see Figure 7B).

The four photographs of lounges preferred by participants:

Figure 15B. Photograph 2 with water

Figure 16A. Photograph 3 with fireplace

Figure 17A. Photograph 5 with natural materials

Figure 18B. Photograph 8 without botanical motifs

Responses by gender. Table 8 illustrates how the responses differed between the twelve female participants and the eight male participants. The majority of women (75%) preferred the lounge shown in photograph 2, without water, while the comments from the males were split equally on their preferences between the first pair of photographs. The majority of the women (58%) preferred the lounge with fire, and all of the men preferred the photograph of the lounge with fire. For the third pair of photographs, the majority of the women (67%), and all but one of the men (87.5%) preferred the lounge with natural materials. Lastly, comments about botanical motifs were divided across gender. The women's preferences were split equally, with and without botanical motifs, while the majority of men (75%) preferred the lounge without botanical motifs. In summary, the women's preferences were split equally between the lounges with and without the REN variables, while two-thirds of male participants preferred the lounges with the REN variables.

		Lounge Photographs- Females							
		Water		Fire		Natural Materials		Botanical Motifs	
		With	Without	With	Without	With	Without	With	Without
Participant	Gender	1	2	3	4	5	6	7	8
1	F		x		x		x	x	
2	F		x	x		x			x
3	F		x	x		x			x
5	F		x		x	x			x
7	F		x		x		x	x	
8	F		x		x	x		x	
11	F	x		x			x	x	
12	F	x		x		x			x
14	F		x	x		x		x	
15	F	x		x			x		x
19	F		x		x	x			x
20	F		x	x		x		x	
		Lounge Photographs- Males							
		Water		Fire		Natural Materials		Botanical Motifs	
		With	Without	With	Without	With	Without	With	Without
Participant	Gender	1	2	3	4	5	6	7	8
4	M		x	x		x			x
6	M	x		x			x	x	
9	M		x	x		x			x
10	M	x		x		x			x
13	M		x	x		x			x
16	M	x		x		x			x
17	M		x	x		x		x	
18	M	x		3		x			x
Female Total:	12	3	9	7	5	8	4	6	6
Male Total:	8	4	4	8	0	7	1	2	6

Table 8. *Preferences for Lounge Photographs by Women and Men*

Participants' photograph pair comments. The second question asked of participants as they viewed the photograph pairs was why they preferred the photographs of lounges they selected, "Why would you prefer to spend time in this space?" The participants' reasons for selecting their preferred photographs of lounges offer valuable insights to the research questions, and increase understanding beyond reviewing the quantity of preferences identified. The participants' comments will be explained through

a discussion of each of the four REN variables, though as will be seen, many comments were regarding design elements of the DE that were not REN variables.

Though most of the participants' comments related to nature, some did not. They also offered many other comments not relating to nature. For each REN variable, there is a table for comments, which were also divided into positive and negative responses. Some of the comments were abbreviated to organize the comments into the table format and the photograph pairs are included with each REN pair for ease of reference. The discussion about participants' responses follows.

Water. As previously stated, participants (65%) preferred the photograph of lounge 2 without water (see Figure 15B). The comments related to why participants preferred to spend time in the lounge they identified are illustrated in Table 9. Overall, for the water REN variable, there was about an equal amount of positive (23) comments as negative (22) comments. Comments were made in reference to the waterfall, color, furniture, décor/style, space, and botanical motifs.

Design Element	Photo 1 = with 2 = without	Positive: Qty of Comments	Positive: Comment	Negative: Qty of Comments	Negative: Comment
		Water (with/without)			
Waterfall	**1**	10	Sound (4)	8	Sound makes one have to go to the bathroom (1)
			Interesting (1)		Not interesting (1)
			Movement (2)		Too permament/would get sick of it (3)
			Relaxing & restful (2)		
Color	**2**	6	Green repeated in finishes and décor (5)	1	Chairs (1)
			Warm and light (1)		
	1			1	
Furniture	**2**			5	Chairs (3)
					Arrangement (2)
	1	3	Chairs (2)		
Décor/Style	**2**	3	Comfortable (2)	3	Uncomfortable (1)
			Wall sculpture (1)		Too modern (1)
					Too formal (1)
Space	**1**			3	Columns too confining (3)
	2	1	Open (1)		
Botanical Motifs	**2**			1	Carpet (1)
Positive Total:		**23**	**Negative Total:**	**22**	

Table 9. *Participants' Comments Related to REN Variable 1 (Water) Pair of Photographs*

Figure 15A. Photograph 1 with water

Figure 15B. Photograph 2 without water

The majority of the comments on the first pair of photographs related to the waterfall in the photograph of lounge 1 (see Figure 15A). Among the 10 comments from participants who preferred the waterfall, some described the sound of the waterfall to be appealing, interesting, demonstrating movement, relaxing, and restful. An 86-year-old female shared her thoughts on the waterfall feature, "The movement of it, and the sound of it, I think it would be very nice, very pleasant." Furthermore, a 77-year-old male spoke about his attraction to water, "I would probably take the waterfall. There is something appealing about running water, relaxing and refreshing."

The comment made second most often was in reference to color. There were six participants who commented on the color used in the photograph of lounge 2 (see Figure 15B). Most (5) participants liked that the green color was repeated in the room in the

carpet, plants, light fixture, and wall sculpture, and one participant liked that the lounge's color was warm and light.

The next most prevalent comments were about furniture. There were three positive comments about the furniture in the photograph of lounge 1 with water (see Figure 15A) related to liking the chairs. There were three positive décor and style comments about the photograph of lounge 2 (see Figure 15B); two participants stated that the lounge looked comfortable, while the wall sculpture was appealing to another participant. The photograph of lounge 2 (see Figure 15B) was preferred by one participant because it had an open feeling.

On the other hand, there were many opposing viewpoints for the photograph pair measuring the water REN variable. The negative comment made most often (8) was about the waterfall. There were three negative comments specifically about the waterfall being too permanent of a structure because they could not easily change it if they got sick of it. One participant thought the sound would make her have to go to the bathroom and another participant viewed it as not interesting.

One participant did not care for the colors used in the chairs in the photograph of lounge 2 (see Figure 15B); additionally, another participant did not find the colors attractive in the photograph of lounge 1 (see Figure 15A). There were five negative comments on the furniture in the photograph of lounge 2 without water (see Figure 15B); three of the comments pertained to chairs, while the other two were regarding furniture arrangement.

There were three negative comments regarding décor and style about the photograph of lounge 2 (see Figure 15B); one participant specified that the lounge looked

uncomfortable. Furthermore, one participant perceived the lounge as being too modern, while another participant felt that the décor and style was too formal.

Three participants negatively commented on the photograph of lounge 1 (see Figure 15A), because the columns felt too confining. Lastly, the botanical leaf pattern in the carpet in the photograph of lounge 2 (see Figure 15B) was not particularly appealing to one participant.

Fire. As noted earlier, for this second REN variable, the majority (75%) of participants preferred the photograph of lounge 3 (see Figure 16A) with fire. The comments related to why participants preferred to spend time in the lounge they identified are illustrated in Table 10. The overwhelming majority of comments on the pair of photographs of the lounges with and without fire were positive (44) as compared to negative (11) comments. The comments include the design elements of the fireplace, furniture, color, space, décor/style, botanical motifs, nature-based artwork, plants, and natural materials.

Design Element	Photo 3 = with 4 = without	Positive: Qty of Comments	Positive: Comment	Negative: Qty of Comments	Negative: Comment
			Fire (with/without)		
Fireplace	**3**	11	Comfortable (1)	1	Flame not turned on (1)
			More functional (1)		
			Warmth (1)		
			Watch the movement (1)		
Furniture	**4**	7	Arrangement (3)		
			Coffee Table (4)		
	3	3	Arrangement (2) Chairs (1)		
Color	**4**	4			
	3	3	Blues and greens (1)	3	
			Coordination between finishes & furniture (1)		
Space	**3**	5	Spacious (5)		
	4			3	Too crowded (3)
Décor/Style	**4**	3	Cozy & relaxing (2)	4	Too cluttered (3)
			Décor in cabinet (1)		Décor in cabinet (1)
	3	1	Décor on shelves (1)		
Botanical Motifs	**4**	2	Upholstery is relaxing (2)		
Nature-Based Art	**3**	2			
Plants	**4**	2	Prefer real plants (1)		
Natural Materials	**3**	1	Stone fireplaces (1)		
Positive Total:		**44**	**Negative Total:**	**11**	

Table 10. *Participants' Comments Related to REN Variable 2 (Fire) Pair of Photographs*

Figure 16A. Photograph 3 with fireplace

Figure 16B. Photograph 4 without fireplace

The most frequent (12) positive comments participants made were in reference to the fireplace in the photograph of lounge 3 (see Figure 16A), with the fire REN variable; there were 11 positive comments from participants who wanted to spend time in lounge 3 (see Figure 16A) with the fireplace, noting that the fireplace creates a comfortable space, is more functional (than the display cabinet in the photograph of lounge 4) (see Figure 16B), provides warmth, and that the movement of the flame is appealing. In sharing her decision-making process about where she would prefer to spend time, an 82-year-old female observed: "Now I have to choose between a china closet and a fireplace. I pick the fireplace." A similar testament was made by an 86-year-old female, "If I had the option of a fireplace, I'd choose a fireplace" (even though she stated she liked the colors and coffee table in the photograph of lounge 4 better (see Figure 16B). A 79-year-old female

shared her thoughts on selecting her preferred lounge to spend time, "Anything that has a fireplace, I would like better…If I have to choose color against fireplace, I choose fireplace."

