INTERIOR DESIGN FOR HOSPITALS: PREFERENCES OF PATIENTS AND STAFF FOR COLORS IN THE PATIENT ROOM

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CHAPTER I

INTRODUCTION

Color is an important element in the interior design of all spaces used by humans. The hospital environment is often frightening to patients and stressful to the staff. Empirical research dealing with the use of color in patient spaces is lacking and needed in order to design supportive spaces for users. Experts believe that carefully planned use of color in hospital spaces can provide interest, comfort and reassurance (Manhke, 1981). Malkin (1982), discussing health care design, points to color theory and research revealing some generalities about the use of color:

> Red, yellow and orange---longer wavelength colors at the warm end of the spectrum --- are exciting and advancing colors, they seem to come towards one and draw one out; while blue, green, and purple---shorter wavelength colors at the cool end of the spectrum---are retreating colors and induce a more quieting, inward-drawing response (Malkin, 1982, p. 252).

Malkin (1982) further suggests that all spaces in the hospital environment should include both warm and cool colors in order to keep the spaces interesting to users. Birren, (1978, 1979, 1983) concurred, indicating that after short periods of response people adapt to color. Using more than one color or values of colors in spaces should be more interesting and less tiring to users.

Strufert and Strufert (1970) studied patient response to color and formulated the following eight questions with which to evaluate color needs in a hospital setting:

1. Who will be subjected to the existing colors? (patients, visitors, personnel, etc.)
2. What is the average period of time that individuals will be exposed to the colors?
3. What is the nature and severity of the illness?
4. Will a diagnosis of cyanosis or erythema be accentuated by the colors within the area?
5. What is the age range of the patients?
6. Will the colors be satisfying to men, women and children?
7. Will the colors aid visual acuity in surgery?
8. Will the colors inspire an attitude favorable to recovery?

One existing problem which makes the planned use of color in hospital environments difficult is the lack of coordination of trained design decisions on a continuing

basis. The area of interior design at the time of hospital construction may be handled by the interior design staff of the architecture firm, or may be performed by an interior design firm on a consultant basis. Hospitals rarely have a full time interior design staff (Hart, personal communication, 1989), which contributes to a lack of overall design continuity after the facility is finished. As the property ages, color selections for replacement colors and finishes are often selected by untrained personnel.

Porter (1982) believes that interior design is especially important in public and patient areas of hospitals, and is useful to increase staff satisfaction and efficiency. The planning of hospitals should concentrate on the three populations served by the facility: the staff of the hospital, the patients, and the public (visitors and family) (Carpman, Grant, & Simmons, 1986; Porter, 1982). The patient room is the space which serves the primary user of the hospital; however, public and staff spaces are also important.

Carpman (1984), as a part of the University of Michigan's hospital replacement program in the mid 1980's, performed in-depth research into the design related needs of patients and visitors through a program called the "Patient and Visitor Participation Project". This project involved some 3200 patients and visitors, as well as 1200 staff

members, in 33 different studies. These studies dealt with all phases of design, from the early phases of schematic design, to layout of patient rooms, to wayfinding within and outside the building. Carpman discussing the role of interior design says:

> Basic interior design services for health care facilities include space planning, which determines the layouts of the rooms and achieves both aesthetic and functional goals; color coordination of all room finishes, furniture, and furnishings; and graphic design for signs and wall graphics (Carpman et al.,1986, p. 3).

Although several of the University of Michigan's studies dealt with patient rooms, including the bath (Carpman, 1984), color in the patient room was not addressed. Patient room studies were concerned with size and arrangement of rooms, number of occupants, safety and privacy, storage, window position, furnishings, lighting, and artwork. Carpman (personal communication, September, 1989) citing the lack of color research dealing with health care facilities, urges further research into that phase of the hospital environment.

Rabin (1981), health design consultant in New York, uses the relationship between good health, natural colors, and sunlight as the elemental emphasis for hospital design. His philosophy of design uses color to reduce stress and

improve the attitudes of patients and to facilitate the operation of the various departments of the hospital and to relieve the fatique of overworked staff. To quote Rabin's concepts about color:

> Color---that magic elixir--- is universally misused. In most hospitals, color is generally selected in a haphazard manner. It has become nothing more than a hit-or-miss proposition, because designers and hospital personnel entrusted with its magical powers know little about human response to color (Rabin, 1981, p. 78).

Environmental designers know that the time of hospitalization is a stressful time, both for the patient and their family (Volicer & Bohannon, 1975). The awareness of ill health and the possibility of treatment and/or surgery is disconcerting. The presence of large and unusual medical equipment is frightening. Patients confined in a strange environment away from home and family need comforting surroundings. Hospitals are searching for ways to improve the hospital environment for patients in order that they may feel more secure and consequently prosper and heal in a pleasant environment. Falick, (1981), who designs hospitals with humanistic concepts states:

> Perhaps we will never be able to empirically measure the effects of the environment. But

> knowing that you can use humanistic design to affect attitudes, you will work to provide a physical response to your goals of treating people with humanity, giving them comfort and making them want to choose your hospital as their own (Falick, 1981, p.72).

Major research of the last decade (1980's) has neglected the subject of color in hospital design. Medical researchers, architects, and interior designers stress the importance of the effect of color on patients, visitors and staff. The need for color research is pressing, in order to provide a knowledge base for informed design decisions relating to color on a continuing basis. The response of patients and staff to color in the patient room is critical to this knowledge base. This research should reveal valuable information useful to architects, interior designers, and hospital administrators in the planning and execution of the design of hospital environments.

Purpose and Objectives

The purpose of this study was to explore the preferences of the patient for different wall colors in the patient room during hospitalization. Further, the study explored the preferences of the hospital staff for different wall colors in the patient room. The dependent variable was the preferences of patients and staff for wall colors in the

patient room. The independent variables of environmental factors, psychological factors relating to color, individual color preferences, and demographic factors were studied relative to the patient and staff. Using the six primary and secondary wall colors in the patient rooms to guide the research, the specific objectives of this study were as follows:

1. To assess the effects of other environmental factors on the preferences of the patient and staff for different color environments for patient rooms.

2. To assess the effects of psychological factors on the preferences of the patient and staff for different color environments for patient rooms.

3. To analyze the effects of individual color preferences on the preferences of the patient and staff for different color environments for patient rooms.

4. To assess the preferences of patients and staff for three values within the primary and secondary colors environments (shade on wall behind the bed, tone on walls opposite bed, tint on ceiling) for patient rooms.

5. To assess the effects of demographic factors on the preferences of patients and staff for different color environments for patient rooms.

