WALL COLOR OF PATIENT'S ROOM: EFFECTS ON RECOVERY

By

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This pilot study examined the effects of the environmental factor color on a patient's recovery in the hospital. The literature suggested that there are many widely held beliefs and intuitions about the healing powers of color. However, this researcher found no scientific studies on color completed within a natural hospital setting, rather than in a laboratory.

Based on previous research on environmental factors, the recovery of cardiac patients was examined by assessing their anxiety levels, lengths of stay, and medication requests, within a control setting and an experimental setting. The study was conducted within ten rooms of a hospital cardiac care unit. A mid-tone shade of either purple, green, or orange was painted on the wall at the foot of the bed in six of the patients' rooms. Beige was the paint color in the other four rooms. An anxiety test was given to the 39 participants in the study to determine if a particular color promoted a higher level of anxiety. The participants' lengths of stay and medication requests were also noted to

determine if these variables were affected by the particular color painted in each room. Informal interviews were also conducted on the patients and staff regarding their particular preferences for certain colors. Throughout the study, notes were kept regarding patient and staff comments about the colors.

There were no significant findings to determine that anxiety levels, lengths of stay, or medication requests were dependent upon the color of the patient's room. Having no significant findings is believed to be caused mainly by the small sample size. Additionally, the pilot study revealed numerous variables that may also play a role in patient recovery. Many things about conducting a study within a hospital environment were learned through this study and a framework for future research in the area of color in the medical environment was developed. The guidelines for future research provided in this study recommend further testing in a natural research setting such as a hospital to learn more about the role that color plays on patient well-being.

CHAPTER 1
INTRODUCTION

As early as 1888, Florence Nightingale asserted that environmental factors have an effect on health and recovery. She was quoted as saying (Palmer and Nash, 1997:148);

> The effect in sickness of beautiful objects, of variety of objects, and especially of colour is hardly at all appreciated. I have seen in fevers (and felt, when I was a fever patient myself) the most acute suffering produced from the patient not being able to see out of a window and the knots in the wood being the only view. I shall never forget the rapture of fever patients over a bunch of bright coloured flowers.
>
> People say the effect is only in the mind. It is no such thing. The effect is on the body, too. Little as we know about the way in which we are affected by form, by colour, and by light, we do know this; they have an actual physical effect. Variety of form and brilliancy of colour in the objects presented to patients are actual means of recovery.

Purpose

The purpose of this study is to explore how one environmental feature, namely color, may impact patient recovery in the cardiac care unit of Shands Hospital in Gainesville, Florida. Shands Hospital is located at the University of Florida and is a 576-bed private, not-for-profit hospital. Shands specializes in tertiary care for critically ill patients and is the primary teaching hospital for the University of Florida College of Medicine. Using the cardiac care unit of the hospital is significant to this study because medical researchers believe that coronary diseases are substantially influenced by environmental factors related to stress (MacMahon and Lip, 2002).

Designers have a responsibility for creating spaces that will help patients to become healthier in a shorter amount of time. Poor design is believed to be associated with anxiety, delirium, elevated blood pressure, and an increased intake of pain medication

(Ulrich, 1991). Although, research on human responses to specific colors has been conducted in laboratory settings, this researcher found no scientific research about whether or not a specific color can effect a patient's recovery process. A natural research setting, within the interior of a hospital unit, provides a unique challenge to learn about the relationship between people and the physical environment. It is believed that color will express the way we feel by either raising or lowering our spirits (Ladd-Franklin, 1973). Based on the beliefs of color researchers, this study tested whether or not color had a positive impact recovery and that orange, considered a universal healer, had a greater impact than green or purple.

This research aims to provide the interior design profession as well as the medical profession with a source of knowledge that will provide evidence about the physical environment's impact on patient well-being. It is hoped that this study will demonstrate that a designer's personal preference for a particular color should have little to do with the selection of colors in hospitals. Instead, colors should be chosen based upon their ability to aid in the patients' recovery process.

Significance

Environmental factors have a tremendous impact on the behaviors that occur within particular building settings. Beginning in the 1960's, designers began to believe that, "If a man can manipulate his surroundings to improve his physical well-being, they reasoned, he can manipulate it to foster desired behavior and to eliminate negative responses" (Chaney, 1973:61). This concept plays a large role in the design of hospital facilities. Under normal situations, when people feel uncomfortable with their physical environment, they can solve the problem by simply leaving or adapting the environment (Malkin, 1992). Unfortunately, this is not the case in healthcare facilities. Patients are

held captive in their environments and have no control over leaving or changing the environment, and this condition places an incredible responsibility on designers (Malkin, 1992).

Designers face a great challenge in designing a positive hospital interior environment. Patients enter a hospital setting already suffering from some ailment; therefore, it is extremely important that the design positively impacts the patients' psychological states, contributes to their recovery, or at least does not exacerbate their illness (Chaney, 1973). Roslyn Lindheim, a critic of the modern hospital facility says (Verderber, 1983:17);

> The adjectives used to describe hospitals include dehumanizing, depersonalizing, neutering, frightening, uncaring. I have neither heard anyone describe a hospital as beautiful, peaceful, healing, warm, joyous …indeed a look at the modern hospital speaks not of human healing but of our technological progress, not of caring but of an increase in the G.N.P. (Gross National Product), not of generating health but of saving jobs and institutions. Despite this, the belief in hospitals is strong today.

Modern hospitals face a great challenge to not only care for the ill, but also to run a successful business. By caring for patients, in a timely manner, hospitals are able to be profitable, efficient, and to improve the care of patients (UCLA, 1987). Today's patients are consumers. If the hospital does not create a welcoming, healing environment, the patients will go elsewhere. The Vidar Klinik is a hospital that was created with healing in mind (Moore, 2000). Wall colors were chosen in this hospital based upon Austrian theoretician, Rudolf Steiner's philosophies about the healing powers of color (Moore, 2000). The patient rooms were painted pink or blue. Pink is believed to be healthful for the spirit and blue is believed to relieve migraines (Moore, 2000). The majority of the patients in this hospital are cancer sufferers or are patients being treated for depression (Moore, 2000). With this in mind, patients in the Vidar Klinik are placed in rooms with

particular wall colors depending on their illness. There have been no studies completed to determine the effectiveness of this strategy.

Many designers remain skeptical about the effects of human responses to environmental factors and continue to select colors based on their own personal preferences, despite many researchers' attempts to document the effects of color on human behavior and physiological systems of the body within a laboratory setting. However, if one sees the hospital from a quadriplegic's point of view, then the effects of the environmental factors can be fully appreciated. A quadriplegic's view is limited to that in a fixed, horizontal position in bed day in and out. Therefore, his or her behavioral, physical, and psycho-emotional repertoire of coping mechanisms is much more restrictive than that of an average, healthy individual (Verderber, 1983). With this example, it is easy to comprehend how the natural light entering the room, the color of the walls, the art that hangs on the walls, and anything else that is within immediate view of the patient can effect not only a quadriplegic patient but others as well.

In 1997, The Center for Health Design compiled a list of environmental design features that were considered important to creating higher quality interiors in healthcare environments. This list of possible research areas included texture or finish of walls and furnishings, noise, windows, and color of walls and furnishings (Rubin et al., 1998). These researchers conducted an extensive review of the existing published articles that explored how particular environmental factors effected patients. They found no scientific published articles that addressed the issue of color (Rubin et al., 1998). The physiological effect of visible color in a natural setting has not been documented by

medical science (Birren, 1961), despite many widely held beliefs and declarations about the impact of color on people.

Although the literature review for this work did not reveal any research on how color effects a patient's recovery in a hospital setting, there are two significant studies that suggest that environmental factors can effect a patient's recovery in healthcare facility design. Verderber (1983) and Ulrich (1984) both conducted research on the effects of a window on a hospital patient's well-being. Verderber (1983) found that a patient's proximity to a window and the view context out the window had an effect on the patient's well-being. Ulrich's (1984) study showed that the patient's recovery was effected by whether he or she had a view of a natural scene or a view of a brick wall. These two studies are related to the current research on wall color in a patient's room because they show that patients' well-being and recovery can be effected by environmental factors.

Currently, there are no substantive guidelines for the selection of color in healthcare facilities (Malkin, 1992). In fact, Faber Birren believes that, "the medical profession has always been wary of any claims for color theory chiefly because all color experience is highly personal and difficult to test and verify" (Pierman, 1976:5). This study will test the impact of wall color at the foot of a patient's bed on recovery in order to provide the interior design profession with a source of knowledge that may help professionals design the most beneficial healthcare facilities for patients.

Basic Assumptions

The basic assumptions made in relation to this study were the following:

1. The participants of the study are suffering from a cardiovascular illness and therefore are temporarily residing in the cardiac care unit of a hospital.

2. Being cardiovascular patients, it is assumed that the typical stay in the hospital will be between three and four days.

3. Orange, green, purple, and beige painted walls at the foot of a patient's bed are assumed to cause differences in the anxiety levels, lengths of stay, and pain medication requests of the participants.

4. A hospital situation with cardiovascular patients can be used to determine the degree of differences in their anxiety levels, lengths of stay, and pain medication requests as influenced by the wall color at the foot of their bed.

5. The State-Trait Anxiety Inventory can be used to measure the participants' levels of anxiety.

6. The participants' medical records can be used to determine the lengths of stay and the pain medication requests.

Hypotheses of the Study

Three hypotheses are defined for this study.

1. There is a relationship between the color on the wall at the foot of the patient's hospital bed and anxiety levels in a hospital setting.

2. There is a relationship between the color on the wall at the foot of the patient's hospital bed and recovery time in a hospital setting.

3. There is a relationship between the color on the wall at the foot of the patient's hospital bed and the amount of pain medication requested in a hospital setting.

Summary

Investigating the psychological attributes of color can further the understanding of its effect on patient well-being. Research has shown that environmental factors have an effect on patient well-being, but evidence on how patients are effected by wall color in their hospital room is lacking. Chapter 2 investigates some ancient beliefs about color, gives a brief definition of color, and explores studies on human responses to color. The chapter also describes how heart disease is effected by environmental factors and how color therapy is believed to work. Chapter 3 explains the methods used to conduct this

research on how color effects a patient's recovery, and chapters four and five report the findings of this research and the researcher's conclusions about this study.

CHAPTER 2
REVIEW OF LITERATURE

It is believed that color can effect human emotions and can induce physiological responses. Kenneth Edwards (1979) has shown that if people are effected by color in their normal lives, then they are even more susceptible to the effects of color on their behavior when they are not feeling their best. Thus, an appropriate color scheme may aid in a patient's recovery (Carpman, 1993). The following review of literature attempts to explain the relationship between color and psychological well-being.

Color Explained

"Color is that part of perception that is carried to us from our surroundings by differences in the wavelengths of light, is perceived by the eye, and is interpreted by the brain" (Nassau, 1997:3). The human eye does not have the capacity to see color. Light reflects off surfaces and triggers an electrochemical response in the eye, which translates into color within the brain (Miller, 1997). Different colored surfaces are distinguished by a different pattern of nerve signals that are generated by color receptors found within the retina of the eye (Verity, 1980). There are two types of receptors found within the retina, called rods and cones. The cones are the ones responsible for the perception of color (Verity, 1980). Cones can detect visible wavelengths between 400 (violet) to 700 (red) nanometers (Miller, 1997).