The comment made most frequently after the fireplace comments were regarding furniture. There were seven participants who commented on the furniture in the photograph of lounge 4 (see Figure 16B); three participants specifically commented on their preference for the furniture arrangement, and four stated that they liked the coffee table. In the photograph of lounge 3 (see Figure 16A), three participants commented on the furniture, two specifically liked the furniture arrangement and one found the chairs appealing.

Some participants liked the colors in the photograph of lounge 3 (3 participants, see Figure 16A) and lounge 4 (4 participants, see Figure 16B). One participant, an 87-year-old female was attracted to the blues and greens in the photograph of lounge 3 (see Figure 16A); she reflected on why she was drawn to blues and greens, "When you think about it, those are nature's colors- blue skies, green grass, green trees." In the photograph of lounge 3 (see Figure 16A), one participant, an 82-year-old male pointed out that he liked the color coordination in between the carpet, lamp shade, artwork, and ottoman.

There were five participants who felt the photograph of lounge 3 (see Figure 16A) felt spacious. Three participants commented on finding the décor and style in the photograph of lounge 4 (see Figure 16B) pleasing, two participants specifically observed that the space was cozy and relaxing and one found the décor in the cabinet appealing. One participant was attracted to the décor on the shelves in the photograph of lounge 3 (see Figure 16A).

In addressing which lounge participants would like to spend time, the botanical motifs in the photograph of lounge 4 (see Figure 16B) were called out by two participants because they thought the leaf-inspired paisley upholstery pattern on the chairs made the lounge feel relaxing. Other participants liked the nature-based artwork in the photograph of lounge 3 (see Figure 16A). The plants in the photograph of lounge 4 (see Figure 16B) were commented on by two participants. One of the participants, a 75-year-old female stated that she hoped the plants were real (none of the plants are live plants in any of the photographs), which again calls attention to the importance of nature being authentic. Lastly, a positive comment was made about natural materials because one participant specifically commented on being drawn to the stone on the fireplace.

There were also a few negative comments for the pair of photographs for the fire REN variable. The only negative comment about the fireplace in the photograph of lounge 3 (see Figure 16A) was by a 79-year-old female who did not like that the fireplace was not turned on. This could call attention to the importance of nature being real and functional.

In the photograph of lounge 3 (see Figure 16A), three participants did not like the color palette. Three participants did not like the photograph of lounge 4 (see Figure 16B) because they thought it seemed too crowded. Four participants did not find the décor and style attractive in the photograph of lounge 4 (see Figure 16B); three participants found the space to be too cluttered, while one did not find the décor in the cabinet particularly appealing.

Natural materials. The participants' responses to natural materials, the third REN variable, showed that the majority of participants (75%) preferred the photograph of

lounge 5 with natural materials (see Figure 17A). The comments relating to why participants would prefer to spend time in the lounge they identified are illustrated in Table 11. The overwhelming majority of comments were positive (51) rather than negative (17). Comments were made in reference to décor/style, furniture, natural materials, fireplace, plants, space, botanical motifs, color, nature-based artwork, and geometric pattern.

	Natural Materials (with/without)				
	Photo	Positive		Negative	
Design Element	5 = with 6 = without	Qty of Comments	Comment	Qty of Comments	Comment
Décor/Style	**5**	10	Interesting (7)	2	Too much interest (1)
			Comfortable (3)		Too formal (1)
	6	6	Simpler (3)	3	Too simple (2)
			Comfortable (3)		Too modern (1)
Furniture	**5**	6	Coffee Table (2)	5	Coffee Table (4)
			Chairs (2)		Chairs (1)
			Bookcases (2)		
	6	2	Chairs (1) Arrangement (1)	2	Chairs (2)
Natural Materials	**5**	7	Stone fireplaces (6)		
			Wood mantel (1)		
Fireplace	**5**	2	Hearth (2)	3	Not usable with screen (3)
	6	1			
Plants	**5**	4	Prefer real plants (1)		
	6	1			
Space	**5**	4	Spacious (3)		
			Mirror increases perceived size of room (1)		
	6			1	Too crowded
Botanical Motifs	**5**	4	Rug (3)		
			Upholstery (1)		
Color	**5**	3			
Nature-Based Art	**5**	1			
Geometric Pattern	**6**			1	Upholstery
Positive Total:		**51**	**Negative Total:**	**17**	

Table 11. *Participants' Comments Related to REN Variable 3 (Natural Materials) Pair of Photographs*

Figure 17A. Photograph 5 with natural materials

Figure 17B. Photograph 6 without natural materials

The most frequent positive comments participants made about the natural materials REN variable were in reference to décor and style. Ten participants had positive comments about the photograph of lounge 5 (see Figure 17A). The lounge was interesting to seven participants, while three other participants thought it seemed comfortable. In the photograph of lounge 6 (see Figure 17B), six participants had positive comments; three participants liked that the design was simple, whereas three others participants thought it seemed comfortable.

The comment made second most often was regarding furniture. Six participants had positive comments on the furniture in the photograph of lounge 5 (see Figure 17A); two participants specifically liked the coffee table, two others were attracted to the chairs,

and another two participants found the bookcases on either side of the fireplace to be appealing. Two participants had positive comments about the furniture in the photograph of lounge 6 (see Figure 17B); one participant specified preference for the chairs, while another participant made a positive comment about the furniture arrangement.

The third most frequent positive comments (7) were made in reference to the natural materials shown in the photograph of lounge 5 (see Figure 17A). Six participants liked the stone fireplace, while one participant was attracted to the wood mantel. A 77-year-old male recognized the value of stone, "I like fireplaces, that one has a fireplace too, but that one has a stone one, it has more of a natural feel to it." Another participant, an 81-year-old female shared her impression of the stone, "Fireplace with the stone is very soothing."

After natural materials, the fireplace was the most frequently commented on design element. The fireplace was preferred in the photograph of lounge 5 (see Figure 17A) by two participants because it has a hearth. One participant was attracted to the fireplace in the photograph of lounge 6 (see Figure 17B).

Four participants commented on the plants in the photograph of lounge 5, and one participant liked the plants in the photograph of lounge 6 (see Figure 6B). Again, a 75-year-old female specifically mentioned that she hoped the plants were live plants, stressing the subject of authenticity. Four positive comments were made about space in the photograph of lounge 5 (see Figure 17A); three participants thought it felt spacious and one participant specifically commented on liking how the mirror increased the perceived size of the room.

Botanical motifs in the photograph of lounge 5 (see Figure 17A) were commented on by four participants; three participants specifically liked the rug and one participant found the upholstery attractive. Both the chair and rug have a paisley pattern. The photograph of lounge 5 (see Figure 17A) was preferred by three participants because of the color palette. Lastly, one participant liked the photograph of lounge 5 (see Figure 17A) because of the nature-based artwork above the mantel.

There were many comments made by participants with opposing viewpoints for the photograph pair measuring the natural materials REN variable. Three participants had negative comments about décor and style in the photograph of lounge 6 (see Figure 17B); two participants thought the design seemed too simple, while one participant thought it felt too modern. Additionally, there were two negative comments about the photograph of lounge 5 (see Figure 17A), because one participant thought there was too much interest in the lounge and another participant viewed the lounge as being too formal.

Five participants had negative comments on the furniture in the photograph of lounge 5 (see Figure 17A); four participants stated that they did not care for the coffee table and one participant did not like the chairs. Two participants had negative comments about the furniture in the photograph of lounge 6 (see Figure 17B), because they did not find the chairs appealing.

The fireplace in the photograph of lounge 5 (see Figure 17A) was not preferred by three participants because the it did not look usable with the fireplace screen in front. One negative comment was made about space in the photograph of lounge 6 (see Figure 17B), referencing that the lounge seemed too crowded. Lastly, one negative comment was made about the geometric upholstery pattern in the photograph of lounge 6 (see Figure 17B).

Botanical motifs. The last of the four REN variables examined botanical motifs. The majority of participants (60%) preferred the photograph of lounge 8 (see Figure 18B), without botanical motifs. The comments related to why participants preferred to spend time in the lounge they identified are illustrated in Table 12. For botanical motifs, the overwhelming majority of comments relating to nature were positive (50) instead of negative (6). The comments included the following design elements: natural materials, furniture, color, fireplace, décor/style, geometric pattern, and space.

	Botanical Motifs (with/without)				
	Photo	Positive		Negative	
Design Element	7 = with 8 = without	Qty of Comments	Comment	Qty of Comments	Comment
Natural Materials	**8**	14	Rustic timber wood (12)	2	Too rustic (2)
			Stone (1)		
			Wood mantel (1)		
	7	2	Stone (2)		
Furniture	**7**	6	Arrangement (4)	3	Chairs (2)
			Ottoman (1)		Ottoman (1)
			Lamp (1)		
	8	4	Arrangement (2)		
			Chairs (2)		
Color	**7**	9	Colors key off fireplace stone (2)		
	8	4		1	
Fireplace	**8**	3	Fireplace looks real (1)		
			Hearth (1)		
	7	1			
Décor/Style	**8**	3	Décor (1)		
			Homey (1)		
			Soft lighting (1)		
	7	1	Carpet instead of tile (1)		
Geometric Pattern	**8**	2	Chairs (2)		
Space	**7**	1	Seems larger (1)		
Positive Total:		**50**	**Negative Total:**	**6**	

Table 12. *Participants' Comments Related to REN Variable 4 (Botanical Motifs) Pair of Photographs*

Figure 18A. Photograph 7 with botanical motifs

Figure 18B. Photograph 8 without botanical motifs

The majority of participants' comments (16) were in reference to natural materials. There were 14 positive comments about the photograph of lounge 8 (see Figure 18B). Specifically, 12 participants preferred the rustic timber wood. An 87-year-old female claimed, "The more rustic and wood there is, the better I like it." Another 81-year-old female shared her perception of the lounge, "It just gives me a warm, rustic feeling." One participant commented on the stone being attractive, and another found the wood mantel on the fireplace appealing. In the photograph of lounge 7 (see Figure 18A), two positive comments were made about natural materials, both in reference to being attracted to the stone.