6. To make recommendations for future research related to the use of color environments for patient rooms.

Definition of Terms

After-image: The visual stimulation by one color can result in seeing another color after the stimulus has been removed. These after effects are called after-images. The most common after-image is the perception of the complementary color of the original stimulus. After-images vary in hue, value, intensity, shape, pattern, texture, focus, and duration (Burnham, Hanes, & Bartleson (1963).

Beck (1976) and Beck and Van Slyke (1977) further discussed the use of color and light in the operating suites of the hospitals. Beck noted that the color green first replaced the color white for use in the hospital operating room in 1914 in San Francisco when Dr. Harry Sherman was disturbed by the glare of white walls and drapery. Color pigment theory suggests that green walls will absorb the green after-image present in the eyes of the surgeon who has been staring at the red of blood and human tissue as he looks away. A white wall would reflect the green spots of the after-image. The color green was used widely throughout hospitals for many years.

Color Associations: Individuals have associations for colors. Psychologists have proven theories of human color associations for the dominant feelings and concepts of life, such as pain, anger, love, hate, death, work, etc. Associations for color also exist for commonplace objects of life, for example money, nature, flowers, fruit, etc. (Brynes, 1983).

Color Preferences: Humans have shown individual preferences for certain colors over other colors, as a part of their personality make-up. Psychologists have explored these human preferences for certain colors since the end of the Nineteenth Century (Eysenck, 1941). Based within the cultural context of society and affected as well by the individual personality of the user, color preferences vary from culture to culture and from person to person.

Color Temperature: Warm and Cool Colors:

Warm colors: Colors which are considered to be warm have longer wave lengths in light and also eminate physical warmth when measured by machinery. Warm colors are advancing and stimulating to users (Examples: Red, yellow, orange) (Birren, 1964, 1969).

Cool colors: Colors which are considered to be cool have shorter wave lengths in light, and also do not eminate physical warmth when measured by machinery. Cool colors are receding and restful to the user (Examples: Blue, green, violet) (Birren, 1964, 1969).

Dimensions of Color: Hue, Value, Chroma:

Three terms are defined as follows by Munsell (1946).

Hue: Hue is the name of the color, and is used to differentiate between colors (Example: red, blue). Hue is determined by the wavelength of the color, and is a term also interchangable with the word color.

Value: Value is the lightness or darkness of a color or hue, and is defined by the amount of white, grey or black in the pigment of the color. A color of a high value has a large amount of white in the pigment and is called a tint of the color. A color of medium value has a medium amount of grey in the pigment and is called a tone of the color. A color of low value has a large amount of black in the pigment of the color and is called a shade of the color.

Chroma: Chroma is the strength of the color or hue, and is defined by the brightness or dullness of the color (sometimes also called intensity).

Environmental Design: Designers of architecture and interior design should be mindful of the effects of the manmade environment on the human spirit. Environmental design concepts suggest that humanistic design with comfort and convenience provide an atmosphere of security for users (Falick & Thomas, 1967), and that a pleasent environment will positively affect the user's behavior. (Barker, 1968).

Environmental Factors: Hershberger (1972) considered the seven most important environmental factors in an architectural space to be aesthetic, friendliness, organization, potency, space, ornateness, and color. Environmental factors are evaluated in this study, using Hershberger's scale (1972) of twenty items for the measurement of the meaning of architectural spaces.

Mood Tones: Individuals have associations between colors and mood tones. A mood-tone relates to the various emotional feelings people experience, some of which may be positive, and others negative. (Example: Secure and comfortable as opposed to upset and disturbed, Wexner, 1954).

Psychological Factors: Design factors within the environment which affect the human mind are considered to be psychological factors in this study. Colors within an environmental space could affect the user; the use of space, line, or form could affect the user.

Assumptions

1. Respondents were able to answer the questionnaire truthfully and accurately.

2. The instrument used for collecting data, a questionnaire, accurately measured the perceptions of the respondents regarding color in the environment.

Limitations

1. Patients did not represent a cross section of the hospital population, due to their selection as a result of being a particular kind of patient (obstetrics).

2. Patients were of only one gender (female).

3. Patients were of a limited age range.

4. The Munsell Color System is limited to a ten color wheel including the colors red, yellow-red, yellow, yellow-green, green, blue-green, blue, purple-blue, purple and red-purple. The system does not have the colors orange or red-orange, contained in some other color systems. For this study the color yellow-red in the Munsell Color System was used to represent the color orange. The yellow color of the Munsell Color System contains a lot of green; yellow in other systems does not contain as much green. The Munsell Color System was chosen because it is the only internationally recognized standardized color notation system.

CHAPTER II

REVIEW OF LITERATURE

Patterns of Hospital Construction and Use

The American hospital industry received an injection of federal support in 1946 when the Hospital Survey and Construction Act (Hill-Burton Act) was passed by Congress for the purpose of granting or loaning monies to the states for new hospital facilities. In the prosperous years after World War II, communities all across the country built new medical facilities (O'Conner, 1976). In 1966 the advent of Medicare and Medicaid legislation further expanded the base for federally supported medical expenditures (Tetlow, 1984). Douglas (1972) declared the health care industry to be the fastest growing industry in the country. As technology expanded, this unprecedented growth was also accelerated by the proliferation of new medical equipment, which required new accomodations, thus encouraging new additions to medical facilities.

It was not until 1983 that the federal government, having found escalating medical costs out of control, passed legislation which mandated price ceilings on the

reimbursement procedures for hospitals, based on average regional treatment costs for diagnostically related groups of illnesses (DRGs), rather than on actual charges for services by various hospitals. Gaskie (1985) noted that as a result of the mandated DRGs by Medicare and Medicaid, which were also quickly embraced by private health insurers, the length of hospital stays were shortened, leaving hospitals with low occupancy rates.

Shumaker and Piquemat (1989) report that "as a result of DRGs, since the early 1980's hospitals have gone from overcrowded to underused, having vacancy rates as high as 69%". Hospital construction also has fallen off, beginning in 1983 and continuing through 1986 (Powills, 1987). Certainly these changes in hospital usage in America are tumultuous to the health care industry.

At the 1984 Future of Hospital Design Conference, sponsored by the U.S. Department of Health and Human Services, Panther (1984), Vice President of the Hospital Corporation of America, predicted that there will be 65 million Americans age 65 or older by the year 2000, with life expectancy continuing to increase. In order to serve the aging population, Panther expects three hospital conditions to evolve early in the twenty first century: (1) health oriented communities surrounding health care facilities, using day care and home care services, (2) minorplex hospitals (small community hospitals, 125 beds)

providing routine care, and (3) majorplex hospitals (large hospitals, 250-300 beds) providing advanced technology and highly specialized services.