Color can be measured with spectrophotometers and radiometric colorimeters. Spectrophotometers measure the reflection characteristics of an object in wavelengths (Nassau, 1997). Spectrophotometers illuminate the object with polychromatic light,

which contains all the wavelengths in the visible spectrum, and analyzes the light reflected off the surface of the object (Nassau, 1997). Radiometric colorimeters detect color in a similar way as spectrophotometers do, with the exception that they can only measure self-luminous objects, such as lamps, displays, and computer screens (Nassau, 1997).

Paints are comprised of pigments, which are chemical components that selectively reflect colored light to the observer (Verity, 1980). The primary pigment colors are magenta, cyan, and yellow, which can be mixed together to produce innumerable colors (Verity, 1980). Pigments absorb wavelengths, transmit wavelengths, and bend light in different directions (Nassau, 1997). The pigment is a finely ground organic or inorganic material that is combined with a liquid vehicle before it can be applied to a surface in a paint form (Verity, 1980). Organic materials are derived from vegetable or animal sources, native earths, and calcium natural earths (Verity, 1980). Today, inorganic, or synthetic pigments are more often used than organic materials (Verity, 1980).

In order to perceive color fully, hue, saturation, and brightness need to be described. Hue describes the actual color (Nassau, 2001). The hues that the human eye sees are determined by reflected wavelengths (Miller, 1997). Saturation describes how pure the color is, or how much white is mixed in (Nassau, 2001). A high-saturation hue is bright and vivid (Miller, 1997). Brightness describes how much light a surface receives. Brightness differentiates objects from their backgrounds and provides shade and shadow (Miller, 1997).

Historical Overview of Beliefs About the Healing Power of Color

"Color is an ubiquitous, primary, and nonverbal aspect of human environments, and investigating its psychological significance furthers the understanding of human

behavior on the most basic level" (Ireland et al. 1992:1). Throughout history, color has been assumed to have an effect on health. The Assyrians, Babylonians, and Egyptians all used forms of color and light therapies in healing (Demarco and Clarke, 2001). The Persians are believed to have practiced a form of color therapy based on the emanations of light (Birren, 1961). Pythagoras, a Greek philosopher around 500 BC, is believed to have used music, poetry, and color to cure disease (Birren, 1961). Celsus, who practiced medicine at the beginning of the Christian era, prescribed medicine with color in mind. He once wrote, "there is one plaster almost of a red color, which seems to bring wounds very rapidly to cicatrize" (Birren, 1961:21). The early beliefs behind the healing power of color were fairly simple. "Colors were associated with disease because disease produced color" (Birren, 1961:35). The Egyptians were the first civilization to research color healing. They created "color halls" within their great temples, such as Karnack and Thebes, in which they explored the impact of color on an individual's ability to heal (Anderson, 1975).

With the advancement of modern medicine, the interest in the healing power of color was left to the artists and poets. Johann Wolfgang von Goethe (1749-1832) was a famous German poet, who developed his own theory on color, which explained,

> Experience teaches us that the individual colours induce particular moods. In order to experience fully these important individual effects the eye should be entirely surrounded by one colour; we should be in a room of one colour, or look through a coloured glass. We are then identified with the colour; it induces both eye and mind in unison with it. (Boos-Hamburger, 1963:5)

Goethe had very particular beliefs as to what emotions particular colors would induce. He believed that orange gave people a warm feeling that is reminiscent of the setting of the sun (Boss-Hamburger, 1963). Goethe believed that green was very satisfying to the eye. "If both mother colours (yellow and blue) are absolutely balanced in the mixture so

that neither is more noticeable than the other, the eye and the mind rest on the mixture as though on something simple. Therefore, a green wallpaper is so often chosen for a room which is in constant use" (Boss-Hamburger, 1963:7). Further, Goethe believed that a very pale form of purple has a certain amount of life in it, but no joyousness (Boss-Hamburger, 1963).

Through the efforts of S. Pancoast in 1877, color therapy was reunited with medicine. He wrote, "to accelerate the Nervous System, in all cases of relaxation, the red ray must be used, and to relax the Nervous System, in all cases of excessively accelerated tension, the blue ray must be used" (Birren, 1961:53). Around this same time, Edwin D. Babbitt began to wonder how to incorporate color therapy with modern medicine. He wrote,

> Substances combine in a harmonizing union with those substances whose colors form a chemical affinity with their own and thus keep up that law of equilibrium which is the safety of all things. This law having been so abundantly explained, it is obvious beyond guesswork, that if the red arterial blood vessel should become overactive and inflammatory, blue light or some other blue substance must be the balancing and harmonizing principle. While again if the yellow and to some extent the red and orange principle nerves should become unduly excited, the violet and also the blue and indigo would be the soothing principles to have applied. This applies to the nerves of the cranium, stomach, bowels, and kidneys, as well as elsewhere, in which the heating and expansive action of these thermal principles may beget the condition of delirium, emesis, diarrhea, diuresis, etc., that can be assuaged only by the cooling and contracting influence of substances possessing the electrical colors. Can this law, which thus stands out clearly and simply like a mathematical demonstration be shown to have a basis in actual practice harmony with the experiences of the medical world for ages back? (Birren, 1961:57-8).

Although there is no scientific backing to the historical beliefs about the association between color and health, the historical beliefs found show the long standing fascination with the association. This association can be dated back to 500 BC, and yet there is still a lack of scientific evidence to prove the effects color has on health.

Intuition, Beliefs, and Research-Based Evidence About the Effects of Color

Today there are numerous widely held beliefs about the effects of color on humans, but very few theories that have a scientific backing. Two University of Washington researchers, B.K. Wise and J.A. Wise, reviewed previous research, and came up with a summary of what is empirically known about responses to color (Carpman, 1993). They also looked at the perception of a setting on one's behavior in that setting. After reviewing over 200 laboratory studies they found that, "A positive reaction to color is a mixture of social and emotional context and general fashion, as well as a specific response to the interaction among light source, background color, and object order." They also found that, "Perceived appropriateness of colors varies with the function and style of an interior; including its decoration and with education and sociocultural norms (taste). Characteristic appearance preferences for each style are unique to that style" (Carpman, 1993:174). When classic color preference studies were examined (Park and Guerin, 2002), it was found that various colors have different meanings to different cultures. These differences effect their preferences for certain colors that can ultimately effect their cognitive and motor abilities. Further, Park and Guerin (2002) discovered that there is a relationship between color and meaning, and that the most preferred hue temperature, value level, chroma level, and contrast level depends on the culture.

Certain colors tend to stimulate the body's functions in different ways. Marberry (1995) believes that the immune system detects elements of the environment, such as color, that elude other senses. Dr. Deepak Chopra believes that, "our immune cells are constantly eavesdropping on our internal conversations. Immune cells are thinking cells, 'conscience little beings' like brain cells, equivalent to a circulating nervous system" (Marberry and Zagon, 1995:86). This idea may contribute to the causation of illness.

According to Carol Vernolia (1988:63), “Red stimulates and invigorates the physical body. It increases circulation, muscular activity, blood pressure, respiration, nervous tension, heart rate, and hormonal and sexual activity. It stimulates the nervous system, liver, adrenals, and senses in general.” Yellow raises blood pressure, pulse and respiration. It can relieve depression, tension, and fear, and soothe mental and nervous exhaustion (Vernolia, 1988). Orange is an appetite stimulate, and is seen as a universal healer that can counteract depression and humorlessness (Vernolia, 1988). Green effects the whole nervous system and is especially beneficial to the central nervous system. It has a sedative effect, relieving irritation and exhaustion. It soothes emotional disorders and nervous headaches (Vernolia, 1988). “Green harmonizes us. If we wish to refresh ourselves we go to the countryside, where the green of nature restores us after the city has taken its toll of our nerves” (Anderson, 1975:8). Purple induces relaxation and sleep, lowers body temperature, and decreases sensitivity to pain. It also increases the activity of the veins (Vernolia, 1988).

Laboratory Studies on Human Responses to Color

Laboratory research studies have shown that color can have a direct effect on a person physically, as well as, mentally. Kurt Goldstein is a recognized authority on psycho neurology. He wrote, “It is probably not a false statement if we say that a specific color stimulation is accompanied by a specific response pattern in the entire organism” (Birren, 1961:144). His studies have documented the effects of specific colors on individuals having certain diseases. In one such case, a woman with a cerebellar disease had a tendency to fall unexpectedly and to walk with an unsteady gait. When she wore a red dress, her symptoms were more pronounced. Green and blue clothing restored her equilibrium to almost normal (Birren, 1961). Another study showed that when patients

suffering from tremors and twitching wore green glasses, their symptoms were relieved (Birren, 1961).

The Environmental Docility Hypothesis, developed by M. Powell Lawton, states that, "the less competent the individual, the greater the impact of environmental factors on the individual" (Malkin, 1992:47). A patient's emotions can be related to their environment, which can effect wellness. Cohen (1986) found that environmental stress, or a situation in which the demands on an individual tax or exceed his adaptive capabilities, could effect a person's physiological and psychological well-being. Research on the psychological effects of color has been difficult because human emotions are not stable and an individual's psychic make-up varies from person to person (Birren, 1961).

In 1976, a special workshop, "Color in the Health Care Environment," was held at the National Bureau of Standards in Gaithersburg, Maryland. This workshop brought together the architects, engineers, financial institutions, builders and users of the healthcare facilities. Marcella Graham (Pierman, 1976), an environmental design consultant, was a speaker at the workshop. Graham believes that the human response to color falls within six categories, which are shown in Table 2.1.

Table 2.1. Human Responses to Color (Pierman, 1976).

Physiological:	Changes in blood pressure, pulse rate, automatic nervous system, hormonal activity, rate of tissue oxidation and growth.
Within the eye:	Change in size of pupil, shape of lens, position of eyeball, chemical response of retinal nerve endings.
Cognitive:	Memory and recall illusion and perceptive confusion, values judgment, associative response
Mood:	Stimulating, irritating, cheerful, relaxing, boring, exciting, melancholy, gay
Impressionistic:	Space seems larger, smaller, warmer, cooler, clean or dirty, bright or drab; people appear healthy or unhealthy, food is appetizing or not, older, younger, old, new
Associative:	With nature, with technology, religious and cultural traditions, with art and science, typical or atypical

Some of the responses that Graham predicts color can produce may be detrimental to a patient's recovery within the hospital setting. Alterations in blood pressure due to an organismic or physiological response or changes in mood can lead to patient stress. Graham did not specify whether she believes that particular colors promote these specific responses, or if color in general promotes these responses. The Physiological Model of Stress states that the sympathetic-adrenal medullar system reacts to various emergency situations with increased adrenalin. The increased adrenalin, repeated over time, can result in a sequence of responses that can ultimately accumulate in illness, which might include increased blood pressure, increased heart rate, increased cardiac demand for oxygen, and provocation of ventricular arrhythmias (Cohen et al. 1986).

During the past 30 years, no studies have been focused on how color effects patients in a hospital setting. However, 84 studies have examined how other environmental factors have been shown to impact well-being (Rubin, 1998). The Center for Health Care Design stated that color is an important environmental feature in the design of hospitals that needs to be further explored. Although the human response to the application of color on walls within the interior hospital environment has not been

thoroughly explored, the application of colored lights has been explored. Studies have been able to show that colored lights can have impacts on concentration, alertness, aggression, stress, and even dyslexia (Demarco and Clarke, 2001). The use of applying colored lights to relieve illness in known as chromotherapy.