After natural materials, furniture had the most positive comments. Six participants had positive comments on the furniture in the photograph of lounge 7 (see Figure 18A). More specifically, four participants had positive comments on furniture arrangement; one of these participants directly commented on how they liked that the chairs face the fire.

Another participant liked the ottoman, while another participant liked that there was a lamp by the chair so the lounge can be used for reading. In addition, the photograph of lounge 8 (see Figure 18B) had four positive comments about furniture; two participants liked the furniture arrangement and two found the chairs appealing.

Nine participants had positive perceptions of the colors that were used in the photograph of lounge 7 (see Figure 18A); two of the participants liked how the colors key off the colors in the stone on the fireplace. Four participants perceived the colors used in the photograph of lounge 8 positively (see Figure 18B).

Three participants had a positive perception of the fireplace in the photograph of lounge 8 (see Figure 18B); one participant pointed out that the inclusion of a hearth was appealing and another participant was attracted to the fireplace because it appears to be a working fireplace (note that none of the fireplaces in any of the photographs are real, working fireplaces). The fireplace in the photograph of lounge 7 (see Figure 18A) was preferred by one participant.

Regarding décor and style, the photograph of lounge 8 (see Figure 18B) was viewed positively by three participants; specifically, because one participant was attracted to the décor, another thought it seemed homey, and a third participant recognized that the lounge had soft lighting. A 77-year-old female preferred the photograph of lounge 7 (see Figure 18A) because she noticed it had carpet, whereas the photograph of lounge 8 (see Figure 18B) had ceramic tile flooring.

Two participants found the geometric plaid pattern on the chairs in the photograph of lounge 8 attractive (see Figure 18B). Lastly, there was one positive comment about

space in the photograph of lounge 7 (see Figure 18A), as the participant thought the space seemed larger.

There were a few negative comments for the pair of photographs for the botanical motifs REN variable. There were two negative comments about the photograph of lounge 8 (see Figure 18B) regarding the use of timber wood; participants thought it made the lounge too rustic. Three participants had negative comments on the furniture in the photograph of lounge 7 (see Figure 18A); two were directed at the chairs, while one referred to the ottoman. One participant had a negative perception of the colors that were used in the photograph of lounge 8 (see Figure 18B).

Although much information was learned from reviewing the participants' comments on the four REN variables, many questions were raised as well, including the many comments relative to design elements that were not REN variables but seemed influential in participants' preferences. Note that since some fireplaces had natural materials, it is unclear in some cases whether participants liked the fireplace, the natural materials, or both. It is also not understood why some participants liked furniture and others did not, for example, the coffee table and chairs in the photograph of lounge 5 (see Figure 17A). The results of the four REN variables will be reviewed further in the discussion section.

Research Questions 3 and 4: Self-Perceived Well-Being

Both Section 2, questions 1-5 and Section 3, question 7 from the survey instrument address research questions 3 and 4, which focus on measuring participants' self-perceived well-being. The measures for Sections 2 and 3 will be discussed separately.

Analysis of Section 2 of the questionnaire. Research questions 3 and 4, addressed by Section 2 of the questionnaire measured participants' self-perceived well-being. Research question 3, "Will seniors' self-perceived well-being be affected by observing representative elements of nature (REN) in the interiors of senior living facilities?" and research question 4, "Which REN variables have the most significant influence on seniors' well-being?" both measured the participants' self-perceived well-being. Also, in both research questions, the NE inspires the incorporation of REN variables into the DE, and then the DE influences the HO's self-perceived well-being.

To operationalize these research questions, the four photographs of a senior living community's main public lounge that participants preferred in Section 1 were evaluated by the five questions in Section 2 of the questionnaire. Each of the five questions had a pair of semantic differential words to measure the participants' response to the question, "Would spending time in these spaces make you feel [pair of words]?" about the photographs of the lounges. Numeric values (1-5) were assigned to the responses. The higher the number, the more positive the influence on the participants' self-perceived well-being.

The first question in Section 2 asked how participants would feel if spending time in the four preferred lounges in the photographs between very refreshed to very exhausted (i.e., very refreshed = 5, somewhat refreshed = 4, neutral = 3, somewhat exhausted = 2, or very exhausted = 1) (all subsequent pairings used this differential structure with different words). The results of each of the five questions are shown in separate tables. The numbers indicate the how refreshed/exhausted the participant would feel when spending time in the lounge shown in the photograph (see Table 13). The mean

score for each lounge photograph is shown at the bottom of the table. A higher number indicates better well-being. Subsequent Tables 14 through 17 for questions 2-5 follow this same format.

When answering question 1, the majority of participants stated they would feel somewhat refreshed (3.6-4.5) in all of the photographs of lounges (see Table 13).

Question: Would spending time in these spaces make you feel:

5 = Very Refreshed
4 = Somewhat Refreshed
3 = Neutral
2 = Somewhat Exhausted
1 = Very Exhausted

		Photographs of Lounges							
		Water		Fire		Natural Materials		Botanical Motifs	
		With	Without	With	Without	With	Without	With	Without
Participant	**Gender**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	F		3		3		3	3	
2	F		4	4		4			5
3	F		4	5		5			4
4	M		3	4		4			5
5	F		2		4	3			4
6	M	5		3			4	4	
7	F		5		4		4	5	
8	F		3		4	4		5	
9	M		4	3		3			5
10	M	5		4		3			5
11	F	3		4			2	5	
12	F	4		3		3			5
13	M		4	4		4			5
14	F		4	3		4		4	
15	F	4		3			5		4
16	M	5		4		4			5
17	M		4	5		4		5	
18	M	3		5		4			4
19	F		4		4	4			3
20	F		3	3		4		5	
	Mean:	**4.1**	3.6	**3.8**	3.8	**3.8**	3.6	**4.5**	**4.5**

Table 13. *Perceived Well-Being: Refreshed Versus Exhausted*

Participants reported that they would feel more refreshed when spending time in the lounge with water (4.1), than when spending time in the lounge without water (3.6); though in terms of fire, participants would feel equally refreshed when spending time in the lounge with or without fire (3.8). Considering natural materials, participants noted they would feel more refreshed when spending time in the lounge with natural materials (3.8) versus the lounge without natural materials (3.6). Lastly, participants noted they would feel equally refreshed when spending time in the lounge with or without botanical motifs (4.5). In summary, the participants reported that they would feel either more refreshed or equally refreshed in the four lounges with the REN variables, than the four lounges without the REN variables.

Question 2 in Section 2 of the questionnaire asked participants if spending time in the four preferred lounges shown in the photographs would make them feel: very attentive versus very distracted (see previous scale explanation). Participants stated that they were basically neutral when spending time in a lounge with or without water; though with water they would lean towards attentive (3.4) versus without water they would lean toward distracted (2.8) (see Table 14). When considering fire, participants stated they would feel more attentive when spending time in the lounge with fire (3.6), than spending time in the lounge without fire (3.0). Participants also reported that they would feel slightly more attentive when spending time in the lounge without natural materials (3.4) than spending time in the lounge with natural materials (3.1). Lastly, participants would feel somewhat attentive when spending time in either lounge, both without botanical motifs (4.1) or with botanical motifs (4.0). To summarize responses to Question 2, the participants reported that they would feel more attentive in two lounges with the REN

variable (water, fire), one lounge without the REN variable (natural materials) but with a minimal difference, and one pair of lounges equally with and without the REN variable (botanical motifs).

Question: Would spending time in these spaces make you feel:

5 = Very Attentive
4 = Somewhat Attentive
3 = Neutral
2 = Somewhat Distracted
1 = Very Distracted

		Photographs of Lounges							
		Water		Fire		Natural Materials		Botanical Motifs	
		With	Without	With	Without	With	Without	With	Without
Participant	**Gender**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	F		3		5		4	4	
2	F		3	3		2			5
3	F		2	5		5			2
4	M		3	4		4			4
5	F		1		2	2			4
6	M	2		4			4	4	
7	F		2		2		2	2	
8	F		5		2	1		4	
9	M		4	2		3			5
10	M	5		2		2			4
11	F	3		4			2	5	
12	F	2		1		2			5
13	M		4	4		5			5
14	F		3	5		5		5	
15	F	5		2			5		2
16	M	3		4		4			4
17	M		1	5		2		5	
18	M	4		5		4			5
19	F		3		4	3			4
20	F		3	4		2		3	
	Mean:	**3.4**	2.8	**3.6**	3.0	3.1	**3.4**	4.0	**4.1**

Table 14. *Perceived Well-Being: Attentive Versus Distracted*

For the third question in Section 2, participants reported if spending time in the four preferred lounges shown in the photographs would make them feel very relaxed

versus very harried (see previous scale explanation). Table 15 indicates that the majority of participants would feel somewhat relaxed (3.1-4.6). First, the results showed that participants would feel more relaxed when spending time in the lounge shown in the photograph with water (4.0), than when spending time in the lounge without water (3.1); whereas, they would feel more relaxed when spending time in the lounge without fire (4.4), than when spending time in the lounge with fire (3.7). Likewise, participants stated they would feel more relaxed when spending time in the lounge without natural materials (4.4), than when spending time in the lounge with natural materials (3.6). Lastly, participants reported they would feel more relaxed when spending time in the lounge with botanical motifs (4.6), than when spending time in the lounge without botanical motifs (4.3). Again, in participants' responses to question 3, the results were split between the four REN variables because the participants reported that they would feel more relaxed in two lounges with the REN variables (water, botanical motifs), and in two lounges without the REN variables (fire, natural materials); however, participants mean scores were neutral to relaxed in all lounges shown in the photographs, with our without the REN variables.