These predictions indicate that although the organization of hospitals is expected to change, the need for hospitals will be more critical than ever. Thoughtful and intuitive design for these hospitals will be extremely important. Architects and interior designers must face these new challenges with skillful dedication.

Today, many of the services previously performed in the hospital setting are now performed in ambulatory and emergency treatment centers, or separate diagnostic clinics. The market for hospital care has become a buyer's market. Hospitals are consequently looking for methods of attracting patients. Health care providers are convinced that the humanization of hospital spaces will attract new patient clients (Gaskie, 1986). The trend is toward more home like spaces, with comfortable furniture and colorful surroundings. The need for research into the use of color in hospital environments is confirmed by these trends.

Color and Health Care Design

Ruga (1989), founder of the National Symposium of Health Care Interior Design, writes on behalf of design that supports healing. He reports that there are just over one million general acute care inpatient beds in America

today, with an average length of stay of seven days. The average cost per day for hospital services is $500; thus generating a total of $350 million per year by the hospital industry.

Ruga urges interior designers to strive to create environments which promote the well being of the patient. He further encourages the recognition of the fact that healing originates in the brain with the cognitive desire to live. He suggests that a sixth sense, imagination, can aid in the process of healing. Both physical and psychological factors are a part of his design theory.

In discussing the hospital environment, Ruga (1989) quotes Florence Nightingale (1969), who also on the subject of the environment said:

> I have seen, in fevers (and felt, when I was a fever patient myself), the most acute suffering produced from the patient (in a hut) 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. I remember (in my own case) a nosegay of wild flowers being sent me, and from that moment recovery becoming more rapid. People say the effect is only on 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 light, we do know this, that they have an actual physical effect.

Sommer and Dewar (1963) remarked that even though the time spent in hospitals by hospital staff exceeds that spent by patients, at least the staff can move about the various hospital spaces, and are allowed to leave after an eight hour shift. The patient conversely is obliged to remain in an unfamiliar restricted space for days at a time. The invasion of the patients personal space is drastic while confined in a hospital. "Often he must lie in a bed and permit a host of strangers to observe, move, and even operate on his body" (Sommer & Dewar, 1963, p. 323). Further discussing the effects of the hospital milieu, Sommer and Dewar (1963) state:

> Aspects of the physical environment that are relatively unimportant to a well person may loom large upon the horizon of a person confined to a hospital bed. The healthy person is able to adjust his environment to suit his own needs. A patient in hospital may be physically unable to change the position or height of his bed or the color scheme of his room. He has no way of avoiding the reverberating echoes from the corridors or the odor of the hospital dispensary. One ingredient of the patient-role is the acceptance of the hospital environment as given, and this is one major difference between the home and the

hospital as a locus for treatment (Sommer & Dewar, 1963, p. 324).

In their studies of a mental hospital ward, Sommer and Dewar (1963) felt that careful attention should be given to the physical environment of the spaces. They found that long term patients were significantly less likely to complain about their surroundings than short term patients. Katz (1931) found that short term mental patients prefer colors from the short wavelength part of the spectrum (blue, green, violet) while long term patients prefer colors from the long wavelength part of the spectrum (red, orange, yellow).

The trend in American hospitals toward a patient oriented environment is sweeping in scope. One of the most unusual experimental environments called Planetree was developed by a non-profit community group in San Francisco, California. Angelica Theirot, founder, environmentalist and health care advocate, reports research conducted into all the areas of the environment, nursing care, food, the role of the arts in healing (N.R.G., 1986). A horseshoe shaped thirteen bed model unit was renovated at Pacific Presbyterian Medical Center. The central work and lounge space is used by patients, visitors and staff. The unit concentrates on a homelike atmosphere. Patients are encouraged to get out of bed into the lounge area and to be responsible for their own medication. The environment

includes colorful furnishings, bookshelves, bulletin boards, and musical tapes for each patient. Families are encouraged to stay overnight. Planetree adopted the concepts of the ancient Greeks, using art and nature as an integral part of the healing process. Planetree board members hope the concept will be copied by other hospitals looking for supportive environments for their patients.

The patient room environment is an important factor in the sense of well-being of patients, and affects their behavior. Taylor (1979) suggests that as a result of the depersonalization of hospital environments, which forces the lack of control over one's daily existence, patients assume either "good patient" behavior (cooperative), or "bad patient" behavior (non-cooperative) while in the hospital. Both types of behavior can be harmful to the mental and physical health of the patient. Taylor suggests that a well informed patient with a participative role in his health care program is the most ideal patient profile. If the patient room environment is pleasant and appealing, patients should feel comforted and reassured, and not be prone to adverse behavior.

The impact of environmental factors on architecture has been studied by architects seeking to design buildings with meaningful and useful spaces for their clients. Hershberger (1972) compiled a typical list of environmental factors used by seven architectural researchers, from which

he developed a set of twenty factors, useful in empirical evaluation of the architectural environment. These factors include aesthetics, friendliness, organization, potency, space, ornateness, coloring, neatness, size, temperature, lighting, privacy, shape, ventilation, noise, rigidity, formality, texture, time and utility.

The concept of color, and its influence on the interior design environment of hospitals was the topic of the National Bureau of Standards special workshop called, "Color in the Health Care Environment" in 1976. Marcella Graham (1978), in her presentaion at that meeting, equated the skillful and educated use of color to the skillful and educated use of any language. She suggested that color plays an important role in the human perception of the world, and in feelings of health and well being. She proposed that color falls into six categories which she identifies and defines, explaining their sensitive effect on the user and the environment as follows:

1. Organismic or Physiological: Changes in blood pressure, pulse rate, nervous system, hormones, oxidation, growth.
2. Within the eye: Changes in size of pupil, shape of lens, position of eyeball, chemical response of retinal nerve endings.
3. Cognitive: Effects on memory and recall, illusion, perception, value judgement, associative response.

4. Mood: Effects which can be stimulating, cheerful, irritating, relaxing, boring, exciting, melancholy and/or gay.
5. Impressionistic: Effects on perception in which spaces may seem larger, smaller, warmer, cooler, clean or dirty, bright or drab; people may appear healthy or unhealthy, older or younger; food may seem appetizing or not.
6. Associative: Associations with nature, with technology, with religious and cultural traditions, with art and science, which may be typical or atypical (Graham, 1978, p.9).