Chromotherapy Explained

Chromotherapy, or color healing, is the application of beams of colored light to the body to restore imbalance (Anderson, 1975). Color light rays activate the nerves, glands, and blood (Stevens, 1938). This healing technique examines the electro-magnetic field, which surrounds every human body. It is believed that the aura around the effected human body part will appear discolored, which tells the color healer where the chemical imbalance, which produces illness, is located (Anderson, 1975). Today, a process called Kirlian photography is able to photograph the subject and show the emanations of energy, or aura. A color health practitioner interprets the photograph to reveal the individual's physical, emotional, and psychological characteristics (Demarco and Clarke, 2001). Color raying energy reaches both the mental and physical conditions, where most diseases originate, which then directly treats the cause and not just the symptoms (Stevens, 1938). Proponents of chromotherapy believe that it is much safer than drugs because it leaves no harmful residuals that the body has to overwork to eliminate. Drugs can also be unreliable because people react differently to each drug (Anderson, 1975).

It is believed that chromotherapy was utilized as early as 1876, when Augustus Pleasanton used blue light to treat a variety of diseases that were associated with pain (Demarco and Clarke, 2001). During the 1920's, Dinshah Ghadiali, a Hindu scientist developed the Spectro-Chrome system of healing (Demarco and Clarke, 2001). This system explains how and why the different colored rays have various therapeutic effects

on organisms. Ghadiali believed that each organism and system of the body has a color that can stimulate it, and another color that inhibits it (Anderson, 1975). He said that the Spectro-Chrome system could be implemented by applying the correct color that will balance the action of the abnormally functioning organ or system (Anderson, 1975). It is believed that palpitation, or abnormal beating or throbbing of the heart, can be treated with projected blue light (Stevens, 1938).

Through this system of treatment the normalizing color ray should be projected on the nude body, or the part of the body with the ailment in twenty-minute intervals (Stevens, 1938). The normalizing color ray varies depending on the part of the body that is out of balance and thus creating illness. Also, different color rays are believed to promote different functions in the body. It is believed that the violet ray causes bone growth, the green ray increases vitality and energy, and the orange ray acts as a nourishing tonic (Stevens, 1938).

Cardiac Illness and Patient Responses to Environmental Factors

It is estimated that 5 percent of all hospital admissions can be attributed to heart failure (MacMahon and Lip, 2002). The National Center for Health Care Statistics reported that in 2000 heart disease was the number two leading cause of death for people between the ages of 45 and 64, which total 100,124 deaths in the United States. For the population over 65 years of age, heart disease was the leading cause of death with 605,673 deaths.

This current study was conducted using the cardiac care unit of a hospital because there is clear evidence of cardiac illnesses being effected by environmental factors. Sirois and Burg (2003) believe that specific negative emotional states, namely depression, anger, and anxiety, can have a negative influence on medical variables and

quality of life for patients with coronary heart disease. The effect that negative emotional state can have on patients with coronary heart disease needs to be examined. Evidence shows that the physical environment can effect emotional states. Introducing the colors of red and blue to an environment has been attributed to feelings of anxiousness or depression (Birren, 1961).

The impact that psychological factors can have on cardiac functioning has been extensively tested (MacMahon and Lip, 2002). When a patient begins to feel anxious their body is in a state of stress, which can negatively effect the cardiac output of a patient with cardiac heart failure (MacMahon and Lip, 2002). Psychological stress can cause a patient's heart rate to increase, which places an even greater physical stress on the body (MacMahon and Lip, 2002). A study conducted by Frasure-Smith in 1995 found that patients with higher anxiety levels were 4.9 times more likely to suffer from in-hospital cardiac complications or death after a myocardial infraction than those with normal stress levels (Sirois and Burg, 2003).

Depression can have an equally devastating effect on patients with coronary heart disease. Major depression is found in 16 percent to 23 percent of all coronary heart disease patients (Sirois and Burg, 2003). The general population has a depression rate of 5 percent (Sirois and Burg, 2003). Major depression can be attributed to patients not complying with their medical treatment after coronary heart failure (MacMahon and Lip, 2002). Noncompliance is believed to contribute to a high rate of readmission rates for these patients (MacMahon and Lip, 2002). Patients with depression who suffer from a myocardial infraction are found to have a 40 percent mortality rate within 12 months (Sirois and Burg, 2003). Based on these studies, it is extremely important to

acknowledge the effects that anxiety and depression can have on a patient with coronary heart disease. By addressing hospital environmental factors that may contribute to a coronary heart disease patient's anxiety and depression, we can aim to decrease the likelihood of mortality due to heart failure while recovering in the hospital setting.

Summary

As this review of literature shows, there are many widely held beliefs about the effect of color on the recovery process. The beliefs date back prior to the Christian era, and yet today there still are many people who remain skeptical about the healing effects of color. Color can be implemented into the healing process in various forms, including chromotherapy and applying it to the physical environment. The important concept to understand is the effect that color can have on a patient's psychological state while in a hospital environment. It has been shown that, a patient's psychological state plays a large role in the recovery process, particularly with coronary heart patients. By examining the impact of color in relation to recovery, researchers can provide evidence to support designers as they strive to create healing environments, which foster the recovery process.

CHAPTER 3
METHODOLOGY

Using an experimental research design within the natural setting of a hospital, this study explored the impact of wall color at the foot of the hospital bed on patient recovery in the cardiac care unit of a hospital. Data was collected from multiple sources to examine the effect of wall color on a patient's anxiety level, amount of pain medication requests, and length of stay. Anxiety level was used to measure a patient's recovery in this study because research shows that anxiety can have a negative influence on a patient's recovery (MacMahon and Lip, 2002). A pre-interview process with several doctors, who were currently practicing in the hospital, suggested that there is a belief among physicians that anxiety can effect a patient's recovery.

Amount of pain medication and length of stay were also used to measure a patient's recovery based on work by Verderber (1983) and Ulrich (1984). Verderber's (1983) study was a good base for the current research study because an environmental factor within a hospital setting was linked with patient recovery. Verderber's study used patient and staff interviews to determine the effect that a window can have on a patient. His findings suggested that the interview process was a good beginning for a study involving a hospital setting. Ulrich's (1984) study built upon Verderber's findings. His study examined patients' records looking for pain medication requests and lengths of stay and compared patients with a view of a brick wall with those with a natural scene. He found that the frequency of pain medication requests and lengths of stay were accurate measures in determining patient recovery. Verderber's (1983) and Ulrich's (1984)

studies helped this researcher identify measures to use for testing patients' recovery rates in a hospital setting. Pain medication requests and length of stay were the same measures used in Ulrich's (1984) study. Ulrich (1984) was able to show that when a patient had a view from a window there were fewer pain medication requests and the length of stay was shorter than when the patient had a view of a brick wall. The following is a definition of the hypotheses and a description of the study participants, the setting, and the tools used to collect the data.

Hypotheses

Based on previous research on physical environmental variables and beliefs about color, it is believed that a patient's recovery will be positively effected by the wall color within their particular hospital room. It is anticipated that this study will determine generally, whether wall color impacts recovery and specifically, which colors have the greatest impact on recovery. It is expected that the results will show that orange will have the most positive effect on the patient. Previous research suggests that orange is considered the universal healer and is often used in the hospital environment (Venolia, 1988).

Three hypotheses are defined for this study. They are:

- There is a relationship between the color on the wall at the foot of the patient's hospital bed and the patient's recovery time in a hospital setting.
- There is a relationship between the color on the wall at the foot of the patient's hospital bed and the amount of pain medication requested by the patient in a hospital setting.
- There is a relationship between the color on the wall at the foot of the patient's hospital bed and the patient's anxiety level in a hospital setting.

Research Setting

The hospital selected for this research was Shands at the University of Florida. Shands Health Care began in 1958 as the University of Florida Teaching Hospital. In 1979, Shands Teaching Hospital changed from a state institution to a private, not-for-profit corporation and was renamed Shands Hospital. Through the years, Shands has added a network of facilities. Shands Health Care now includes eight hospitals. Shands Hospital, located on the University of Florida campus, specializes in tertiary care for critically ill patients. Shands is also the primary teaching hospital for the University of Florida College of Medicine. In 2001, Shands treated 46,653 patients throughout their network of facilities. The facility at the University of Florida contains 576 patient beds and has over 500 physicians who represent 110 different specialities.

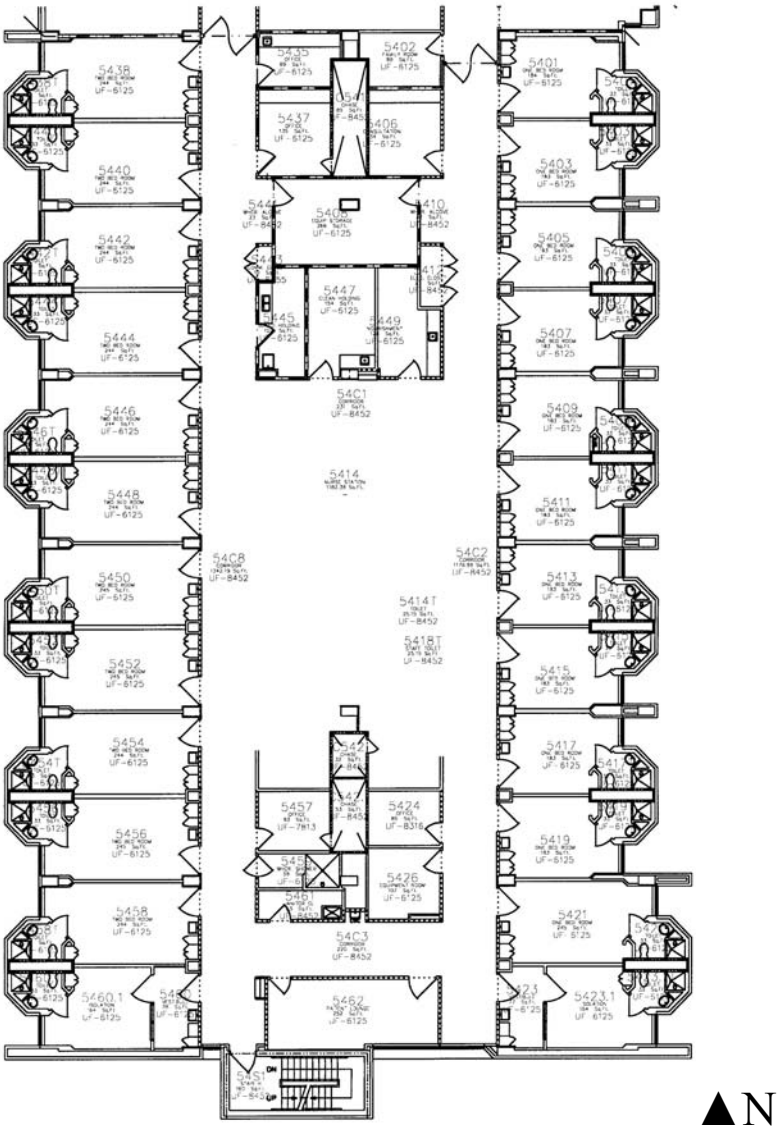

Figure 3.1. Layout of the fifth floor cardiac care unit at Shands Hospital.