Question: Would spending time in these spaces make you feel:

5 = Very Relaxed
4 = Somewhat Relaxed
3 = Neutral
2 = Somewhat Harried
1 = Very Harried

		Photographs of Lounges							
		Water		Fire		Natural Materials		Botanical Motifs	
		With	Without	With	Without	With	Without	With	Without
Participant	**Gender**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	F		3		4		5	4	
2	F		3	3		2			5
3	F		1	5		5			2
4	M		3	3		4			5
5	F		1		5	4			2
6	M	4		5			5	5	
7	F		5		4		5	5	
8	F		4		4	3		5	
9	M		4	3		3			5
10	M	5		3		3			5
11	F	2		5			2	5	
12	F	3		2		2			5
13	M		4	4		4			5
14	F		4	4		4		4	
15	F	5		3			5		4
16	M	5		4		5			5
17	M		1	4		2		5	
18	M	4		5		4			5
19	F		3		5	5			4
20	F		4	3		4		4	
	Mean:	**4.0**	3.1	3.7	**4.4**	3.6	**4.4**	**4.6**	4.3

Table 15. *Perceived Well-Being: Relaxed Versus Harried*

The fourth question in Section 2 that measured perceived well-being, asked participants if spending time in the four preferred lounges shown in the photographs would make them feel very patient versus very irritable (see previous scale explanation). Table 16 indicates that the majority of participants would feel somewhat patient (3.2-4.6). The results showed that participants would feel somewhat patient when spending time in the lounge with water (4.0), than spending time in the lounge without water (3.2). For

fire, results showed that participants would feel slightly more patient when spending time in the lounge without fire (4.2), than when spending time in the lounge with fire (3.7), through both lounges made participants feel somewhat patient. Likewise, the results of the natural materials REN variable showed that participants would feel slightly more patient when spending time in the lounge with natural materials (4.0), than when spending time in the lounge without natural materials (3.7). And finally, participants reported that they would feel somewhat to very patient when spending time in the lounge shown in the photographs with botanical motifs (4.5) or without botanical motifs (4.6). In conclusion, the participants reported that they would feel more patient in two lounges without the REN variables (fire, natural materials), in one lounge with the REN variable (water), and one pair of lounges equally with and without the REN variable (botanical motifs).

Question: Would spending time in these spaces make you feel:

5 = Very Patient
4 = Somewhat Patient
3 = Neutral
2 = Somewhat Irritable
1 = Very Irritable

		Photographs of Lounges							
		Water		Fire		Natural Materials		Botanical Motifs	
		With	Without	With	Without	With	Without	With	Without
Participant	**Gender**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	F		4		4		5	4	
2	F		3	3		3			5
3	F		1	5		5			4
4	M		3	4		4			5
5	F		2		5	4			4
6	M	4		4			4	4	
7	F		5		4		3	4	
8	F		4		4	3		5	
9	M		5	3		3			5
10	M	4		3		3			5
11	F	3		5			3	5	
12	F	3		1		2			5
13	M		3	4		4			5
14	F		3	4		4		5	
15	F	5		3			5		4
16	M	5		5		4			4
17	M		2	5		4		5	
18	M	4		5		4			5
19	F		2		4	4			4
20	F		5	4		5		4	
	Mean:	**4.0**	3.2	3.9	**4.2**	3.7	**4.0**	4.5	**4.6**

Table 16. *Perceived Well-Being: Patient Versus Irritable*

The fifth question (final one in Section 2) measuring self-perceived well-being, asked participants if spending time in the lounges shown in the four preferred photographs would make them feel very comfortable versus very uneasy. Table 17 illustrates that overall the majority of participants would feel comfortable or somewhat comfortable in the lounges they preferred (3.0-4.4). First, results showed that participants would feel more comfortable when spending time in the lounge with water (3.6), than

when spending time in the lounge without water (3.0). Second, participants stated they would feel more comfortable when spending time in the lounge without fire (4.2), than when spending time in the lounge with fire (3.8). Likewise, participants reported that they would feel more comfortable when spending time in the lounge without natural materials (4.2), than when spending time in the lounge with natural materials (3.7). And finally, results showed that participants would feel comfortable when spending time in the lounge with (4.4) or without (4.3) botanical motifs. To summarize, participants reported that they would feel more comfortable in two lounges without the REN variables (fire, natural materials), in one lounge with the REN variable (water), and one pair where the lounge with the REN variable was equal to the lounge without the REN variable (botanical motifs).

Question: Would spending time in these spaces make you feel:

5 = Very Comfortable
4 = Somewhat Comfortable
3 = Neutral
2 = Somewhat Uneasy
1 = Very Uneasy

		Photographs of Lounges							
		Water		Fire		Natural Materials		Botanical Motifs	
		With	Without	With	Without	With	Without	With	Without
Participant	**Gender**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	F		3		4		5	3	
2	F		3	4		3			5
3	F		1	5		5			3
4	M		2	4		4			5
5	F		2		5	4			3
6	M	4		5			5	5	
7	F		5		4		4	5	
8	F		3		4	3		5	
9	M		4	2		3			5
10	M	4		3		3			5
11	F	2		4			2	5	
12	F	3		1		2			5
13	M		4	4		4			5
14	F		4	4		4		4	
15	F	5		2			5		3
16	M	5		5		5			5
17	M		1	5		2		5	
18	M	2		5		5			5
19	F		3		4	4			3
20	F		4	4		4		3	
	Mean:	**3.6**	3.0	3.8	**4.2**	3.7	**4.2**	**4.4**	4.3

Table 17. *Perceived Well-Being: Comfortable Versus Uneasy*

Analysis of Section 3, question 7 of the questionnaire. Previously described research questions 3 and 4 were also measured by results from a three-part question 7 from Section 3, which asked, "Would you feel connected to nature in any of these spaces?" Research question 7 was the last question on the questionnaire and it directly asked the study's underlying question throughout the interviews. The four photographs of

lounges preferred by the participant were set in front of the participant by the researcher when asking this three-part question.

Table 18 illustrates participants' comments about which lounge they were shown in photographs that they would feel a connection to nature. The totals at the bottom of the table show the number of participants that answered "yes," that they would feel connected to nature in the lounge in the photograph, followed by the total number of participants that preferred that lounge, and the percentage of participants who felt their preferred lounge connected them to nature.

		Photographs of Lounges							
		Water		**Fire**		**Natural Materials**		**Botanical Motifs**	
		With	**Without**	**With**	**Without**	**With**	**Without**	**With**	**Without**
Participant	**Gender**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	F		Yes		Yes		Yes	No	
2	F		No	No		Yes			No
3	F		No	No		No			Yes
4	M		No	No		No			Yes
5	F		No		No	No			No
6	M	Yes		Yes			No	Yes	
7	F		Yes		Yes		Yes	Yes	
8	F		No		No	No		No	
9	M		Yes	No		No			Yes
10	M	No		No		No			Yes
11	F	No		Yes			No	Yes	
12	F	No		No		No			Yes
13	M		No	No		No			No
14	F		No	No		No		No	
15	F	Yes		No			Yes		No
16	M	Yes		No		Yes			Yes
17	M		No	Yes		No		Yes	
18	M	No		Yes		No			No
19	F		No		No	Yes			Yes
20	F		Yes	Yes		Yes		Yes	
	Total Yes:	3	**4**	**5**	2	**4**	3	5	**7**
	Out of:	7	13	15	5	15	5	8	12
	Total %:	**43%**	31%	33%	**40%**	27%	**60%**	**63%**	58%

Table 18. *Self-Perceived Connection to Nature from Photographs of Preferred Lounges*

Some participants (4) responded that they would not feel connected to nature in any of the photographs of their preferred lounges, while other participants (2) responded that they would feel connected to nature in all four photographs of lounges they preferred. An 81-year-old, female participant responded to the question immediately by declaring, “You can be connected to nature anywhere.”

For the first REN variable, water, the photograph of the lounge without water was selected by four participants (31%) and the lounge with water was selected by three participants (43%), indicating that they would feel connected to nature when spending time in that lounge. The photograph of the lounge with fire was identified by five participants (33%) who would feel connected to nature when spending time in the lounge, while the photograph of the lounge without fire was selected by two participants (40%). For natural materials, the third pair of photographs, the photograph of the lounge with natural materials was selected by four participants (27%), and the photograph of the lounge without natural materials present was selected by three participants (60%). Of the fourth pair of photographs of lounges, the photograph without botanical motifs was selected by seven participants (58%) and the lounge with botanical motifs was selected by five participants (63%) who felt that they would feel connected to nature in the lounge.