Previous research has found that architectural environments have an effect on the satisfaction of the users with those spaces. There has been little research related to the use of color in the hospital environment. Basic experimental color research is needed.

Color and Physiological and Environmental Factors

In the study of the physical properties of color, scientists consider color to be a subjective sensation, a perception which Chamberlain and Chamberlain (1980) break down into four stages. These stages are:

1. the light source.
2. the colored object.

3. the eye with a color sensitive mechanism.

4. the brain to interpret the energy message.

Visible light is that narrow band of the electro-magnetic spectrum falling between 380 and 770 nanometers which man is able to perceive and use. The color red has the longest wavelength and violet the shortest wavelength.

The pigment of colored objects which humans see have the ability, due to their molecular composition, to reflect some wavelengths and to absorb others from the spectrum, which causes the sensation of color. A green object, like grass, absorbs the long wavelengths (like red) and reflects the short wavelengths producing the color green. Conversely a red object, like a tomato, absorbs the short wavelengths of the spectrum (like green) and reflects the long ones producing the color red. An object which reflects all wavelengths is considered to be white; an object which absorbs all wavelengths is considered to be black. Generally the longer wavelengths are considered to be warm colors, and the shorter wavelengths to be cool coloro.

The eye is the human organ which receives the light and focuses it on the retina. Within the retina the rods register the presence of light and the cones perceive the color. There are three different kinds of cones, each containing a different kind of protein which reads the

pigment from the light source. Cones are sensitive to the green, red or blue parts of the spectrum (Rossotti, 1983). The optic nerve conveys the message of light and color to the brain.

Authorities differ on this method of the physical conveyance of the message of color to the brain. Rossotti (1983) states:

> We do not yet know if the method by which we adapt to the colour of the illumination takes place in the brain or in the eye. But there seems to be a series of brain cells, each of which picks up processed signals from a very narrow band of wavelengths (Rossotti, 1983, p. 141).

It is believed that in 90% of the people of the world there is no difference in the perception of color (Chamberlain & Chamberlain, 1980). However, there are some humans who are considered to be color deficient. Most of these color deficient humans are males, comprising approximately 8% of the male population. Only one half of 1% of females (or one female in 20,000) have color deficiencies. This deficiency is passed by a recessive gene from the female to her sons. A minute percentage of the population may also be color deficient due to injury to the eye.

Empirical studies have explored the effects of light color and pigment color on human physical functions.

Gerard (1958) studied the effect of colored lights on psychophysiological functions. His studies found that colors significantly affected blood pressure, respiration rate, palmar skin conductance, brainwaves (EEG), and frequency of eyeblinks. Colors did not significantly affect heart rates. Subjects noted more tension and arousal during red light stimulation. They reported a greater calm and sense of well being during blue light stimulation. They were bored and disinterested under white light stimluation.

Jacobs and Hustmeyer (1974) studied the effect of colored light on galvanic skin response (GSR), heart rate, and respiration rate. They found significant color effects of the GSR only. They found red to be significantly more arousing than blue or yellow, and green to be signifiantly more arousing that blue. The lack of a significant effect on respiration is contrary to Gerard's findings. Both Gerard (1958) and Jacobs & Hustmeyer (1974) found no significant color effect on heart rate. These physical reactions of the body to color are important factors for the hospital patient.

Fehrman's (1986) studies of the effect of pigment color on school task performance found no statistically significant effects of color on skin response or pulse rate during task performance. This study used pigments carefully controlled for saturation and brightness.

Fehrman believes this control of value to be the responsible for finding no difference in the effect of color on the human body functions. Previous researchers had not controlled for value changes in colors presented.

Kinesiological research was done by Pellegrini, Schauss, and Birk (1980) dealing with a bright pink color, called Baker-Miller pink after the two corrections officers in California who first tested the use of the color, and its effect upon muscular strength. Findings revealed that male college students had significantly less muscle strength when staring at hot pink stimulus cards than when staring at blue stimulus cards. Findings from a second similiar study were less conclusive, finding only partial support for the weakening of muscles by visual pink stimuli.

Schauss (1979) had studied the effect of Baker-Miller pink on aggressive behavior in the correctional field. He suggested that bright pink might have an effect on the endocrine system of the body and subsequently on health and behavior, independent of the optic system. However, Pellegrini, Schauss, and Miller (1981) were unable to prove empirically the effect of Baker-Miller pink on aggression. A subsequent study at a Naval correctional facility did show lowered hostility and aggression from inmates (Schauss, 1985). The issue of effects of Baker-Miller pink

on aggression has continued to be controversial throughout the 1980's.

Institutions around the country have experimented with the use of Baker-Miller pink and most seem to feel that there is less aggression on the part of inmates, as Johnston (1981) reported in "Corrections". Schauss (1985) review of the research reported that various institutional programs were using Baker-Miller pink to reduce the incidence of client, patient, and inmate aggressive behavior. Hospitals were among these institutions; Baker-Miller pink has been used in mental hospitals and in emergency waiting rooms in acute hospitals.

The warmth and coolness of colors was studied by Newhall (1941) of Johns Hopkins University. His findings supported the common beliefs that green and blue seem to be cool colors, and that red and yellow suggest warmth. Newhall's data revealed that the range of cool colors from yellow through green, blue, and violet was more extensive than the range of warm colors, but that the warm colors were considered more decisively warm. Smets (1969) found that the perception of time spent under warm color stimulus was perceived to be shorter than time spent under cool color stimulus. The results of Newhall's study and Smets' study should impact the patient's perceptions of body temperature and time expended in an environment.

Colors are also affected by the type of artificial light used in the environment. Hospitals rarely have large amounts of natural light and are generally lighted artificially. Beck (1976) discussed the three types of lamps used by hospitals: (1) the incandescent lamp, a warm light rich in the yellow and red end of the spectrum, (2) the fluorescent lamp, the cool white the most commonly used by hosptials, rich in the blue end of the spectrum, and (3) the high intensity discharge lamp, which produces large amounts of white light. Beck suggests that good lighting is elemental to the evaluation of the patient's appearance, that differene kinds of light can enhance or destroy the effect of a patient room color scheme, and that light can affect the mood and appetite of the patient.

Styne (1989) suggests that the color rendering characteristics of a light source is described by a Color Rendering Index (CRI) number. This number is useful to the designer of the environment in order to maximize color effects of artificial light. The CRI is established by readings of the light source measurement on the International Commission on Illumination (CIE) chromaticity diagram. Styne says, "Interior color schemes should be assembled and evaluated under the type and level of light under which they will be used" (1989, p.105).