The area of the hospital used for this study was the cardiac care unit located on the fifth floor of the hospital. This unit was chosen based upon the opinions of the Shands Hospital administration. The administration determined that the cardiac care unit was the only area of the hospital where there were ten rooms located in close proximity to each other that were used for patients with similar illnesses. It was also determined that the patients would have similar lengths of stay and medication requests in this unit. The unit

consists of a total of twenty-two rooms. The eleven rooms located on the west side of the unit are double occupancy rooms that are used for patients recovering from surgery and patients that are under cardiac observations. The eleven rooms located on the east side of the unit are single occupancy rooms that are used for patients waiting for heart transplants and patients recovery from transplant surgery. Staff and service rooms occupied the core of the unit. Figure 3.1 shows the arrangement of the rooms.

The rooms numbered 5438, 5440, 5442, 5444, 5446, 5448, 5450, 5452, 5454, and 5456 were used in this study. Shands donated ten rooms for the use of this study and so the first ten rooms in the hall were selected for use. They were all double occupancy rooms with an area of 244 square feet. They all contain the same size window that looks out over the west side of the building. The artwork on the walls that were painted for the study was removed from each room so that as many of the environmental factors that could influence the patient were eliminated. The walls that weren't painted were left in their current beige color. The curtains separating the two patients were a combination of orange, yellow, green, blue, and purple. The laminate countertops were green and the floors were orange and green. All the furniture in the rooms was neutral shades of white, gray, or beech wood. Figure 3.2 shows an enlarged version of the layout and dimensions of the typical room used for this study.

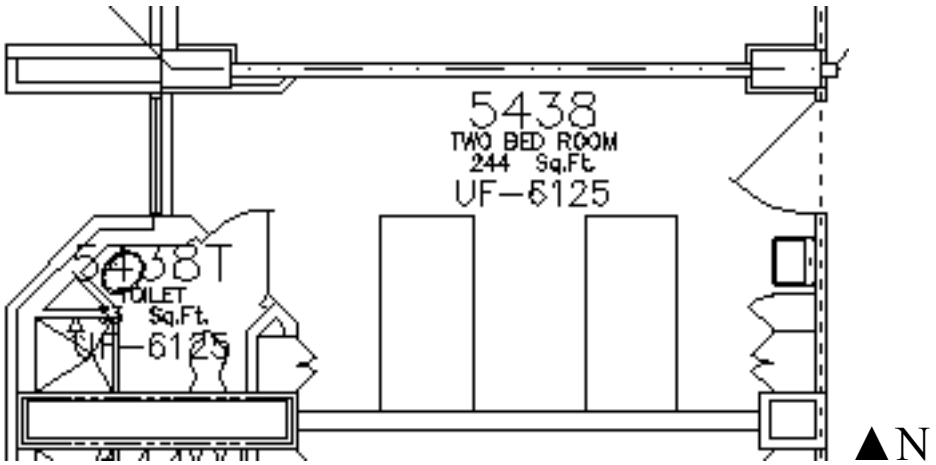

Figure 3.2. Enlarged layout of a typical room in the cardiac care unit at Shands Hospital.

Prior to the start of the study, the wall at the foot of the patients' beds were painted in rooms 5438, 5440, 5442, 5444, 5446, and 5448. The paint colors were chosen to coordinate with the colors already found within the room so that the patients would not suspect anything about being involved in a study. An attempt was also made to choose colors that were perceived to not be harmful, in any way, to the patients. The walls at the foot of the patients' beds were painted purple; Sherwin Williams color SW6556 (Figure 3.3), in rooms numbered 5438 and 5444. Purple was chosen for use in this study because it is believed to induce relaxation and sleep, lower body temperature, and decrease sensitivity to pain. The walls at the foot of the patients' beds were painted green; Sherwin Williams color SW6451 (Figure 3.4), in rooms 5440 and 5446. Green was chosen because it is perceived to have a sedative effect and relieve irritation and exhaustion. Orange, Sherwin Williams color SW6346 (Figure 3.5), was painted on the walls in rooms 5442 and 5448. Orange is believed to be a universal healer that can be used to counteract depression and humorlessness. The rooms numbered 5450, 5452, 5454, and 5456 were left unpainted in their natural beige color, similar to Sherwin

Williams color SW6658 (Figure 3.6). There was an attempt made to have one room of each color located close to the nurses' station and it just worked out that all the beige rooms were located next to each other.

Figure 3.3. Purple paint color.

Figure 3.4. Green paint color.

Figure 3.5. Orange paint color.

Figure 3.6. Beige paint color.

Participants

The participants were thirty-nine patients who occupied a bed in the cardiac care unit on the fifth floor of Shands Hospital in Gainesville, Florida between February 3, 2003 and March 2, 2003. Ten of the participants were recovering from cardiac surgery, while twenty-nine patients were undergoing cardiac observations. The patients ranged in

age from 26 to 89. There were a fairly equal number of male and female participants with 19 females and 20 males (Table 3.1). Although there was no specific demographic information collected, except for age and gender, it was the researcher's perception that the patients were from various religious, ethnic, and socioeconomic backgrounds. The patients were randomly placed in the hospital rooms by the hospital administration upon their admission to the hospital.

Table 3.1. Number of male and female patients who occupied each colored room.

	Beige	Purple	Green	Orange	**Total**
Female	7	3	3	6	**19**
	(17.9%)	(7.7%)	(7.7%)	(15.4%)	
Male	6	7	6	1	**20**
	(15.4%)	(17.9%)	(15.4%)	(2.6%)	
Total	**13**	**10**	**9**	**7**	**39**

Data Collection

A quantitative approach, consisting of three parts was used for this study. The three parts included administering an anxiety test, documenting the length of stay and medication requests, and informally interviewing patients and staff. This researcher determined that a sample size of 100 participants would likely provide enough information to determine if the patients' recovery process was being effected by the color painted on the wall at the foot of the bed. There was no research found to help determine the required sample size. The hospital administration estimated that conducting the study for four weeks would provide the appropriate sample size. Due to variables out of the researcher's control, the four-week study only produced 39 participants. During the length of the study there was an unusually low number of admissions. Also, eleven patients had to be eliminated from the study for various reasons.

All three instruments were conducted on the day that the patient was being released from the hospital. The final day of the patient's stay in the hospital was chosen for multiple reasons. First, the researcher wanted to be sure that each patient had spent enough time in the room to have an opportunity to be effected by the color. Second, the nursing staff determined that the doctors notified the nurses of who was to be released at a certain time everyday. It then took the nurses time to prepare the patients to be released. This was suggested to be the best time to conduct the research because all the patients were awake, preparing to go home, and all the medical information was available to the researcher. Lastly, conducting research on the final day proved to be of the least inconvenience to the nursing staff. The researcher was able to check the notes board to determine who was being sent home, and therefore who should be interviewed, without bothering any of the hospital staff.

Gaining Consent

The Medical Internal Review Board determined that the researcher could not be the first person to approach the patient to participate in the study. Therefore, the patients were first approached by the nurse manager for the unit and asked to participate in this study. If they agreed to participate the principal investigator then approached them to explain the study and obtain a signed informed consent form. Eleven patients who were approached could not be used in the study. Three patients explained that they would just prefer not to participate. Two of the patients were considered legally colorblind. It was the researcher's opinion that they would not be effected by the color on the walls and therefore should not be used in the study. One patient was extremely confused and could not understand the information being explained to him. He was eliminated from participating in the study. One patient felt uncomfortable with having the principal

investigator examine his medical records and was therefore eliminated. One patient was considered extremely depressed by the nurse manager and was not approached to participate in the study and two patients could not speak English and were therefore left out of the study. Lastly, one patient was extremely nervous and worried that the anxiety test would reveal that she should have to stay in the hospital for an extended amount of time. It was the researcher's opinion that she altered her answers on the test to make it appear as though she had no anxiety in her life. This left thirty-nine patients who could participate in the study.

Once each patient signed the informed consent form, the researcher explained the anxiety test and how it was going to be used. The patient was told that the test would take approximately ten to fifteen minutes and that it would entail answering forty multiple-choice questions about how they feel at the moment and about how they "generally" feel. Once the researcher felt the patient understood what was being asked of them, the patient was told that they would be left alone to take the test while the researcher examined their medical records to document the length of stay in that particular room and the pain medication they had requested.

State-Trait Anxiety Inventory

The anxiety test used in this study was the State-Trait Anxiety Inventory (Appendix), which was developed by Charles D. Spielberger. The test consists of two separate 20-item self-report scales, which were self-administered to measure state anxiety and trait anxiety. State anxiety consists of subjective feelings of tension, apprehension, worry, and activation of the autonomic nervous system (Speilberger et al. 1999). Trait anxiety is the differences in proneness to anxiety (Speilberger et al. 1999). The State-Trait Anxiety Inventory was chosen as the tool to measure anxiety because of its ability

to access both state and trait anxiety with reliable, relatively brief, self-report scales (Speilberger, 1985).

Today, the State-Trait Anxiety Inventory has become widely used in many different disciplines including: counseling and guidance, criminal justice, education, nursing, speech and hearing, sports psychology, sociology and anthropology, fine arts, political science and government, and teacher education (Speilberger, 1985). The particular area of interest for this study is its use in assessing whether color produces or alleviates anxiety, which can impact recovery (Speilberger, 1985).

During the study, the participants were generally left to complete the anxiety test on their own. The researcher administered the test orally to four of the participants. One patient could not read. The three other patients had left their reading glasses at home and therefore could not see the test.

Documenting Length of Stay and Medication Requests

While the patient was taking the anxiety test, with the nurses' permission, the researcher examined the daily nurses' notes to determine medication requests and length of stay. Located in the hallway outside the patients' rooms were carts that held a notebook, which contained the daily nurses' notes for each patient. The notebooks were divided according to the bed number. To find the length of stay that each patient was in the particular room of interest, the researcher looked at the first page of nurses' notes where the patient's name and the date they were admitted could be located. The researcher noted the date the patient was admitted and the date that they were being released to conclude how many days the patient had spent in that room.

To document the pain medication requested by the patient, the researcher turned to the section in the nurses' notes that listed pain medication administered by date and time.

The researcher noted how many dosages were administered to the patient each day that they were in the particular hospital room of interest. The lengths of stay and medication requests were then recorded on the researcher's data chart and the researcher returned to the patient's room to pick-up the anxiety test and to thank the patient for participating.

Discussions with Staff and Patients

Throughout the four-week study the patients and staff were very willing to offer their opinions and beliefs about the colors located in the rooms. The researcher documented the informal staff and patient conversations at the end of each day. These notes were then compiled at the end of the study to compare the findings in the study with the patients and staff's preferences for particular colors.

CHAPTER 4
FINDINGS

The purpose of this study was to explore the effect that wall color has on a patient's recovery while occupying a hospital room. A review of literature showed that there are many widely held beliefs about how color effects healing, but there are no scientific studies that have been conducted in a hospital setting. In an attempt to test some of the suppositions about color, the study hypothesized that wall color at the foot of the patient's bed can effect a patient's anxiety level, length of stay in the hospital, and the amount of medication requested by the patient while in the hospital. All data was collected by using the nurses' notes, regarding pain medication requests and lengths of stay, and administering an anxiety test on the last day of the patients' stay in one of the hospital rooms used for this study.