The participants specified reasons why they would feel connected to nature when spending time in the lounges they preferred shown in the photographs as the third-part of the question. The comments from participants are presented in Table 19 organized by design element relating to nature; some are REN variables and others are other design elements placed in rank order by responses.

REN Variable Rank	Overall Rank	Design Element	Connected to Nature in Photos of Lounges			
			Photo		Qty of Comments	Comment
			With	Without		
1	1	**Natural Materials**	3, 5, 7	2, 8	**17**	Stone (10)
			5	8		Wood (6)
				4		Pottery (1)
	2	**Plants**	5	2, 4, 6	**9**	
	3	**Color**	3, 5, 7	2	**5**	
	4	**Nature-Based Art**	3	8	**4**	
2	5	**Fireplace**	3, 7		**3**	
3	6	**Waterfall**	1		**3**	
4	7	**Botanical Motifs**		2, 6	**2**	
				Total:	**45**	

Table 19. *Self-Perceived Connection to Nature via Design Elements*

The most prevalent response by participants (17) for feeling connected to nature in the lounges in the photographs was natural materials, one of the four REN variables. Of them, participants identified stone (most of which were on fireplaces) (10), wood (6), and the pottery (1). Six (1, 2, 3, 5, 7, and 8) out of the eight photographs of the lounges have stone. All of the lounges in the photographs have wood in them in some aspect if furniture is included, although only six of them have a built-in wood element. All of the comments about wood were referring to built-in elements.

The second most common comment by participants (9) for feeling a connection to nature was the presence of plants. Half of the photographs of lounges (2, 4, 5, and 6) had plants. Participants also commented on photographs of lounges that included color, nature-based artwork, fireplace, waterfall, and botanical motifs. Artwork that is based on nature (representational), not interpretive or abstract artwork inspired by nature, was present in half of the photographs of lounges (3, 5, 7, and 8). Five of the photographs of

lounges (3, 5, 6, 7, and 8) had fireplaces. There were four photographs of lounges (2, 3, 4, and 7) that had an apparent presence of botanical motifs in the room furnishings, and all the photographs, with the exception of photograph 8, had botanical motifs in some interpretive aspect (i.e., paisley pattern).

It is important to note that there were no windows in any of the photographs of lounges evaluated by the participants. It was by design that the windows were removed as a variable because previous research (Bates & Marquit, 2011; Kaplan, R., 2001; Ulrich, 1984; Ulrich, 2008) widely supports the human preference for viewing nature out the window. One 75-year-old female noted the absence of windows and commented that she would feel the most connected to nature in a space that offered a window view.

In summary, Section 2, questions 1-5 and Section 3, question 7 were reviewed in this section, as they both address research questions 3 and 4, which measure participants' self-perceived well-being. A discussion of the findings from the study will be further discussed next in Chapter 5.

CHAPTER 5. CONCLUSION

This chapter includes a discussion of the findings and implications for future research. The discussion of the findings follows the same format as the findings of exploratory interviews in Chapter 4, starting again with a discussion of the sample, followed by the research questions. Implications for future research will include what the researcher would do differently next time, followed by closing remarks.

Discussion of the Findings

The discussion is reviewed in the order of the research questions. In addition to the four REN variables, implications of the participants' comments on the other design elements will be reviewed within research question 2.

Sample

It is ideal that the gender ratio of the sample was the same as the independent living population at Johanna Shores, 60% female, 40% male. With five couples in the sample, half of the participants were couples, which may have helped engage the male participants. It was unexpected that 8 males would volunteer to participate in the study. The couple participation may have helped encourage males to volunteer.

Research Question 1: Self-Perceived Connection to Nature

Section 3 of the questionnaire focused on the NE influence on the HO's self-perceived well-being. The questions measured participants' self-perceived connection to nature. It addressed research question 1, "Can a human/nature connection influence seniors' self-perceived well-being?" The overall mean self-perceived connection to nature score for all participants was 4.2 (highest possible score = 5.0), indicating that

participants have a strong self-perceived connection to nature. The results of questions 1-5 suggest that a human/nature connection can influence seniors' self-perceived well-being. The overall mean self-perceived connection to nature score was higher for females (4.4) than it was for males (3.8). Therefore, it is possible that a human/nature connection has a stronger influence on women.

Additionally, comments in response to question 6 about outdoor activities support the participants' responses for questions 1-5, relative to their connection to nature. Furthermore, comments about outdoor activities support the need to incorporate biophilic design principles in senior living environments. Biophilic design incorporates elements of the natural environment into the built environment, and can be literal or representational to varying degrees (Joye, 2006b, 2007; Kellert, 2008). This study indicated that participants have a greater desire to spend time outside, than what is actually feasible for their lifestyle. Therefore, bringing REN indoors could be beneficial to their well-being.

In terms of participant engagement in providing comments, the question about time spent in the outdoors sparked more interest than any other question. Many participants told stories of enjoyment they have had in the outdoors. An 82-year-old female resident acknowledged, "I do need fresh air and sunshine. I love animals. I love the moon. I like nature period." Regarding participants' acknowledgement of not having access to gardening at Johanna Shores, perhaps elevated (i.e., stand up) individual outdoor gardens available at other Presbyterian Homes & Services' senior living communities could be added at Johanna Shores.

Research Question 2: Response to REN Variables

In research question 2, the NE inspires the incorporation of REN variables into the DE, and subsequently the DE influences the HO's self-perceived well-being. Research question 2 is addressed in Section 1 of the questionnaire and it asked, "Do seniors prefer environments in with REN variables over environments without REN variables?"

In analysis of the participants' comments regarding the pairs of photographs of the lounges with and without the REN variable, the idea of nature was influential to the participants. However, there is an apparent disconnect between participants recognizing the influence of nature, and participants specifically selecting photographs of the lounges based on REN variables. Each photograph pair of lounges had many differences in terms of design elements present (i.e., furniture, color) in addition to the REN variable (with or without conditions). In addition, in many photographs, there were more than one REN variable present (i.e., fire and natural materials), which could confound participants' decision-making regarding preference and subsequently the analysis of participants' preference by this researcher.

Participants seemed easily able to picture themselves in the lounges shown in the photographs evident from the depth of their comments. Also, the majority of comments were not based solely on aesthetics or personal preference, but rather on an understanding of the lounge's perceived function, intent, and character. Participants also had a clear understanding of what they valued in interior space, exemplified by the fact that most had an instant reaction to the photographs of the lounges and were able to answer the questions rather quickly. In addition, the participants noticed differences between

photographs of lounges that the researcher did not identify prior to the beginning of the study. For example, that the lounge in photograph 7 had carpet whereas the lounge in photograph 8 had ceramic tile flooring. Another example is that some participants noticed that some fireplaces had hearths and others did not.

The number of opposing comments from participants was a surprise, but an important reminder that design will always be somewhat subjective, and it is difficult to apply design principles to a population at large. Also, the female participants felt more comfortable describing design styles and details than the male participants; whereas, the male participants seemed a little uncomfortable with participating in the study at the beginning of the interviews and made comments about not having a lot of interior design knowledge. The female participants seemed far less intimidated.

The comments presented in Tables 8-12 that discuss the REN variables provide a more in-depth understanding of participants' reactions to the photographs of the lounges, than Table 7 that simply shows which photographs of a pair of lounges the participants preferred.

Subsequently, Table 20 reviews all comments by participants regarding connection to nature on the four REN variables from Section 1. There are 11 design elements including furniture, color, décor/style, natural materials, fireplace, space, waterfall, plants, botanical motifs, nature-based artwork, and geometric patterns. The comments continue to be separated by positive and negative comments. The results of the participants' preferences pertaining to the four REN variables and other design elements are reviewed below.

REN Variable Rank	Overall Rank	Design Element	Qty of Postive Comments	Qty of Negative Comments
	1	Furniture	31	15
	2	Color	29	6
	3	Décor/Style	27	12
1	4	Natural Materials	24	2
2	5	Fireplace	18	4
	6	Space	11	7
3	7	Waterfall	10	8
	8	Plants	7	
4	9	Botanical Motifs	6	
	10	Nature-Based Artwork	3	
	11	Geometric Patterns	2	2
		Total:	**168**	**56**

Table 20. *Overall Comments for all Design Elements Including REN Variables*

Water. When examining all comments on the four REN variables, water had the third most comments (10 positive, 8 negative) as compared to the other three REN variables, and seventh most comments for all design elements. These results for water are consistent with comments in Table 19 that also shows that of the four REN variables, water was the third most common reason for feeling connected to nature in the photographs of lounges. This could imply that water is the third most preferred REN variable.

The specific comments about water regarding sound, movement, and providing relaxation, were not unexpected. It is important to state the limitation of using a photograph of water on the evaluation of water as a REN variable, as it is an animate (moving) element. Participants did not experience the sound and movement of water.

However, the comments from participants (3) about the waterfall being too permanent of a structure are interesting. Fireplaces are just as permanent as a waterfall,

yet no one viewed their permanence as being a negative aspect of the photographs of the lounges.

Though only third in number of overall comments about the REN variables, water had the most negative comments. The particular waterfall shown in the photograph could be contributing to these comments as it had a solid, black backdrop, and could be considered somewhat cold or modern (as noted by some participants). More research using multiple photographs of water in interior space is needed.

Fire. When reviewing all comments by participants regarding connection to nature on the four REN variables in Section 1, fire was commented on the second most times (18 positive, 4 negative), and the fifth most times for all design elements. These results for fire are consistent with comments in Table 19 that also shows that of the four REN variables, fire was the second most common reason for feeling connected to nature in the photographs of lounges. This could suggest that fire is the second most preferred REN variable.