Burton (1983) in her research relating to the use of color and light in hospital interiors found that hospitals

did not plan color schemes and lighting sources to complement each other. Her redesigned spaces coordinated color and light usage, with special attention to the use of different kinds of light sources for general lighting and task lighting needs. Light and color are often used for coding of departments and wayfinding within the hospital setting.

Birren (1949, 1969), world renowned American color authority and consultant, proposed that warm colors, since they are stimulating, would be appropriate for convalescent types of patients; and that the cool subdued colors would give a more relaxed mood for chronic patients. He suggested that soft tones are best for patients rooms whether in warm or cool palette. He proposed the use of light green and aqua for cool color usage and coral, peach and soft yellow for warm color usage.

Sloan, early twentieth century editor of The Modern Hospital, summarized much of his earlier writings in the book Hospital Colors and Decoration (1944). He proposed that the environmental exposure of the patient room should be the primary concern when making color choices for patient rooms. He planned color schemes for private rooms, semi-private rooms, and wards for men, women and children with the four specific exposures of North, South, East, and West in mind. Sloan was an exponent of solariums, the general use of plants in hospital spaces, as well as roof

gardens, and the landscape planting of hospital grounds with access for ambulatory patients.

Mahnke (1981), whose firm is technical consultant to private and governmental health care projects, discusses the physiological and psychological response to color:

> Research has indicated that our response to color is total; it influences our emotions and the whole of our organism. Color affects the automatic nervous system such as heart rate, respiration, cortical activation, muscular tension and other functions, and definite emotional and aesthetic associations are aroused (Mahnke, 1981, p. 256).

Mahnke concurs with other color consultants in concluding that the warm colors are stimulating and the cool colors retiring in effect. Mahnke and Mahnke (1987) further suggests that the following five colors in particular should be rejected for use in hospitals.

1. White: should not be used because of the glare produced and the emotional sterility of the color.
2. Red: should not be used in the pure intense state because it is overstimulating. Tints and/or tones of red are preferred.
3. Purple: is deemed not suitable because of the after-image of yellow-green, which is very uncomplementary to the human complexion.

4. Blue: is not suggested because it is cold and bleak and depressing when used in light values. The use of blue is suggested only in medium or deep values.
5. Yellow-green: is not suggested because this color gives the human complexion a sickly appearance.

Tetlow (1989) reported in detail the success of the Rudolph Steiner Seminary in Jarna, Sweden, which uses the properties of architecture, color and art in the process of healing. Based on anthroposophy, the science of the spirit, the holistic method of healing, strives for a stimulating environment for patients of all types. A large variety of colors is applied on both the exterior and the interiors of the wooden and stucco buildings. The paint is a non-toxic milk based translucent medium applied so that the grain of the wood shows through. Tetlow says: "Patients are assigned cool or warm colored rooms according to the nature of their illness (40% have cancer and are most likely to be given warm colored quarters)" (Tetlow, 1989, p.96).

In some cultures the use of colored lights is used in the process of healing. Physicans in England and India are the most experienced in colored light therapy. Copen (1975) and Clark (1950) explain the use of color treatment lamps and light filters of seven colors in color therapy in England. The colored light filters of red, orange, yellow, green, blue, indigo, and violet are used, each to heal a

particular part of the body. Colored light therapy is not accepted by the medical community in the United States. The use of colored light in the process of healing is of special interest; it deals with additive light and color theory. This study is concerned with pigment color applied to interior surfaces, which deals with subtractive color theory.

Color Preferences

Empirical research in the area of color preferences began as early as 1894 with the German philosopher Cohn. Cohn (1894) believed that there was not a decided order of preference for colors among human subjects. By 1941, Eysenck, noted that although some fifty researchers had studied color preferences, there was disagreement about the most fundamental points:

1. the existence of a general order of the preference for colors.
2. the relationship of the popularity of saturated amd unsaturated colors.
3. the differences in preferences for colors between sexes.

Eysenck found that nearly all previous investigators had included the saturated primary colors of red, yellow, and blue, and the secondary colors of orange, green and violet among the colors studied. An average ranking of color

preferences found by 17 researchers he studied placed these six colors in the order of blue, red, green, violet, orange, and yellow. Further Eysenck found that there are essentially no differences in color preferences between the races or between sexes. Eysenck found the matter of color saturation secondary to the color preference factor.

Guilford, first in the 1930's at the University of Nebraska, and later in the 1950's at the University of Southern California, performed research into color preferences in the United States. The University of Nebraska study (Walton, Guilford, & Guilford, 1933) involved 1279 university students over a period of 14 years of study (1920-33), using the Milton Bradley series of chromas. The results of these studies fluctuated yearly, but general patterns of preferences were for blue, red, green, orange, and yellow. Violet was not shown in these tests. Guilford and Smith's (1959) system of color preferences used the Munsell system of colors and preferences were calibrated on a 9 point scale. This study revealed that preferences for the color red fluctuated more than other colors, and that males prefer orange over yellow and females vice versa.

Dorcus (1926) at Johns Hopkins University, was one of the first researchers to explore the color preferences of different age groups. Dorcus' subjects included three age groups: children, college age and two groups of adults.

The most unusual finding among the aged group of adults (over age 60) was the preference for violet; other researchers had not studied the preferences of aged adults. Spruiell and Jernigan (1982) studied women over 65 and found blue to be the most popular color for clothing. Tate and Allen (1985) studied older males and females and found that both sexes prefer light colors to dark colors.

Studies of the American Indian also reveal some differences in color preferences. Garth (1922) in a study of 550 full-blooded American Indians found red to be the color most liked by this native American group, contrary to major studies of Western cultures which reveal blue to be the most liked color. The state of Oklahoma has a strong Indian heritage, therefore influences of the preferences of the native Indian population might be expected in the findings of this study.

Two major color preference systems have evolved in the twentieth century which relate to color preferences and personality. The Luscher Color Test (LCT) (Scott, 1969) was first presented in 1947 and is still widely used by psychologists and physicians to screen job applicants as well as to discover psychological problems among general subjects. The LCT continues to be tested by researchers. Donnelly (1974) cautions that interpretations of the test should be carefully weighed in view of the differences between the America and European samples. Braun and Bonta

(1979) concluded that the LCT has major shortcomings and suggested that alternative tests be used. Holmes and Buchanan (1984) questioned the ability of the LCT to accurately describe personalities. The results of the research of Hafner and Corotto (1980) supported the LCT major premise that age, sex, and race are independent of color preferences.