Anxiety Level

Anxiety levels were recorded using the State-Trait Anxiety Inventory developed by Charles D. Speilberger. There are two parts to this anxiety test. The first part analyzes a person's anxiety levels based on his or her feelings of tension, apprehension, nervousness, and worry (Speilberger, 1983). The second part of the anxiety test examines clinical anxiety and is largely used for screening for anxiety problems and evaluating the immediate and long-term outcome of psychotherapy, counseling, behavior modification, and drug-treatment programs (Speilberger, 1983). It was determined that the first part of the test, the State Anxiety Level, would be more beneficial in determining the effects of wall color on patient anxiety because it examines a person's feelings at the

moment of the test. This study was interested in how the patients' anxiety levels were effected while in the hospital, which was a relatively short amount of time. The second part of the State-Trait Anxiety Inventory examined long-term anxiety, which would not have been beneficial in understanding how the colors effected the patients.

The state anxiety was scored based on twenty questions. Each question was given a score of 1 to 4, with 4 indicating the highest level of anxiety. The scores for each of the twenty questions were then added together to give each participant an anxiety score between 20 and 80. The publisher of the test provided normative data about the state scores for general medicine and surgery patients. The data provided was collected in six veterans hospitals throughout the southeastern United States. The mean state anxiety score for the 161 patients tested was 42.4. The normative data provided suggested that there was no significant difference in anxiety scores based upon age. Within this current study, the mean anxiety scores were much lower. The average anxiety level for all participants of this study was 32.5. When the patients were separated based upon the color of the wall at the foot of their bed, the average anxiety level of the patients with a beige wall at the foot of their bed was 29.7. The patients with a purple wall at the foot of their bed had an average anxiety level of 33.2, the patients with a green wall had an average anxiety level of 35.3, and the average anxiety level of a patient occupying a room with an orange wall was 33.0 (Table 4.1).

Table 4.1. Average anxiety levels of patients occupying rooms of each color.

	Mean	N	Std Deviation
Beige	29.69	13	10.363
Purple	33.20	10	10.717
Green	35.33	9	10.173
Orange	33.00	7	5.066
Total	**32.49**	**39**	**9.578**

A chi-squared test was used to test the independence of color and anxiety levels. To perform this test, anxiety scores were placed into two categories, low anxiety and high anxiety. No information was found by this researcher that indicated what a normal anxiety range is for a population similar to the one in this study. Therefore, this researcher created two categories, low anxiety and high anxiety, in an effort to compare the effects of the various colors on anxiety levels. The mean anxiety level of all participants in this study was determined to be 32.49. The low anxiety represented all the anxiety levels that were below the average anxiety level for this study. The high anxiety represented all the anxiety levels that were above the average anxiety level for this study. The low anxiety was determined to be between 20 and 32 (or less than the mean anxiety score) and the high anxiety was determined to be between 33 and 80 (or more than the mean anxiety score). The results of the chi-squared test are reported in Table 4.2. This test was not significant ($p>.05$) possibly due to the low number of cases in each cell. Therefore, there is no evidence that the anxiety levels of the patients are dependent on the color of the wall at the foot of the bed.

Table 4.2. Chi-squared test for color and anxiety levels.

		Low Anxiety	High Anxiety	Total
Beige	Count	10	3	**13**
	Expected Count	7.7	5.3	**13.0**
	% within color	76.9%	23.1%	**100.0%**
	Adjusted Residual	1.6	-1.6	
Purple	Count	5	5	**10**
	Expected Count	5.9	4.1	**10.0**
	% within color	50.0%	50.0%	**100.0%**
	Adjusted Residual	-.7	.7	
Green	Count	5	4	**9**
	Expected Count	5.3	3.7	**9.0**
	% within color	55.6%	44.4%	**100%**
	Adjusted Residual	-.2	.2	
Orange	Count	3	4	**7**
	Expected Count	4.1	2.9	**7.0**
	% within color	42.9%	57.1%	**100.0%**
	Adjusted Residual	-1.0	1.0	
Total	**Count**	**23**	**16**	**39**
	Expected Count	**23.0**	**16.0**	**39.0**
	% within color	**59.0%**	**41.0%**	**100.0%**

Because of the small sample size, a Fischer's exact test was run which requires a 2x2 table. The anxiety levels of the patients were explored based on color (purple, green, and orange) and no color (beige). The average anxiety score for patients with no color on the wall at the foot of the bed was 29.7. The average anxiety score for the patients with color on the wall at the foot of the bed was 33.9. The results of Fischer's Exact Test, similar to chi-squared, are reported in Table 4.3. This test used measures of low anxiety (20 to 32) and high anxiety (33 to 80). This test was not significant ($p>.05$) and suggests that anxiety levels are not dependent on the color of the wall at the foot of the bed.

Table 4.3. Fischer's Exact Test on color and anxiety levels.

		Low Anxiety	High Anxiety	**Total**
No Color	Count	10	3	**13**
	Expected Count	7.7	5.3	**13.0**
	% within color	76.9%	23.1%	**100.0%**
	Adjusted Residual	1.6	-1.6	
Color	Count	13	13	**26**
	Expected Count	15.3	10.7	**26.0**
	% within color	50.0%	50.0%	**100.0%**
	Adjusted Residual	-1.6	1.6	
Total	**Count**	**23**	**16**	**39**
	Expected Count	**23.0**	**16.0**	**39.0**
	% within color	**59.0%**	**41.0%**	**100.0%**

Gender and Anxiety

Other factors that were believed to have a possible effect on anxiety levels were also tested. One factor is the impact of gender on anxiety levels. Nineteen of the participants of this study were female and twenty were male. Of the female patients, seven occupied a room with a beige wall at the foot of the bed; three occupied a room with a purple wall; three occupied a room with a green wall; and six occupied a room with an orange wall during their stay in the hospital (Table 4.4). Out of the twenty male patients, six occupied a room with a beige wall at the foot of the patient's bed. Seven of the male patients occupied a room with a purple wall; six of the patients had a room with a green wall; and one patient occupied a room with an orange wall during their stay in the hospital (Table 4.4).

Table 4.4. Number of male and female patients who occupied each colored room.

	Beige	Purple	Green	Orange	**Total**
Female	7	3	3	6	**19**
	(17.9%)	(7.7%)	(7.7%)	(15.4%)	
Male	6	7	6	1	**20**
	(15.4%)	(17.9%)	(15.4%)	(2.6%)	
Total	**13**	**10**	**9**	**7**	**39**

A t-test comparing the anxiety levels of the female and male patients showed no significant difference ($p>.05$) in their anxiety scores. As seen in Table 4.5, the female patients had a mean score of 33.0 and the male patients had a mean anxiety score of 32.0. It is unknown why the standard deviations are high. The standard deviations were also found to be high in similar studies conducted on general medicine and surgery patients (Speilberger, 1983). These scores indicate that there is little difference between the anxiety scores of the female and male patients. Thus, gender cannot be credited with effecting the patients' anxiety levels.

Table 4.5. Anxiety scores of the female and male patients.

	Mean	N	Std. Deviation
Female	33.00	19	10.661
Male	32.00	20	8.675
Total	**32.49**	**39**	**9.578**

Female patients. A t-test run on the female participants in this study showed no significant difference ($p>.05$) on anxiety scores based upon whether or not they occupied a room with a color (purple, green, or orange) on the wall. Within this study twelve patients occupied a room with a color painted on the wall at the foot of their bed (Table 4.4). The mean anxiety score of the female patients who occupied a room with color on the wall was 35.9 and the mean anxiety score for patients in a beige room was 28.0. A chi-squared test was not significant ($p>.05$) in determining whether anxiety scores were dependent upon the color of the wall for female patients.

Male patients. A t-test run on the twenty male participants in this study showed no significant difference on anxiety scores based upon whether or not they occupied a room with color (purple, green, and orange) painted on the wall. Within this study fourteen male patients occupied a room with a color painted on the wall at the foot of

their bed (Table 4.4). The mean anxiety score for the male patients who occupied a room with color on the wall was 32.1. The mean anxiety score of the patients in a beige room was 31.7. A chi-squared test was not significant ($p>.05$) in determining that anxiety scores were dependent upon the color of the wall for male patients.

Window View and Anxiety

Based on previous studies (Ulrich, 1984, and Verderber, 1983), distance from a window and view from a window are believed to have an effect on patient recovery. For this study, the views out of the windows are the same from all rooms. Because these rooms were double occupancy, some patients were closer to the windows than others. This factor was examined to test the effect it had on patient anxiety levels. The patients were divided into two groups based upon the location of their beds. Group A included the patients who occupied beds closest to the window. Group B included patients who occupied beds furthest from the window. Fifteen patients were included in Group A and twenty-four patients were included in Group B. The participants were randomly assigned to a bed by the hospital administration. Having more participants in Group B may have effected the outcome of the results.

Within Group A, five patients occupied rooms with a beige wall at the foot of the bed, three patients occupied rooms with a purple wall, six patients occupied rooms with a green wall, and one patient occupied a room with an orange wall (Table 4.6). Within Group B, eight patients occupied a room with a beige wall at the foot of the bed, seven patients occupied a room with a purple wall, three patients occupied a room with a green wall, and six patients occupied a room with an orange wall during their stay in the hospital (Table 4.6).

Table 4.6. Number of patients in each colored room based upon location of bed.

	Beige	Purple	Green	Orange	**Total**
Group A	5	3	6	1	**15**
	(12.8%)	(7.7%)	(15.4%)	(2.6%)	
Group B	8	7	3	6	**24**
	(20.5%)	(17.9%)	(7.7%)	(15.4%)	
Total	**13**	**10**	**9**	**7**	**39**

A t-test comparing anxiety levels of patients in Group A (closest to the window) and Group B (furthest from the window) found no significant difference ($p>.05$) in anxiety levels between the two groups based on proximity to a window. The mean anxiety score of the fifteen patients in Group A was 32.6 and the mean anxiety score of the twenty-four patients in Group B was 32.4 (Table 4.7).

Table 4.7. Mean anxiety scores for patients in relation to their proximity to a window.

	Mean	N	Std. Deviation
Group A	32.60	15	10.322
Group B	32.42	24	9.311
Total	**32.49**	**39**	**9.578**

Group A. A t-test on the fifteen patients that occupied a bed closest to the window found no significant ($p>.05$) difference between the anxiety scores based upon whether or not they occupied a room with a color (purple, green, or orange) painted on the wall. Within this study there were ten patients who occupied a room with color (Table 4.6). The mean anxiety score of the patients in a room with color was 34.8 and the mean anxiety score of the patients in a beige room was 28.2. A chi-squared test was not significant ($p>.05$) in determining that the anxiety scores were dependent upon the color painted at the foot of the patient's bed.

Group B. A t-test on the twenty-four patients who occupied a bed away from the window found no significant ($p>.05$) difference between the anxiety scores based upon whether or not the patients occupied a room with color (purple, green, or orange) on the

wall. The mean anxiety score of the patients occupying a room with color on the wall at the foot of the bed was 33.3. The mean anxiety score of the patients in the beige rooms was 30.6. A chi-squared test was significant ($p<.05$) in determining that anxiety scores were dependent on the color painted at the foot of the bed. Because of the small sample size, it is suggested that further tests should be run before any conclusions can be made.