The most comments about fire were regarding the presence of hearths. It is surprising that participants picked up on the key difference of whether or not a fireplace had a hearth, and it is interesting that they were a preferred fireplace component. Perhaps fireplaces with hearths suggest that the fire is in a real, working fireplace. More research is needed on the importance of hearths.

It is important to acknowledge the possible limitation of fire as a REN variable because participants were not actually experiencing fire by viewing the photographs of the lounges. The fireplaces in the photographs in this study were electric or gas (i.e., "fake") fireplaces. Real fireplaces offer more visual and olfactory interest, and the sound

of a crackling fire can be pleasing. Furthermore, the fire REN variable was always shown in a fireplace.

The other comments about fire were not unexpected; fireplaces provide warmth, watching the movement is interesting, and they make the lounge feel comfortable. Additionally, participants commented that a fireplace is a functional use of space. The researcher did expect more participants to specifically note that the fireplace adds an element of comfort to the lounge; however, it seems that participants who commented about comfort did not specifically attribute the feeling of comfort to the fireplace per se.

Natural materials. Natural materials was the most commented on (24 positive, 2 negative) of the four REN variables, and the fourth most commented on for all the design elements. These results for natural materials are consistent with comments in Table 19 that also shows that natural materials was the most commented on reason for feeling connected to nature in the photographs of lounges. This could indicate that natural materials are the most preferred REN variable.

When reviewing all the natural materials comments by participants regarding connection to nature on the four REN variables in Section 1, there were 23 comments on wood and 10 comments on stone. This is opposite of Table 19 because more participants commented on stone (10) over wood (6), when asked about where they would feel connected to nature in viewing the photographs of lounges. Both stone and wood as a built-in element occur in six of the eight photographs of lounges. It would be useful for future research to determine which natural materials, i.e., stone or wood, are more preferred.

Botanical motifs. When examining all comments on the four REN variables, botanical motifs had the fourth most comments (6 positive, no negative) as compared to the other three REN variables, and received the ninth most comments for all design elements. These results for botanical motifs are consistent with comments in Table 19 that also shows that of the four REN variables, botanical motifs was the fourth most common reason for feeling connected to nature in the photographs of lounges. This could indicate that botanical motifs are the least preferred REN variable out of the four REN variables.

Botanical motifs was the most difficult REN variable to measure, since there were not many comments on surface pattern in general. The lack of comments for the last pair of the photographs of lounges regarding botanical motifs was particularly surprising because one of the three participants in the pilot study selected photograph 7 of the lounge with botanical motifs specifically based on preference for the botanical motif in the upholstery pattern.

Perhaps the limited number of comments indicates that pattern is not preferred by participants as much as other variables. But on the other hand, it is possible that pattern is a design detail and not as noticeable of a design element like furniture or REN like water, fire, and natural materials; therefore, it is more difficult for the conscious mind to discern a difference in the pair of photographs of the lounges and make selections based on pattern.

It is possible that people like paisley pattern motifs because they liked it in both photograph of lounges 4 and 5, which were the two photographs of lounges with paisley patterns. Likewise, negative comments made about patterns that were not botanical

motifs could be interpreted as support for human preference for botanical motifs. One participant did not like the geometric upholstery pattern in the photograph of lounge 6. To the contrary, two participants found the non-botanical, plaid pattern on the chairs in the photograph of lounge 8 attractive. In addition, the botanical leaf pattern in the carpet in the photograph of lounge 2 was not particularly appealing to one participant. The results of botanical motifs are therefore inconclusive; future research is needed on this REN variable.

The REN variables were cited often in terms of self-perceived well-being. There were far more positive comments relating to the REN variables than negative comments. Therefore, this study reinforces the constructs of ART, namely, nature's restorative effects on people.

Other design elements in addition to REN variables. Though not directly part of the REN variables being measured, Table 20 also documents comments on other design elements from participants' responses to questions posed in Section 1. Again, the comments are separated by positive and negative comments.

Furniture was the most commented on (31 positive, 15 negative) design element not relating to the four REN variables, closely followed by color (29 positive, 6 negative), then décor and style (27 positive, 12 negative), followed by space (11 positive, 7 negative), plants (7 positive, no negative), nature-based art (3 positive, no negative), and geometric patterns (2 positive, 2 negative).

The high number of comments on furniture is of interest. The most comments were made regarding furniture arrangement. Many participants observed which direction chairs were facing; they noted whether or not they were facing each other for

conversation, and the participants made comments on whether they were facing the focal point of a fireplace or waterfall or facing out into the open space. The design of chairs regarding comfort was also important to participants. Ottomans and coffee tables were also commented on a lot. Participants talked about the way the lounge could function with the inclusion of an ottoman or table. Participants also noticed how the addition of an ottoman or coffee table affected the amount of clear travel space to get in and out of seating.

Color is ranked as the second most common design element commented on in Table 20; these results are similar to the comments in Table 19 that shows that color was the third most common reason for feeling connected to nature in the photographs of lounges. Colors that were specifically referred to as being representative of nature were green and blue. The earth tone colors in cultured stone were also mentioned.

Table 21 illustrates the responses about color shown in the photograph of lounges including positive and negative comments. The photograph of lounge 7 had the most positive reactions to color (9 positive, no negative), which showed warm shades of brown. Next, the photograph of lounge 2 was preferred for its colors (6 positive, no negative), which showed primarily green and caramel colors. Interestingly, the same amount of participants liked the colors in the photograph of lounge 3 as participants who did not find the colors attractive (3 positive, 3 negative). Therefore, the results of color are difficult to generalize because in some cases they contradicted each other.

Photograph	Qty of Postive Comments	Qty of Negative Comments
1	0	1
2	6	1
3	3	3
4	4	0
5	3	0
6	0	1
7	9	0
8	4	1
Total:	**29**	**7**

Table 21. *Overall Comments on Color*

For décor and style, there were 11 positive comments about the lounge in the photograph feeling "comfortable," "cozy," "relaxing," or "homey" (see Table 20). It is surprising that there were not more comments of a similar nature. The pairings of words in Section 2, however, do address participants' feelings. "Interesting" and "simple" were positive reasons for liking the décor and style. Negative descriptive words for décor and style included: "too simple," "too cluttered," "too formal," or "too modern". From these responses, it is apparent that décor and style is interpreted differently by different people.

Regarding the design element space, there were 11 comments about the photographs of lounges feeling spacious. On the other hand, there were seven comments about the photographs of lounges feeling too crowded.

While plants was the second most common reason in Table 19 for feeling connected to nature in the photographs of lounges, it was only ranked as the eighth most commented on design element in Table 20. It is important to mention the limitations of plants again because participants were not actually viewing live plants in the photographs of lounges. These findings support previous research that states that incorporating plants

improves well-being (Bringslimark et al., 2009; Dijkstra et al., 2008; Ferguson, 2010; Huelat, 2008).

While nature-based art was the fourth most common reason in Table 19 for feeling connected to nature in the photographs of lounges, it was only ranked as the tenth most commented on design element in Table 20. The nature-based artwork all contained trees as the subject, although not all artwork pieces would be considered landscape paintings. These findings support previous research that states that incorporating nature-based artwork into interior space has a positive effect on well-being (Bates & Marquit, 2011; Nanda et al., 2011; Ulrich, 2008; Wilson, A., 2008).

Lastly, geometric pattern was commented on the least. As previously discussed under botanical motifs, there were not many comments on pattern overall.

Research Question 3 and 4: Self-Perceived Well-Being

In research question 3, the NE inspires the incorporation of REN variables into the DE, and then the DE influences the HO's self-perceived well-being. Research question 3 asked, "Will seniors' self-perceived well-being be affected by observing representative elements of nature (REN) in the interiors of senior living facilities?"

Again, the NE inspires the incorporation of REN variables into the DE, and then the DE influences the HO's self-perceived well-being in research question 4, which asked, "Which REN variables have the most significant influence on seniors' well-being?" analysis of Section 2 and 3 responses follow.

Analysis of Section 2 of questionnaire. The overall self-perceived well-being results as reported by participants looking at photographs of their preferred four lounges are examined for each photograph of the lounges, as illustrated by Table 22. The higher

self-perceived well-being score in each pair of photographs of lounges is in bold text. When looking at the results for the five questions on well-being, a sense of overall well-being for each photograph of the lounges is apparent.

According to the comments, participants would have the greatest self-perceived well-being (4.4) when spending time in the lounge with and without botanical motifs (photographs 7 and 8), raising questions about the presence/absence of botanical motifs, especially in context with findings relative to REN variable responses discussed earlier. However, these two photographs are of lodge style design, so perhaps participants feel a greater sense of well-being in a lodge environment. It is possible that since a lodge style design is popular in Minnesota, participants prefer to live in a senior living community that reflects the vernacular architecture and design, especially common for Minnesota vacation homes. Or, it is possible that older adults prefer a retirement home that reflects a greater state of relaxation than their previous lifestyles. These concepts echo the research by Hartig, Catalano, Ong, and Syme (2013) about vacation homes and longevity. The findings of their longitudinal study indicate that taking vacations reduces psychological stress for people in the workforce as well as retired individuals. Additionally, in another longitudinal study, Fransson and Hartig (2010) found that people who own vacation homes are less likely to have an early death, suggesting that having a place to retreat to for the purpose of relaxation has a restorative impact on peoples' health. It is important to note that people often own vacation homes that provide access to nature (Fransson & Hartig, 2010). Typically, lodge style homes are located in the woods and/or near a lake or river.