The Pyramid Color and Personality Test devised by Schaie and Hess (1964) was a more general device for pinpointing personality traits. Holanchock (1965) found in a study of elementary school children that the Pyramid Test failed to differentiate between adjusted and non-adjusted children. The results of the research of Sameonoff (1980) also revealed specific problems in the test's rationale and methodology.

Looking for differences in personality traits, color preferences of criminals and noncriminals was studied by Akhtar and Singh (1974) in India. Their research found a significant difference in the order of color preferences between criminals and noncriminals.

Choungourian (1968), at the American University of Beirut, studied university students from Lebanon, Iran, and Kuwait, as well as from America, and found that although red and blue were preferred by the Americans, students from the middle eastern cultures preferred green or blue-green. Choungourian (1969) later studied younger children, from

the age of 5 to 20 and found that red and blue were preferred by the younger subjects, with a movement to a preference for green by age 20. Gotz and Gotz (1974) in a study at the Academy of Arts, Dusseldorf, using imagined colors, found that blue and red were the most preferred colors by the German students. These studies indicate differences in color preferences within cultures.

In more recent years a study concerning color called the "Blue Seven Phenomenon" by Simon (1971) requested that subjects, college students, write down the name of a color, as well as a number between one and nine. Note that subjects were not requested to name their favorite color, but merely any color that came to mind. The most commonly listed color was blue: 49% by males, and 40.74% by females, with an average of 48.57% for both sexes. Red was the second most mentioned color: 10.98% by males, and 8.64% by females with an average of 10.20% for both sexes. These first and second choices of colors written do follow the pattern of favorite colors found in all major color preference studies. Seven was the most chosen number with a 32.86% average for both sexes. The recent studies of Silver, McCulley, Chambliss, and Charles (1988) at Tulane University support Simon's "Blue Seven Phenomenon". Subjects of both sexes and races (black and white) chose the color blue and the number seven most often.

Further "Blue Seven Phenomenon" studies have been performed in many other countries. Findings have revealed that in Australia (Trueman, 1979) and in East Africa (Philbrick, 1976) the blue phenomenon held, but with lower percentages. In the Netherlands, the color red replaced blue as the first color chosen (Wiegersma & DeKlerck, 1984). Red was also declared to be the preferred color in India (Krishna 1972). These differences in the Netherlands and in India seem to be cultural differences reflecting the traditions of the two countries.

D'hondt and Vandewiele (1983) of the University of Dakar, with a sample of 2500 primary school children and 943 secondary school children, asked the West African subjects to name their favorite number (between one and nine) and their favorite color. The primary children's preferences were for five-brown; the secondary children's preferences were for nine-black. The researchers discussed greater awareness of school children of their cultural identity as a possible reason for these different findings. They also mentioned the fact the Eysenck's sample, although heterogeneous, contained few Africans. In further studies Vandewiele, D'Hondt, Didillon, Iwawaki and Mwanwenda (1986) found that children from Niger prefer red, from Japan prefer blue, from Transkeia prefer black and from Brassaville prefer red. These studies again indicate that color preferences are related to culture and/or race.

The studies of color preferences in China are from the 1930's. Chou and Chen (1935) studied the preference for color words only, using the primary and secondary colors, as well as white, black and grey. Elementary school children comprised the subjects. The order of preference for color words was white, blue, red, yellow, green, black, orange, violet, and grey. A noted difference in the preference for the color yellow might be explained by the fact that young children prefer the warm colors, or that yellow is considered the imperial color in China. Shen (1936) repeated the studies of Chou and Chen testing middle school children and university students. Results of color preferences of all groups combined in descending order are for blue, white, green, orange, violet, yellow, red, gray and black. Note the definite difference between Eysenck's rank order including several races, and the Chinese rank orders.

Color and Psychological Factors

Sociologists have suggested that life events have an effect on the psychological well being of humans. Holmes and Rahe (1967) developed a Social Readjustment Rating Scale (SRRS) of 43 life events in their work which evolved from the studies of Adolph Meyer who proposed that the phenomena of important life events affect the processes of health and disease in man. Note the order of these health

related life events on the Social Readjustment Rating Scale:

#1. death of a spouse.

#5. death of a close family member.

#6. personal injury or illness.

#11. change in health of a family member.

#12. pregnancy.

#17. death of a close friend.

Certainly two of the most important events of life are birth and death, and both generally occur in the hospital. The importance of the hospital environment and its psychological effect upon patients during times of crisis cannot be overlooked.

The primary reason the public goes to a hospital is because they are seriously ill. The time in the hospital is psychologically a most stressful one for the patient, and for the family of the patient. The environment is a strange technical one in which there are many unknowns and new experiences for the patient. Volicer and Bohannon (1975) developed a Hospital Stress Rating Scale intended to measure the general psychological stress experienced by short term medical and surgical patients. They hoped to evaluate the speed of recovery from illness with this stress criteria. Their research involved 261 patients who completed a card sorting procedure by which a ranking of 49 events related to a hospitalization experience was

developed. Many of these 49 events were directly related to the hospital room and the nursing care received there.

The need for the development of these two scales serves to direct interior design research to focus on the fact that the patient room should be a space which is supportive of physical healing and the psychological climate one of comfort and security. A pleasant color environment is elemental to such a supportive climate. Color is an innate part of each of the elements of a hospital room, including the painted wall surfaces, floor coverings, window treatments, furnishings, etc. Each of these surfaces do have color at no added cost.

Robinson (1975) studied color preference as a function of introversion and extroversion in personality. He found that introverts prefer cool/calming colors and extroverts prefer warm/stimulating colors. Aguilera (1980) found that extroverts significantly preferred red over black and that introverts preferred grey over purple. It appears from the Aguilera study that the neutrals like black and gray also may have an interface with colors in personality preference patterns. Both Rim (1981) and Menon, Shukla, and Menon (1974) found that extraverts differed from introverts in color preferences.

Color preference and stimulation seeking was studied by Nelson, Pelech, and Foster (1984). Their studies presented red and blue stimuli to 170 adolescents. Both

males and females who scored high on the Sensation Seeking Scale preferred the color red; those who scored low preferred blue. Wilson's (1966) study found that red had more exciting effects than green on behavior. Nakshian's (1964) study of the effects of red and green on behavior had been less conclusive.