Surgery and Anxiety

Ten of the patients included in the study were recovering from surgery, while twenty-nine of the patients were simply being observed in the hospital. The effects of a patient having surgery was examined in relation to a patient's anxiety levels. Of the ten surgery patients, three occupied rooms with a beige wall at the foot of the bed, four patients occupied a room with a purple wall, three patients occupied a room with a green wall, and there were no patients who occupied a room with an orange wall (Table 4.8). Out of the twenty-nine patients under observation, ten occupied rooms with a beige wall at the foot of the bed, six patients occupied rooms with a purple wall at the foot of the bed, six patients occupied a room with a green wall, and there were seven patients who occupied a room with an orange wall at the foot of the bed (Table 4.8).

Table 4.8. Number of surgery and observation patients in each set of colored rooms.

	Beige	Purple	Green	Orange	**Total**
Surgery	3	4	3	0	**10**
	(7.7%)	(10.3%)	(7.7%)	(0.0%)	
Observation	10	6	6	7	**29**
	(25.6%)	(15.4%)	(15.4%)	(17.9%)	
Totals	**13**	**10**	**9**	**7**	**39**

A t-test comparing the anxiety levels of the surgery patients and the patients under observation found a significant ($p<.05$) difference in their anxiety levels. The mean

anxiety level of the ten surgery patients was 38.2 and the mean anxiety level of the observation patients was 30.5 (Table 4.9).

Table 4.9. Mean anxiety levels of surgery patients and observation patients.

	Mean	N	Std. Deviation
Surgery	38.20	10	11.650
Observation	30.52	29	8.074
Total	**32.49**	**39**	**9.578**

Based on the significant difference in anxiety levels between the surgery patients and the observation patients, the two groups were separated to examine the effects of color on anxiety levels within the two groups.

Surgery patients and anxiety. Within the ten surgery patients, the mean anxiety score was 38.2. Three occupied a room that had a beige wall at the foot of the bed. These three patients had a mean anxiety score of 38.0. Four of the surgery patients occupied a room with a purple wall at the foot of the bed and had a mean anxiety score of 41.0. Three surgery patients occupied a room with a green wall at the foot of the bed and had a mean anxiety score of 34.7 (Table 4.10).

Table 4.10. Mean anxiety of the surgery patients based upon the color of the room they occupied.

	Mean	N	Std. Deviation
Beige	38.00	3	16.093
Purple	41.00	4	11.633
Green	34.67	3	10.693
Total	**38.20**	**10**	**11.650**

A chi-squared test measured whether the anxiety scores were dependent on the color of the wall at the foot of the patient bed (Table 4.11). The color on the wall at the foot of the bed made no significant ($p>.05$) difference in the anxiety levels of recovering surgery patients.

Table 4.11. Chi-squared test on color and anxiety levels within surgery patients.

		Low Anxiety	High Anxiety	Total
Beige	Count	1	2	**3**
	Expected Count	.9	2.1	**3.0**
	% within color	33.3%	28.6%	**30.0%**
Purple	Count	0	4	**4**
	Expected Count	1.2	2.8	**4.0**
	% within color	.0%	57.1%	**40.0%**
Green	Count	2	1	**3**
	Expected Count	.9	2.1	**3.0**
	% within color	66.7%	14.3%	**30.0%**
Total	**Count**	**3**	**7**	**10**
	Expected Count	**3.0**	**7.0**	**10.0**
	% within color	**100.0%**	**100.0%**	**100.0%**

Observation patients and anxiety. Within the twenty-nine observation patients, 10 occupied a room with a beige wall at the foot of the bed, 6 with a purple wall, 6 with a green wall, and 7 had a room with an orange wall at the foot of the bed. The mean anxiety score of the observation patients was 30.5. The patients who occupied a room with a beige wall at the foot of the bed had a mean anxiety level of 27.2. The patients with a purple wall had a mean anxiety of 28.0. The patients who occupied a room with a green wall had a mean anxiety level of 35.7 and the patients with an orange wall had a mean anxiety level of 33.0 (Table 4.12).

Table 4.12. Mean anxiety of the observation patients based upon the color of the room they occupied.

	Mean	N	Std. Deviation
Beige	27.20	10	7.465
Purple	28.00	6	6.663
Green	35.67	6	10.930
Orange	33.00	7	5.066
Total	**30.52**	**29**	**8.074**

A chi-squared test compared the anxiety levels across observation patients in the different colored rooms (Table 4.13). No significant ($p>.05$) difference was found on patients' anxiety levels and therefore color could not be proven to effect anxiety levels.

Table 4.13. Chi-squared test on color and anxiety levels within observation patients.

		Low Anxiety	High Anxiety	Total
Beige	Count	9	1	**10**
	Expected Count	6.9	3.1	**10.0**
	% within color	45.0%	11.1%	**34.5%**
Purple	Count	5	1	**6**
	Expected Count	4.1	1.9	**6.0**
	% within color	25.0%	11.1%	**20.7%**
Green	Count	3	3	**6**
	Expected Count	4.1	1.9	**6.0**
	% within color	15.0%	33.3%	**20.7**
Orange	Count	3	4	**7**
	Expected Count	4.8	2.2	**7.0**
	% within color	15.0%	44.4%	**24.1%**
Total	**Count**	**20**	**9**	**29**
	Expected Count	**20.0**	**9.0**	**29.0**
	% within color	**100.0%**	**100.0%**	**100.0%**

Length of Stay

The study sample of 39 patients was broken into two groups in order to compare patients who were in the hospital for similar reasons and to provide a more accurate account of how the length of stay was effected by the color of the wall located at the foot of the patient's bed. The first group consisted of 10 patients recovering from surgery. Their length of stay ranged from 2 to 6 days. Three patients recovered in a room with a beige wall at the foot of the bed; four patients recovered in a room with a purple wall; three patients recovered in a room with a green wall; and there were no surgery patients who recovered in a room with an orange wall (Table 4.8). The second group comprised 29 patients under observation. The patients who were occupying the observed hospital rooms while under physician observation had lengths of stay ranging from 2 to 6 days.

Ten of these patients occupied rooms with a beige wall at the foot of the bed; six occupied rooms with a purple wall; six occupied rooms with a green wall; and seven occupied rooms with an orange wall (Table 4.8).

As shown in Table 4.14, the average length of stay for a patient recovering from surgery in a room with a beige wall at the foot of the bed was 5.3 days. The average length of stay for patients with a purple wall was 4.3 days and for patients with a green wall the average length of stay was 4.0 days (Table 4.14). Chi-squared tests revealed that there was no significant ($p>.05$) difference between the patients' length of stay based on the color of the wall at the foot of the bed.

Table 4.14. Average length of stay for surgery and observation patients recovering in each set of colored rooms.

	Beige	Purple	Green	Orange	**Total**
Surgery	5.3	4.3	4.0	-	**4.5**
Observation	3.8	3.0	2.7	3.0	**3.2**
Totals	**4.2**	**3.5**	**3.1**	**3.0**	**3.5**

Patients under observation who occupied a room with a beige wall at the foot of the bed had an average length of stay of 3.8 days. The average stay for a patient occupying a room with a purple wall was 3.0 days. A patient occupying a room with a green wall had an average length of stay of 2.7 days, and a patient in a room with an orange wall had an average length of stay of 3.0 days (Table 4.14). There was no significant ($p>.05$) difference between the average lengths of stay based on the wall color at the foot of the patient's bed. A small sample size may have yielded results that are not statistically significant throughout the study.

Pain Medication Requests

Nurses' notes were reviewed to determine the number of pain medication requests for each day of the patient's hospital stay. For example, if a patient requested three doses

of pain medication on the first day of their hospital stay, a three would be recorded under day one for that particular patient. The sample was again divided into two groups for the purpose of analysis. The first group contained the ten surgery patients and the second group contained the twenty-nine patients under physician observation. Out of the twenty-nine total patients under observation, thirteen of them had no medication requests during their stay. Therefore, only the sixteen observation patients who requested pain medication during their stay were included in the examination of pain medication requests on observation patients. Seven of the sixteen observation patients who requested pain medication occupied a room with the wall at the foot of the bed painted beige. Three of the patients occupied a room with a purple wall, three of the patients occupied a room with a green wall, and three of the patients occupied a room with an orange wall (Table 4.15). Out of the ten surgery patients, three of the surgery patients recovered in a room with a beige wall at the foot of the hospital bed, four recovered in a room with a purple wall, three recovered in room with a green wall, and there were no surgery patients who recovered in a room with an orange wall (Table 4.15).

Table 4.15. Number of patients who requested medication during their stay in each colored room.

	Beige	Purple	Green	Orange	**Total**
Surgery	3	4	3	0	**10**
	(7.7%)	(10.3%)	(7.7%)	(0.0%)	
Observation	7	3	3	3	**16**
	(43.8%)	(18.8%)	(18.8%)	(18.8%)	
Total	**10**	**7**	**6**	**3**	**26**

Pain medication requests were examined separately for the first and last days of a patient's stay in a hospital. It was anticipated that a patient would experience the highest level of pain on the first day and the least amount of pain on the last day making it difficult to compare medication requests for all other days in between. The "middle

days," after the first day and before the last day, were all compared together. The patients' length of stay varied and these could be any where from the second day in the hospital to the fifth day.

Surgery patients' medication requests. The surgery patients' medication requests varied from 2 to 6 doses on the first day of their stay in the hospital. Surgery patients recovering in a room with a beige wall at the foot of the bed had an average of 5.3 doses of medication requested on their first day of their hospital stay. The patients recovering in a room with a purple wall at the foot of the bed had an average of 4.3 doses requested and the patients occupying a room with a green wall had an average of 4.0 doses of medication requested on the first day of their stay in the hospital (Table 4.16). There were no surgery patients that recovered in an orange room. The average number of pain medication requests on the first day of the patients' hospital stay was not statistically significant ($p>.05$).

Table 4.16. Average number of medication requests by surgery patients during their stay in the hospital.

	Beige	Purple	Green	Orange	**Total**
First Day	5.3	4.3	4.0	-	**4.2**
Middle Days	3.5	3.2	3.5	-	**3.4**
Last Day	0.0	0.8	0.3	-	**0.4**
Totals	**3.1**	**3.2**	**2.3**	**-**	**2.9**

During the "middle days" of the surgery patients stay, the patients' medication requests ranged from 0 to 10 doses per day. The three surgery patients who occupied a beige room during their stay requested an average of 3.5 doses of pain medication during the middle days of their stay. The four surgery patients who occupied a room with a purple wall average 3.2 doses of medication requested and the patients who occupied a room with a green wall requested 3.5 doses of pain medication (Table 4.16). There were

no surgery patients that occupied an orange room during their stay in the hospital. The average number of the pain medication requests during the "middle days" of the patients' stay was not statistically significant ($p>.05$).

The doses of pain medication requested on the final day of the hospital stay ranged from zero to two doses. The three patients who occupied the rooms with a beige wall at the foot of the bed had 0.0 requests for pain medication on the final day of their stay in the hospital. The four patients who occupied a room with a purple wall had an average of 0.8 pain medication requests and the three patients who occupied a room with a green wall had an average of 0.3 pain medication requests on the last day of their stay in the hospital (Table 4.16). There were no surgery patients that occupied an orange room during their stay in the hospital. The average number of the pain medication requests during the final day of the patients' stay was not statistically significant ($p>.05$).