1 = Lowest 5 = Highest		Photograph of Lounges								
		Water		Fire		Natural Materials		Botanical Motifs		
		With	Without	With	Without	With	Without	With	Without	
Question	**Word Pair**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Overall**
1	Refreshed/ Exhausted	**4.1**	3.6	**3.8**	**3.8**	**3.8**	3.6	**4.5**	**4.5**	4.0
2	Attentive/ Distracted	**3.4**	2.8	**3.6**	3.0	3.1	**3.4**	4.0	**4.1**	3.4
3	Relaxed/ Harried	**4.0**	3.1	3.7	**4.4**	3.6	**4.4**	**4.6**	4.3	4.0
4	Patient/ Irritable	**4.0**	3.2	3.9	**4.2**	3.7	**4.0**	4.5	**4.6**	4.0
5	Comfortable/ Uneasy	**3.6**	3.0	3.8	**4.2**	3.7	**4.2**	**4.4**	4.3	3.9
	Mean:	**3.8**	3.1	3.8	**3.9**	3.6	**3.9**	**4.4**	**4.4**	**3.9**

Table 22. *Overall Perceived Well-Being Across all REN Variables*

Participants would have the lowest self-perceived well-being (3.1) when spending time in the lounge shown in photograph 2, without the water REN variable. It is somewhat interesting that this was the only photograph of a lounge that is not of a senior living community owned by Presbyterian Homes and Services. It is important to note that when examining the water REN variable, the largest differences in well-being occurred between lounges with and without water over the other three REN variables.

Table 22 also reports the overall mean well-being score for each of the five questions in the far right column, as well as a grand mean of 3.9 ("somewhat"). Question 2 had overall lower positive results (3.4), as compared to the comments for the other four questions (3.9 and 4.0). It is possible that the attentive/distracted pair of words were not consistently interpreted by participants and therefore are not as accurate of a measure of well-being. The other four questions (1, 3, 4, and 5) had the same or similar overall results, which strengthens the reliability of the word pairs used in the survey instrument. The results of question 5, which was worded negatively, were in line with the other

questions; this indicates that participants were listening closely to the questions and answering to the best of their ability.

The overall grand mean for well-being measures of the photographs of the lounges by participants was 3.9 on a 5-point scale (see Table 22). The high, positive score suggests that the participants' self-perceived well-being was positively affected by observing the photographs of lounges with and without REN variables. The findings of this study reinforce the constructs of stress reduction theory because the high positive feelings of refreshed, relaxed, patient, and comfort and the limited feelings of fear (i.e. harried, irritable, and uneasy) support personal, psychological restoration.

Analysis of Section 3, question 7 of questionnaire. Photograph 8 of the lounge (lodge design) without botanical motifs, was selected the most by participants (7, 35%) indicating that they would feel connected to nature when spending time in that lounge (see Table 18). These results further support the idea that participants may prefer a lodge design and/or prefer to live in a senior living community that reflects the vernacular architecture/design.

Table 19 provides a more in-depth understanding of participants' reactions to the photographs of lounges. Table 19 describes the *reasons* participants gave for feeling connected to nature in a lounge, whereas Table 18 reports which photographs of the lounges the participants selected.

When reviewing the most commented on REN variables in Section 1 that addressed the participants' preference for lounges with or without REN variables shown in Table 20, the results could imply that natural materials are the most preferred REN variable, followed by fire, then water, and finally botanical motifs. Though not

specifically REN variables measured in this study, other design elements such as plants, color, and nature-based artwork were also identified as influencing participants' preference for the lounges shown in the photographs. However, future research is needed that includes these additional design elements. These three additional design elements, plants, color, and nature-based artwork, are illustrated in Figure 19, a revised model of observation of nature as supported by the findings.

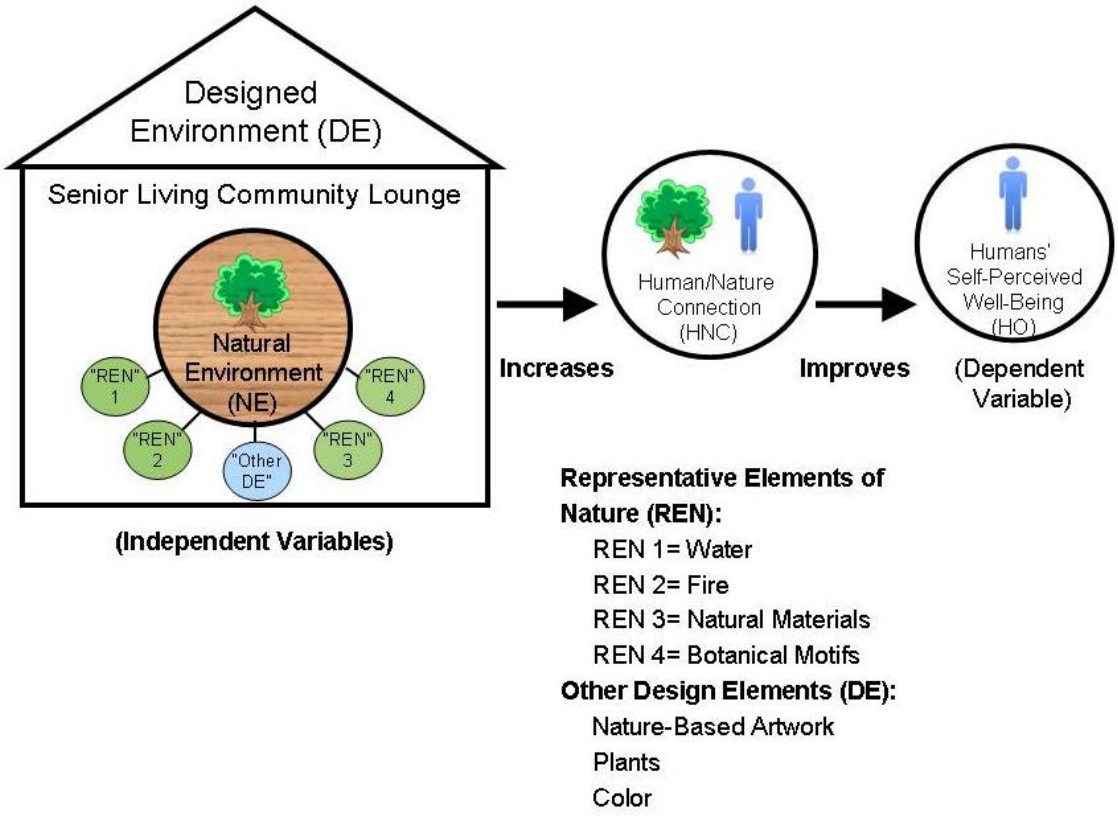

Figure 19. Model of observation of nature as supported by the findings

It is important to note that the study was conducted in Minnesota during the cold and snowy months of November and December, which could lead participants to place a higher value on the fire REN variable (fireplaces) versus sitting by a waterfall (water

REN), which would seem more appealing if the study had been conducted during the hot summer months.

Implications for Future Research

This research focused on the main public lounge at an independent living community. Other areas besides the lounge could be explored in future research, as well as other levels of care, such as assisted living. Additionally, further research is needed with a wider demographic including multiple senior living sites with differing economic levels and other types of housing besides market rate.

While this research was specific to older adults, the benefits of nature stem across all ages. Bates & Marquit (2011) emphasized, "Given the varieties of potential benefits to viewing and/or interacting with nature, it is preferable to incorporate natural elements wherever humans spend time" (p. 522). Future research can apply the four REN variables to people of other ages, perhaps starting with how the staff at senior living communities is influenced by the incorporation of REN.

This research was specific to older adults at senior living communities because well-being is critical for the senior population, yet they have no control over the design of the public space. Future research can apply the four REN variables to other building types where well-being is critical, but the users of the space have no control over the design, such as healthcare facilities, schools, criminal justice facilities, and office buildings.

The comments on the question about time spent outside (Section 3, question 6) raised questions that could be explored in future research. It would be interesting to ask

younger generations the same question about time spent outside to see if they would be as passionate about the outdoors as the senior participants in this study. Further research is needed to determine if passion for the outdoors is a characteristic of the current generation living in senior living communities. Or, it is possible that humans become more appreciative of beauty and the outdoors as they age due to their limitations and the decreasing opportunities to be outside as one ages making the outdoors all the more appealing. It would be interesting to do the study during a different season than winter to see if participants' attitudes about the outdoors differ during different seasons. For instance, if conducted in the summer months, would the water REN be more positively received versus the fire REN? Future research is needed about older adults' attitudes on the outdoors.

Questions were also raised by the comments on photographs 7 and 8 of a lodge style design that could be explored in future research. Participants reported having the greatest self-perceived well-being when spending time in the lounges in photographs 7 and 8. Furthermore, the lodge style space of photograph 8 was selected the most by participants as a space where they would feel connected to nature. It is possible that the majority of the participants grew up in the Midwest and the vernacular lodge design reflects an association with home. However, if the same study was conducted in Florida, it is anticipated that the results might vary because Florida's vernacular architecture/design is different from Minnesota's. Since the participants preferred the lodge design in this study conducted in Minnesota, further research is needed to explore if older persons would prefer living in a senior living community that reflects the

vernacular architecture/design, especially if it can elevate their connection with nature and boost their perceived well-being.