Dorcus (1926) studied color preferences and associations. His study, one of the few to study more than one age group, included children, college students and adults. Dorcus found that association responses fell into several groups which he classified as follows:

1. Natural objects: flowers, sky, tree, grass, water.
2. House furnishings: chair, lamp, drapes, wallpaper.
3. Dress and apparel: ribbon, shoes, hat, dress.
4. Descriptive words: pretty, bright, dull, light.
5. Repulsive words: sickness, yellow, skunk, nausea.
6. Edibles: fruit, pie, orange, ice cream, candy.
7. Miscellaneous objects: box, sign, book, top.
8. Emotional content words: hell, fire, danger, love.

Other research has dealt with color associations and concepts. Brynes (1983) surveyed 337 children and found their choices similiar to those reported from adults in previous studies. Concepts of hope, anger, sadness, fear, honesty, happiness, pain, love, death, strength, school, and life were presented as stimuli. In response to all concepts red was the color most often named, followed by

black, blue, and white. Schuelof (1979) studying color preferences and symbolic values among French children (age 5-13) found that blue, the overall favorite, signified calmness and sensitivity. Red signified a strong will and energy. Yellow denoted spontaneity and originality. Green was related to relaxation.

Wexner (1954) developed a scale of adjectives to access the association between color and mood-descriptions. She prepared a list of 164 adjectives from which judges chose words referring to eleven mood-tones. Subjects were asked to relate mood-tones to colors. She found that more than one mood-tone could relate to a color. The key to the mood-descriptions is as follows:

1. Exciting, stimulating.
2. Secure, comfortable.
3. Distressed, disturbed, upset.
4. Tender, soothing.
5. Protective, defending.
6. Despondent, dejected, melancholy, unhappy.
7. Calm, peaceful, serene.
8. Dignified, stately.
9. Cheerful, jovial, joyful.
10. Defiant, contrary, hostile.
11. Powerful, strong, masterful.
12. Pleasant.

Schaie (1960) at the University of Nebraska, used Wexner's mood-descriptions in color research; his findings confirm Wexner's previous findings of association between colors and mood-tones. Cimmbolo, Beck, and Sendiak (1978) surveying college students and children for emotionally toned pictures and color found that the two groups responded in a similiar fashion. The colors black and brown were found to be sad; the color yellow was found to be happy. Results of a follow up study indicated a strong and reliable association between emotional tone and color.

Summary

The literature points out that changes in hospital usage and occupancy rates are forcing changes in health care design. The trend is toward user (patient) oriented design. Design leaders are creating humanistic environments supportive of healing. Architectural researchers are defining factors to evaluate environments. Sociologists are studying the behavior of patients in the hospital environment. Hospital designers have equated the educated use of color to the use of a skillful language. The personal preferences for color hue and values are an important factor in patient satisfaction with the hospital environment. The concept of color has strong physical and psychological influences on the patient's perception of the hospital environment.

Empirical studies have found that colored light does affect the physical functions of the human body. Kinesiological research has found that pigment color does affect the muscular strength of humans. Findings related to the effects of pigment color on aggressive behavior is controversial. Researchers have found that some colors are perceived to be warm and others cool. Authorities suggest that exposures (N,S,E,W) affect color rendition. Artifical lighting has been found to have an effect on color rendition. Some cultures have used color in healing.

The literature reveals that studies beginning with the last decade of the nineteenth century have explored color preferences as they relate to sex, age, personality, race and culture. Findings of major studies show that there are few differences in color preferences related to sex. A limited number of studies do support theories that there are differences in color preferences related to age. Differences in color preferences related to personality have been found and have led psychologists to develop tests which are useful in screening personality problems. A survey of American Indians found differences in preferences for color from those found in other Western studies (Garth, 1922). Late twentieth century studies do indicate that there are differences in color preferences related to race and/or culture in other countries.

Two scales, the Social Readjustment Rating Scale (SRRS) amd the Hospital Stress Rating Scale (HSRS) have been developed to study the psychological stresses of life events on health and the stresses of hospitalization. Studies have found that there is a relationship between color and the personality traits of introversion-extroversion, as well as sensation seeking, and behavior. Empirical studies reveal that humans have color associations for objects, concepts, and moods as a part of their psychological make-up.

As this research into color preferences of Southwest Americans was undertaken, it was expected that the preferences of the population of this Western based culture would be similiar to those found by Eysenck (1941) in England, as well as Walton, Guilford & Guilford (1933) in Nebraska. Consideration should be made of the fact that a small portion of any American population will be newly assimilated citizens from other races and culturer. The current literature reveals differences in preferences of the black and yellow races.

CHAPTER III

METHODOLOGY

Introduction

This chapter describes the methods and procedures of this research study. Included are discussions of the type of research, the variables of the research, description of the sample composed of two user groups, sample selection methods, room color treatments, description of the instruments, data collection, and methods used for the analysis of data.

Type of research

This study is exploratory in nature; it explores the preferences of subjects for colors in the hospital patient room. Carefully controlled studies of hospital environments of different colors have not previously been conducted. The researcher hopes to provide an elementary familiarity with the subject of color usage in the hospital environment, forming a foundation upon which further research can be based.

This study is quasi-experimental in nature; subjects were exposed to a treatment, color in the patient room. A total of six different colors, the three primary (red, blue, yellow) and the three secondary (green, orange, purple) colors, one in each of six different rooms was used. A seventh room, left in the ivory color currently used on the obstetrics ward, was also included in the study. The effects of color on two sample groups of subjects, the patients and the hospital staff, were studied.

Variables

The dependent variable of this study was the preference of the patient and staff for wall colors of patient room environments. The independent variables of this study were:

1. environmental factors of the patient room.
2. psychological factors relating to color usage.
3. individual preferences for color hue.
4. individual preferences for color value.
5. demographic factors.

It was expected that the independent variables would affect the color preferences of both patients and staff (dependent variables) in a similiar manner.

Sample

Porter (1982) identified three groups who are the users of the hospital. They are the patients, the staff, and the public. This research studied two of these three groups. The two groups sampled were the patients and the staff of the hospital. The third group the public, including family and visitors, was not studied. A university hospital in a Southwest state allowed the research to be performed in their patient rooms.

The patients were the subjects of primary concern. Hospital administrators and interior designers are interested in the physical and psychological welfare of patients as they receive treatment in the hospital. The patients were housed in seven two-bed rooms on the south side of the obstetrics ward, on the fourth floor of the hospital (Appendix A: page 1, floor plan of obstetrics ward). Patients were assigned to a room by the staff as they entered the hospital ward after delivery. Since the patient sample was not randomly selected, some bias could have occurred in the data.