Observation patients' medication requests. The observation patients who requested pain medication during their stay had a range of zero to four doses requested on the first day of their stay in the hospital. The patients who occupied a room with a beige wall at the foot of their bed had a mean of 0.7 doses of medication requested and the patients with a purple wall had an average of 1.0 medication requests. The observation patients who occupied a room with a green wall had an average of 2.0 pain medication requests and the patients who occupied a room with an orange wall had an average of 0.3 medication requests on the first day of their stay in the hospital (Table 4.17).

Table 4.17. Average number of medication requests by observation patients who request pain medication during their stay in the hospital.

	Beige	Purple	Green	Orange	**Total**
First Day	0.7	1.0	2.0	0.3	**0.9**
Middle Days	1.3	1.4	0.5	0.7	**1.4**
Last Day	0.4	0.0	0.3	0.3	**0.3**
Totals	**1.1**	**1.0**	**1.0**	**0.5**	**1.0**

During the "middle days" the observation patients requested between zero and five doses of pain medication per day. The seven patients who occupied a room with a beige wall at the foot of the bed had an average of 1.3 pain medication requests per day. The three patients who occupied a room with a purple wall had an average of 1.4 pain medication requests per day. The three patients who occupied a room with a green wall had an average of 0.5 medication requests per day and the patients who occupied a room with an orange wall had an average of 0.7 medication requests per day (Table 4.17).

Lastly, the pain medication requests were examined for the observation patients on the final day of their hospital stay. The sixteen observation patients who requested pain medication during their stay requested between zero and one dose of medication on the last day. The patients occupying a room with a beige wall at the foot of the bed had an average of 0.4 medication requests on their final day. The patients who occupied a room with a purple wall had no medication requests. The patients who occupied a room with a green wall had an average of 0.3 medication requests and the patients who occupied a room with an orange wall had an average of 0.3 medication requests on their final day (Table 4.17).

Patients' Opinions About the Colors

Patients willingly gave their opinions about the various colors located in their rooms during their stay. All but 5 of the patients who occupied rooms with a wall painted

purple, green, or orange claimed that they had noticed the color upon entering the room. The patients in the rooms with all walls painted beige were disappointed that they did not get placed in a room with a color on the wall. One patient, located furthest from the window in a beige room, claimed that there was no way that color could have any effect on her. In her following statement she said that she had enjoyed her stay in the hospital more on her previous time in the hospital because she had occupied a bed close to the window and she felt this uplifted her mood.

Several of the patients also talked about their preferences for a particular color in their room. Patients had mixed feelings about the all beige rooms. Some patients, particularly the males, tended to like the beige rooms and claimed that if they had had their own way their own homes would all be painted beige. Some of the female patients claimed that the beige walls made the space feel very institutional and that color would make them feel more comfortable.

Opinions about the rooms with a purple wall at the foot of the bed varied. Many of the male patients did not care for the color. They claimed that it made the room feel too dark. Some women really enjoyed the purple color. They said that it was very soft and made them feel comfortable. Overall, the opinions regarding the purple color varied with approximately an equal number of patients liking and disliking the color.

The green color also produced various opinions. Some of the male patients claimed that they liked the color. They claimed that it probably wouldn't be a color that they would put in their homes, but that they didn't mind it in the hospital rooms. The majority of the women did not care for the green color. They stated that it reminded them

of a "hospital green." Upon investigation about what they believed a "hospital green" was, it was discovered that it referred to the color associated with a typical pair of scrubs.

The patients' opinions were very similar in regards to the orange color. The patients all claimed that they had noticed the color upon entering the room. Many said it was a nice surprise to see color on the wall. The patients felt that this color of orange brightened up the room and gave a welcome relief to the beige throughout the majority of the hospital.

Overall, more female patients than male patients enjoyed the purple color. The one main complaint was that it made the room feel dark. Regarding the green color, more male patients seemed to like, or at least not mind the color, than female patients. The female patients said the green color made the room feel too much like a hospital. Lastly, both the male and female patients enjoyed the orange color. Overall, the patients in the beige rooms appeared disappointed that their rooms did not contain colors on the wall.

Hospital Employee's Opinions About the Colors

The hospital employees, including the nurses, patient care assistants, and general staff, had many opinions about the colors. Overall, the employees said that they were ready for color in this particular area of the hospital, even asking if the colors could be kept after the study ended. All the walls in the cardiac care unit of the hospital, except for the ones painted for this study remained beige. The nurses' station had recently been remodeled and the nurses claimed they were disappointed that the only color incorporated was a neutral gray.

One of the nurses claimed that the colored rooms helped them to identify the rooms and different patients. The nurses were typically responsible for multiple adjoining

rooms. The rooms next to each other were painted different colors for this study, which made the nurses responsible for three rooms of three different colors.

At the beginning of the study, many of the hospital employees really enjoyed the purple color. One employee, in fact, painted her bedroom in her home a similar color after seeing it at the hospital. Toward the end of the study, after the employees had spent some time in the rooms with a wall at the foot of the bed painted purple, many felt that the rooms felt too dark compared to the other rooms.

Most of the interviewed hospital employees stated that the green color seemed to be the most appropriate color for a hospital. When asked why green was associated with hospitals, no one knew. The nurses believed that the green seemed to match the laminate and the curtains in the rooms the best. As an interesting side note, none of the patients mentioned whether the colors coordinated with the rest of the objects in the room.

Every female hospital employee that was interviewed claimed that they enjoyed the orange color. Four or five of the nurses stated that the orange matched the orange tiles on the floor well. They felt the color was overall bright and uplifting. A couple of the male employees claimed that the shade of orange was not attractive.

The interesting note regarding the opinions of the patients and the hospital employees is that they are very similar. This is surprising because the nurses' opinions were based on having the ability to experience all three colors, as well as, the beige control rooms. They also spent more time in all of the rooms than the patients did. The patients had a more limited experience with the colors because they only occupied a single color for between 2 and 6 days.

CHAPTER 5
DISCUSSION

Psychological and physiological responses to color have interested scholars and medical caretakers for centuries. As early as 500 BC, the Greeks, Persians, Assyrians, Babylonians, and Egyptians believed color cured diseases. With the development of modern medicine, the focus on the healing power of color was set aside, or left for the artists and poets such as Johann Wolfgang von Goethe (1749-1832) to ponder. Goethe's philosophy was that colors produced moods, which then formed the mind-body connection and effected healing.

When color healing was reunited with modern medicine, it was in a new form known as chromotherapy. Chromotherapy is the application of colored beams of light to particular body parts to activate nerves and promote healing. Modern architects, designers, doctors, and hospital administrators have also started examining the effects that the built environment can have on recovery and healing. Within the built environment, color can have an impact on patients' emotions, which can ultimately effect wellness.

This study was undertaken to examine the specific effects that color can have on a patient's recovery within a hospital setting. Recovery was examined through recovery rate (length of stay), perception of pain (pain medication requests), and emotional responses (anxiety levels). Participants of this study included thirty-nine patients suffering from a cardiac illness. The patients ranged in age from 26 to 89. Nineteen of

the patients were female and twenty patients were male. All participants were randomly placed in one of the hospital rooms included in the study.

Ten rooms located on the fifth floor of Shands hospital in Gainesville, Florida were used in this study. The rooms were part of the Cardiac Care Unit of the hospital and were all double occupancy rooms. The participants were either placed in one of the four control rooms (all beige walls) or one of the six experimental rooms (with one wall in the room painted purple, green, or orange). On the participants' final day of their stay in the hospital, their length of stay, pain medication requests, and anxiety levels were examined.

The participants' anxiety levels were compared between the ten surgery patients and the twenty-nine patients under observation by using a t-test to examine the mean scores based upon the color of the wall in the patient's room. A chi-squared test was performed to examine if anxiety levels were dependent upon the color of the wall at the foot of the patients' beds. Length of stay was also examined using a t-test to compare the means and a chi-squared test was used to examine whether the patients' length of stay was dependent upon the color of the wall at the foot of the bed they occupied. Lastly, the patients' pain medication requests were examined between the two groups of surgery and observation patients. A t-test examined the means of pain medication request on the first day, the middle days, and the final day of the patients' stay in the hospital. Chi-squared tests were also run to determine whether pain medication requests could be determined to be dependent based upon the color of the wall at the foot of the bed. All findings were inconclusive due to the small sample size.

Anxiety levels were analyzed with respect to the color of the wall at the foot of the bed, the participants' gender, the participants' proximity to the window within the room,

and whether or not the patient had had surgery. In this study, the anxiety levels were not dependent upon the color painted on the wall at the foot of the patients' beds. Although the evidence was not significant, it appeared that beige was moving in the direction of produced the lowest anxiety levels followed by orange. Green yielded the highest anxiety levels.

The anxiety levels did not appear to vary based upon the participants' gender or their proximity to a window. A t-test showed that having surgery was statistically significant ($p<.05$) in determining the anxiety levels of the patients. Patients having surgery had a higher level of anxiety than the observation patients.

There was not significant evidence ($p>.05$) that anxiety levels were dependent on the color of the wall at the foot of the bed for patients undergoing surgery. Within this study, the surgery patients who occupied a room with a green wall at the foot of the bed had the lowest average anxiety rates, followed by the patients in the beige rooms. The patients who occupied rooms with a purple wall at the foot of the bed had the highest average anxiety rates of all the surgery patients. There were no surgery patients who occupied any of the rooms with an orange wall at the foot of the bed.

Similarly, there was not significant evidence that anxiety levels were dependent on color for patients under observation. Although there was no significant evidence, the observation patients in the beige rooms had the lowest average anxiety rates. This was followed by the average anxiety rate of the patients with a purple wall at the foot of the bed and the patients with an orange wall at the foot of the bed. This highest anxiety levels were associated with the patients with a green wall painted at the foot of the bed.

When all thirty-nine participants' anxiety levels were analyzed, it appeared as though the beige control rooms produced the lowest anxiety levels. The average anxiety levels of the surgery patients suggested that the rooms with a green wall at the foot of the patients' bed produced the lowest anxiety levels. The average anxiety levels of the twenty-nine observation patients suggested that the beige rooms produced the lowest anxiety levels. Further tests are needed to draw conclusions about colors that produce the lowest levels of anxiety.

This study showed that color on the wall at the foot of the patient bed could not be shown to be statistically significant ($p>.05$) in predicting a patient's recovery based upon the patient's length of stay. The surgical patients who recovered in a green room had a slightly lower length of stay than the patients in the purple and beige rooms. The observation patients in this study had the shortest length of stay in the green rooms, followed by the patients in the orange rooms and the patients in the purple rooms. The observation patients who occupied the beige rooms had the longest length of stay. Overall, this study suggested that green might be the best color to promote a shorter length of stay. Once again, definitive conclusions cannot be made based on the small sample size.

This study did not find that pain medication requests were dependent on the color of the wall at the foot of the bed. Colors that might reduce the patients' perception of pain or amount of pain medication requested were not identified.