Further research is needed on the four REN variables' influence on older adults' well-being in the lounge of senior living communities so the results can be quantified. Empirical data on the REN variables' influence on well-being is needed to provide a way to be competitive in the senior living market. This study could be conducted with future residents as part of the pre-design/programming process phases prior to new construction, or involve current residents in the case of a renovation project. Additionally, the marketing departments of senior living communities could use the data to educate prospective residents about how the senior living community supports the well-being of residents.

Data is also needed to justify the economic implications of incorporating the REN variables. Determining which REN variables are the most preferred, will help direct developers how to be marketable in a cost effective way and where and how to direct design elements dollars. Additionally, it would be advantageous to develop a post-occupancy evaluation (POE) checklist of REN variables to be used by designers of senior living facilities. Furthermore, there are financial benefits to increasing the well-being of residents because they will potentially live a longer life, thereby decreasing resident turnover rates.

What the Researcher Would Do Differently

Conducting a research study is a learning experience. If the researcher were to do the research study again, certain aspects of the study would be designed differently.

For Section 2 on well-being and question 7 in Section 3 about connection to nature, the researcher would ask the participants the well-being questions for all eight photographs of the lounges, instead of only the four preferred photographs of the lounges to get a deeper understanding of their reaction to the REN variables. The comments were either relatively positive or neutral. Perhaps asking the participants to respond to all eight photographs of the lounges would yield more breadth in the comments, providing more variation to be analyzed. Furthermore, when asking question 7 in Section 3 (see Table 18) about feeling to connected to nature in the lounges, it might be beneficial to ask participants to order the eight photographs according to which they would feel the most to the least connected to nature to help identify which REN variables are the most preferred.

Also, there could have been more pointed intentional questions at the end of the questionnaire to find out which REN variables participants prefer. For example, a question could be, "If you had your choice, would you prefer to have a water feature or a fireplace?" Along the same lines, it would have been beneficial to ask participants specific questions about pattern, because botanical motifs were a more difficult REN variable to measure due to the limited number of comments from participants. For example, a question could be, "Which upholstery pattern do you prefer, and why?" Or, "Would this carpet pattern make you feel refreshed or exhausted?"

Information could have been collected about where participants grew up. It would be interesting to know how many participants were raised in the Midwest or elsewhere, because they may associate it with feelings of home and comfort, thereby increasing their well-being in lounges that replicate that design vernacular, or not. Career paths may also

be of interest because certain occupations create opportunities to be outside more than others; farming, for example.

However, a consideration to adding any or all of these additional questions is extending the interview time. Adding to the length may be a problem, as the interviews in this study were already an average of about 24 minutes.

Closing Remarks

Cramer & Browning (2008) declared, "Architecture is desperately in need of a conceptual, theoretical, and philosophical reunion with nature" (p. 335). Furthermore, Kellert (2008) emphasized, "We designed ourselves into this predicament and theoretically can design ourselves out of it, but only by adopting a radically different paradigm for development of the modern built environment that seeks reconciliation if not harmonization with nature" (p. 5). Biophilic design, namely the incorporation of REN variables in interior space, provides hope for a future where design supports the well-being of humans. This exploratory research lays a foundation for future researchers to explore the significance of incorporating REN variables into interior space. There is an opportunity for interior design to improve so as to more fully support the well-being of humans in the built environment. This study also aims to provide new knowledge that could inspire additional research and design approaches for senior living communities, thereby adding to the interior design body of knowledge.

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APPENDIX A. PARTICIPANT RECRUITMENT FLYER

You're Invited!

To be part of a research study
By a University of Minnesota
Graduate student in the College of Design

- Study aims to understand how the design of interior space can influence older adults' well-being
- No design knowledge is required

To participate in this study:

- You must be over the age of 65
- You must live in the Terrace apartments

Individual interviews:

- Meet at Johanna Shores in the Business Office (next to Chaplin's office by Fellowship Hall)
- 45 minutes maximum
- Complimentary beverage and snack offered!

Interested participants- please sign up on the schedule by the mailboxes!

Thank you in advance for your participation!

Sheena Kieffer
University of Minnesota
Master of Science Design Graduate Student
952-913-1899
Kieff099@umn.edu

APPENDIX B. CONSENT FORM

(read to participants prior to beginning interview)

The study aims to understand how the design of interior space can influence older adults' well-being. If you agree to be in this study, I will ask you to answer questions about photographs of interior space that I show you.

Interviews are conducted individually and will not last longer than 45 minutes.

This study is voluntary at all times and has no anticipated risks for participants (i.e., you).

The interviews will be audio recorded. All information will remain confidential. Only the researcher (i.e., me) will have access to the recording.

Please feel free to ask any questions you may have before agreeing to be in the study.

The researcher's contact information:
Sheena Kieffer
University of Minnesota
M.S. Interior Design Graduate Student
240 McNeal Hall, 1985 Buford Ave, St Paul, MN 55108
952-913-1899
Kieff099@umn.edu

You may also contact my faculty advisor:
Dr. Caren Martin, Associate Professor
(612) 624-5318
cmartin@umn.edu

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, you are encouraged to contact the Research Subjects' Advocate Line:
D528 Mayo
420 Delaware St. Southeast
Minneapolis, Minnesota 55455
(612) 625-1650

Signature: _____

Date: _____

APPENDIX C. QUESTIONNAIRE

Subject #: _____

Subject Name: _____

Gender: Male Female

Age: _____

Location of residence: _____

Length of time lived at current residence: _____

Date of interview: _____

Time Start: _____

****Start Recording****

Section 1- Photographs

Instructions:

I am going to show you four pairs of photographs of senior living spaces. The spaces in the photos are similar in many ways. I will ask your opinion about how you feel about the spaces in the photos. Please answer the questions as honestly as possible. There are no "right" or "wrong" answers. First, I will show you an example pair of photographs of flower gardens.

Photo pair Example

1. If you had to make a choice, which space would you prefer to spend time in:
   - Photo A- Iris
   - Photo B- Tulip
2. Why would you prefer to spend time in this space?

_____

_____

_____

_____

_____

*** Now we will continue to pairs of photographs of interior space.

Started with photo #: **_____**

Photo pair 1 ***[REN variable and control]***

1. If you had to make a choice, which space would you prefer to spend time in:
   Photo # _____
2. Why would you prefer to spend time in this space?

_____

_____

_____

_____

_____

_____

Photo pair 2 ***[REN variable and control]***

1. If you had to make a choice, which space would you prefer to spend time in:
   Photo # _____
2. Why would you prefer to spend time in this space?

_____

_____

_____

_____

_____

_____

Photo pair 3 ***[REN variable and control]***

1. If you had to make a choice, which space would you prefer to spend time in:
   Photo # _____
2. Why would you prefer to spend time in this space?

_____

_____

_____

_____

_____

_____

Photo pair 4 ***[REN variable and control]***

1. If you had to make a choice, which space would you prefer to spend time in:
   Photo # _____
2. Why would you prefer to spend time in this space?

_____

_____

_____

_____

_____

_____

Section 2

Instructions:

Layout all the photos of the spaces preferred by the participant. In this next section, you will be given the choice of two words. Choose the word that is closest to how you feel about the photos in front of you. There are no "right" or "wrong" answers. Do not be alarmed if I ask you a similar question more than once. Please let me know if you feel differently about a certain photo than the rest of the group of photos, or if you feel more strongly about a certain photo.

1. Would spending time in these spaces make you feel:

Very Somewhat Neutral Somewhat Very

Refreshed x x x x x **Exhausted**

_____

_____

_____

2. Would spending time in these spaces make you feel:

Very Somewhat Neutral Somewhat Very

Distracted x x x x x **Attentive**

_____

_____

_____

3. Would spending time in these spaces make you feel:

Very Somewhat Neutral Somewhat Very

Relaxed x x x x x **Harried**

_____

_____

_____

4. Would spending time in these spaces make you feel:

Very Somewhat Neutral Somewhat Very

Irritable x x x x x **Patient**

_____

_____

_____

5. Would spending time in these spaces make you feel:

	Very	*Somewhat*	*Neutral*	*Somewhat*	*Very*	
Comfortable	x	x	x	x	x	**Uneasy**

_____

_____

_____

Section 3

Instructions:

Again, there are no "right" or "wrong" answers. Do not be alarmed if I ask you a similar question more than once because the questions are similar in this section. Please answer the following questions on a scale of 1 to 5. The numbers indicate the following meaning:

1- Strongly disagree
2- Disagree
3- Neutral
4- Agree
5- Strongly Agree

1. I think of the natural world as a community to which I belong.
(Disagree) 1 2 3 4 5 (Agree)

_____

_____

_____

2. I often feel a kinship with animals and plants.
(Disagree) 1 2 3 4 5 (Agree)

_____

_____

_____

3. I feel as though I belong to the Earth as equally as it belongs to me.

(Disagree) 1 2 3 4 5 (Agree)

4. I often feel part of the circle of life.

(Disagree) 1 2 3 4 5 (Agree)

5. I often feel disconnected from nature.

(Disagree) 1 2 3 4 5 (Agree)

6. How much time do you spend outside on an average day when it is warm or mild outside? How about when it is cold outside? What kind of activities do you do (such as walking, gardening, watching animals)?

7. *Layout the spaces preferred by the participant.* Would you feel connected to nature in any of these spaces? If so, which ones? Why?

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8. Is there anything else you want to tell me? Is there something else I should be asking?

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Stop Recording*

Time End: _____