Some knowledge was gained through the informal interviews with the hospital staff and the patients. It was concluded that based on preference, orange would be the best color to paint the rooms within this unit of the hospital. The purple rooms were the least

liked by both the patients and the staff. Green was viewed as a color typically associated with a hospital setting. Overall, opinions suggested that color should be incorporated into patient rooms within the hospital setting.

Results found in this study further this researcher's belief that colors should be chosen for an environment based on the type of patient who will occupy the space and not based on the designers' preferences. By investigating the color preferences of the people who will ultimately occupy the space and the implications that those colors may have on the individuals, designers can create a space that focuses on healing.

Limitations and Assumptions

Many factors may have impacted the statistical results. First the sample size was very small. Because this was a pilot study, it was impossible to determine the number of patients that would qualify to participate in the study. Further, it was not anticipated that the patients would have to be divided into two groups, those who had and did not have surgery. This reduced the sample size of the patients who had had surgery to only ten participants with no participants occupying an orange room. The sample size of the observation patients was limited to twenty-nine participants.

Second, although an attempt was made to include only participants with a similar type of illness, this researcher believes that the various degrees of illness found within the sample had a detrimental effect on the study. The length of stay in the hospital and amount of pain medication requests will vary by the illness or surgery that each participant experiences.

Third, bedside manner may have played a role in the participants' recovery. It is unclear how much effect doctors' and nurses' reactions and responses to the patients can have on the patients' psychological state and ability to recover. Each participant had

numerous nurses during their stay and this could have effected different patients in various ways. There were also several doctors who had patients participating in this study. Each doctor may have a different opinion about how much information to give their patients, which could impact the participants' anxiety level. It is also possible that each doctor varied on his or her beliefs about what criteria should be used to determine when to discharge a patient. Ultimately, it was the doctors' decision to release the patients and this would effect the patients' length of stay.

Fourth, it is unclear what effect color can have on the amount of pain medication a patient requested. It is possible that the amount may be impacted by the individual's tolerance to pain. The participants' requests for pain medication may also vary based upon their cultural and religious beliefs. Therefore, the physical environment may have little, if anything, to do with perception of pain. There was a limited amount of demographic information collected on the patients. The demographic information collected about the patients was limited to gender and age. There was no information collected regarding each patient's religious preference, cultural background, or social status.

Fifth, no attempt was made to determine the participants' color preferences ahead of time. Color preference may be influenced by psychological types, age, gender, social status, and culture (Park, 2002). It is not known what effect color preference can have on anxiety levels. This researcher believes that if a patient was placed in a room with a color on the wall that he or she dislikes, the anxiety levels could be altered negatively.

Finally, this researcher found it nearly impossible to eliminate many of the colors not being tested from the room. Although, the tested colors were introduced into the

space through paint on a large wall surface, the drapery, flooring, and countertops contained other colors. It is unclear how much of one color needs to be present in order to have an effect on an individual.

Suggestions for Further Research

Further studies need to be conducted before any conclusions concerning the effect of color on patient recovery can be made. Several items should be considered before undertaking another color study including the extensive process of obtaining consent. There are five main areas requiring further examination in future studies; the complexity of the participants in terms of illnesses and treatments, the complexity of the colors in terms of hue, value, and intensity, the demographics being studied, the regional characteristics of the area in which the study took place, and the patients' preferences for particular colors.

Gaining consent. Attaining consent to perform research in a hospital requires permission from the Medical Institutional Review Board. Due to the increased likelihood of ill patients being negatively effected by research, the medical review board process requires permission of the doctors' of all the patients involved. Since many doctors do not have the time to review a study protocol, seeking permission from doctors can be time consuming. A non-medical review board process takes approximately two to three weeks; gaining permission for this study took three months.

The hospital staff administration approved a four week period for the study. At the end of the study, it was apparent that it is more appropriate to run a study for as long as needed to get an adequate sample size. The small sample size for this study impacted the conclusions that could be drawn. It is suggested that future researchers should consult a statistician early in the study to determine how many participants will be needed to run a

statistical analysis. This study was set-up using a time frame, upon the conclusion of the study it was determined to be more appropriate to run the study for as long as needed to get the appropriate sample size.

Complexity of the participants. Minimizing the differences between patients is important. For example, future studies should involve patients with the same illness or same type of surgery who are treated by the same physician and nursing staff. A better understanding of the participant should be gained through interviews with the doctors and nurses. Questions should be asked in regards to the participant's level of pain tolerance and degree of social support. By gaining a better understanding of the participant, the future researcher will be able to distinguish if the results are related to the complexity of the various patients or by the actual intervention.

Complexity of the colors. Future researchers should consider testing different color palettes rather than just one color. In an actual interior environment, people are not surrounded by only one color, but rather by a multitude of colors that are believed to work together to create an environment. By testing palettes, the researcher can provide a designer with an accurate way of producing the most healing environments, rather than just providing them with one color to use. The colors should coordinate with the colors already in the room. They should also be of various values and saturation levels. It would be ideal to test different types of color schemes, such as monochromatic, analogous, complementary, etc.

Patient demographics. Further studies should examine each patient's demographic characteristics to be able to determine whether or not this information can play a part in determining the outcome of the study. At the conclusion of this study, it is

this researchers belief that the demographic characteristics can play a part in the patients' recovery rate based upon how comfortable the environment makes them feel. For example, patients within this study who appeared to be from a higher socio-economic class claimed they felt more comfortable in a painted room because it gave them the feeling of being in a hotel, not a hospital. Patients who appeared to be from a lower socio-economic class claimed they felt more comfortable in the beige rooms because they felt like they were in a hospital and receiving medical care. It is anticipated that a patient who is comfortable in the environment will have a more competent psychological state and be able to better adapt to the healing and recovery process. This researcher suggests that future researchers explore; age, gender, education, culture, religion, and social-status.

Regional information. Design styles vary in different countries around the world. It is further noted that in the United States design styles vary according to regions and climates within the country. It is unclear what effect the design style of the southeast could have played in the results of this study on color. It is suggested that further research should be conducted in various parts of the United States to determine if there are regional differences that could influence the outcome of the study.

Patient and staff preferences. Within this study, patient and staff preferences for particular colors were stated informally in conversations with the researcher. It is highly recommended that in further studies, a formal qualitative approach should be incorporated to determine what effect the respondent's preference for a particular color has on the outcome of the study. For example, the opinions of both the patients and staff about the particular colors in the environment should be ascertained. Further investigation should also include questions about the color preferences incorporated into

the individual's particular home. It is also suggested that the researcher ask the patients and staff about the colors that they have noticed in other hospitals that they have visited. This information could be beneficial in determining how an individual's preference for color can effect his or her recovery process.

Conclusion

The greatest knowledge gained from this study was the understanding that the variable of color within the interior of a hospital is more complex than originally anticipated. This study was designed in a quantitative framework that did not take into account the complexity of the effect that color plays on human psychological and physiological states. Some designers select a color palette that focuses on the meanings and significance of particular colors in relation to the users of the space. This works well in a homogenous environment, but hospitals are complex environments used by a host of multicultural patients, medical staff, food service and maintenance workers (Park and Guerin, 2002). The optimal way to study color in a medical setting was found to combine qualitative and quantitative methods. Patient recovery is a complex variable that may be effected by many variables. When designing a hospital setting, the effects of both qualitative and quantitative variables on patients should be explored. This will allow designers to make an educated decision on how to create the most healing environments. The following is a framework designed to provide future researchers with the knowledge gained from this study. It is intended to provide researchers with a place to start when designing future studies of color in healthcare.

Framework for Future Researchers

A framework for future research is discussed below.

- Research Setting

    Regional Information

        Investigate regional design preferences.

        Study should be conducted in various regions throughout the United States.

    Area of the Hospital

        The unit of the hospital used should include patients with similar illnesses.

        The unit should have a limited number of doctors and nurses.

        The unit should include enough similar rooms so a comparison can be conducted.

    Hospital Rooms

        Rooms should be single occupancy.

        Rooms should be the same size.

        Rooms should have the same size window to provide the same amount of natural light.

        Rooms should provide the same view out of the window.

    Design

        Choose colors that coordinate with existing furnishings.

        Choose colors that are not believed to be harmful to the patients.

        Test a variety of color palettes.

        Test various hues, intensities, and values.

        Remove as many of the environmental factors that may effect a patient's recovery as possible.

- Participants

Illness

Patients should all have the same illness or have undergone the same surgical procedure.

The illness should not be life threatening.

The illness or surgery should require the patients to stay in the hospital for a similar amount of time.

The illness or surgery should require the patients to request a similar amount of pain medication.

- Data Collection and Analysis

Preliminary Research and Literature Review

Investigate other environmental factors such as, view from a window, ceiling texture, noise level, etc., that may effect a patient's recovery.

Investigate the illness being studied in terms of typical lengths of stay, medication requests, etc.

Investigate hospital dynamics.

Study Duration

Contact statistician to determine the needed sample size to run appropriate data analysis.

Run study until the proper sample size is obtained, not for a specified amount of time.

Preliminary Data Collection

Collect information about patient and staff color preferences.

Collect demographic information (age, gender, education, social-status, etc.) on participants.

Interview doctors and nurses to gain information about pain tolerance, social support, etc. for each participant.

Testing Recovery Variables

An anxiety test is a good means of testing the effects of color.

A follow-up test is suggested to determine the patient's normal level of anxiety.

Collect patients' lengths of stay and compare them amongst each other as well as with predetermined typical lengths of stay.

Collect patients' medication requests on a daily basis and compare them among the individual patients as well as with the entire sample.

APPENDIX
STATE-TRAIT ANXIETY INVENTORY (STAI)

Example:

The S-Anxiety scale consists of twenty statements that evaluate how respondents feel "right now, at this moment."

1 = NOT AT ALL 2 = SOMEWHAT 3 = MODERATELY SO 4 = VERY MUCH SO

- I feel at ease. 1 2 3 4
- I feel upset. 1 2 3 4

The T-Anxiety scale consists of twenty statements that assess how respondents feel "generally."

1 = ALMOST NEVER 2 = SOMETIMES 3= OFTEN 4 = ALMOST ALWAYS

- I feel at ease. 1 2 3 4
- I feel upset. 1 2 3 4

The STAI can be ordered from:

Mind Garden
1690 Woodside Road, Suite #202
Redwood City, CA 94061
Phone: (650) 261-3500 Fax: (650) 261-3505
e-mail: mindgarden@msn.com website: www.mindgarden.com

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BIOGRAPHICAL SKETCH

Kortney Jo Edge was born and raised in Southern California. Upon graduation from high school she began studying interior design at California State University, Fresno, where she was a member of the 1998 NCAA National Championship softball team. After her third semester, she transferred to the University of Florida and changed her major to sociology, all while continuing to play softball. Upon receiving a Bachelor of Arts degree in liberal arts and sciences, she took an internship in the interiors department of an architecture firm.

While obtaining her master's at the University of Florida in interior design, Kortney began her investigation on human responses to color. In order to gain a better understanding of the different specialties within the field of interior design, she accepted an internship with a design firm specializing in hospitality. Through her experiences in school, and through her internships, she has become very excited about all the possibilities that the interior design profession has to offer her. Kortney is anticipating being able to incorporate her knowledge gained during researching into the profession of interior design.

In her spare time, Kortney enjoys spending time with family and friends.