Bias in the patient sample could also occur since all subjects were female. However, Burnham, Hanes, and Bartleson, (1963) found a 95% correlation between male and female color preferences. Bias could occur due to age differences in the subjects; patients and staff were

expected to be of varying ages. The fact that the birth of a child is a happy occurance might bias results; many hospital stays made necessary by serious illnesses could have depressing effects on subjects. In addition, the effects of short stays versus long stays in the hospital could bias opinions of subjects.

In order to counteract the effect of non-random selection, as well as to randomize the survey time of day, the patient sample was surveyed in a particular randomized order. A 7 X 7 Latin square (Fisher and Yates, 1963) was used to randomize the order of the survey of patients.

Within the Latin square each room to be surveyed may occur once and only once in each row and column (room and day). Each row and column is considered a complete block. The purpose of this arrangement was to remove from error the variablity due to differences in rows and columns. One important assumption required is that there is no interaction between rows, columns, and treatments.

Ferguson (1976) suggests that the Latin square design may be used repeatedly, as many times as desired. The Latin square design was used here in a repeated fashion for the survey of subjects in rooms. This repetition could randomly place any number of subjects in each cell or room. The Latin square has been used as a research organizational tool in the scientific laboratory, in industry, and by social science researchers.

Latin Square

Horizontal rows = different survey days.

Numbers 1-7 = color treatments of rooms: 1=orange, 2=blue, 3=purple, 4=yellow, 5=green, 6=red, 7=ivory.

Numbers 130-164 = hospital room numbers.

Vertical columns = order of room surveys.

1	2	3	4	5	6	7
164	162	156	154	138	136	130
4	5	6	7	1	2	3
154	138	136	130	164	162	156
7	1	2	3	4	5	6
130	164	162	156	154	138	136
3	4	5	6	7	1	2
156	154	138	136	130	164	162
6	7	1	2	3	4	5
136	130	164	162	156	154	138
2	3	4	5	6	7	1
162	156	154	138	136	130	164
5	6	7	1	2	3	1
138	136	130	164	162	156	154

The hospital staff was the sample of secondary concern. The staff was expected to be keenly interested in the hospital environment, since it is the space in which they work on a daily basis, in which they perform treatments on behalf of the patient. The staff should have

special insights into the patient room needs, as well as specific work performance needs.

The selection of the staff sample occurred as a result of the systematic selection of subjects from an employee list (n=1230) obtained from the personnel department of the hospital, using every fourth entry on the list. The list of staff subjects was stratified by type of employee or staff position, and included nurses, students, clerical staff, administrators, volunteers, and maintenance staff.

The Latin square sequence was also used to randomly assign staff subjects to patient rooms for the survey. Staff were assigned to survey rooms in the order of the Latin Square using more than one horizontal row on a survey day. Several staff subjects could be surveyed in a colored room on one day; whereas no more than two patient subjects would be housed and surveyed in a colored room on one day.

A total sample of 323 subjects were surveyed, including 175 patients and 147 staff. These numbers were considered necessary in order to have enough subjects in each evaluation cell (or room color) for analysis purposes. An average of 25 patients and 21 staff were surveyed in each of the seven patient room color treatments.

Patient Room Color Treatments

Six two-bed patient rooms were painted each in a different color, using three values of each color in

each room. The three primary colors of red, yellow, and blue, and the three secondary colors of green, violet, and orange were used for the patient room colors. A seventh patient room remained in the ivory color currently used on the obstetrics ward; subjects were also surveyed in the ivory room, in order to know reactions to the use of that color in the patient room.

Color sample boards of all the colors and their values to be used in the experiment were prepared for use in the study (Appendix B). Both patients and staff evaluated all colors, using the color sample boards to represent the colors of the six rooms they were not in. The two subject groups, patients and hospital staff, were exposed to one colored patient room to evaluate in detail. Patients evaluated the color of their room as well as the other six colors using the sample color board. Staff evaluated the color of the room to which they were randomly assigned as well as the other six colors using the sample color board.

Values of the colors used for the patient rooms were selected from the Munsell (1946) standardized color notation system using Munsell student color charts (Appendix C). In each patient room, the wall behind the patient bed was painted a shade of the color (6/4); the wall opposite the patient beds and the exterior wall to the side of the patient beds were painted a tone of the color (8/2). The ceiling of the rooms was also painted in this

tone (8/2) mixed with an equal part of white, which produced a tint of the color. See the floor plan of the typical hospital room (Appendix A: Page 2). It was expected that subjects would prefer one of the tints, tones, or shades for the hospital environment.

Note that the lay person might not realize that the lower values of colors, for instance pink and rose, lower values of the color red, would be considered to be red by design experts. The lay person might consider these different values to be different colors. Providing color boards to visually represent values of colors used in all spaces, served to remove nomenclature bias from subject preferences in the study.

The Munsell color chips were read by Pittsburg Paint Company's spectrometer to arrive at a duplicatable formula for the tints, tones and shades of the color hues used in the study. The paint used for this research was donated by the Pittsburg Paint Company. The labor for the painting of the walls of the patient rooms was provided by the maintenance staff of the hospital in which the research was conducted.

Color is affected by light; the two-bed patient rooms on the obstetrics ward had natural light from one large window on the wall opposite the head of the beds. This natural light was closer and more beneficial for the patient in Bed B than for the patient in Bed A, which was near the door and bathroom.

Artificial lights used in the space were composed of two types, including both fluorescent and incandescent light sources. Two-way (up and down) fluorescent type fixtures were mounted on the wall behind the bed above the head of each patient, and included two forty watt cool white lamps. An incandescent type spot light was recessed in the ceiling directly above the lower section of the bed of each patient, and included a quartz five hundred watt spot lamp. The spot lights were used primarily by physicians when examining the patients, and were rarely used by the patients. The patients and staff primarily used the fluorescent light fixtures.

Instrumentation

The evaluations by the patients and hospital staff of the color in the hospital rooms were assessed with two self-completed questionnaires: one for the patient sample, and one for the staff sample. These instruments (Appendix D and E) measured the independent variables of (1) environmental factors, (2) psychological factors, (3) individual color hue preference, (4) individual color value preferences and (5) demographic factors. The researcher delivered the instruments to subjects and was available for questions while the questionnaires were completed.

The instruments included a semantic scale developed by Hershburger (1972) to measure the meaning of the architectural environments, as well as an adjective descriptor scale, developed by Wexner (1954) and also used and tested by Schaie (1960) to evaluate mood tones. Stability coefficients for Schaie's repeated scale values are in Appendix F. A Likert type color preference assessment scale was used to evaluate color hue and value preferences of the subjects.

A pretest of the instruments was performed. Using Dillman's (1978) suggested procedures for surveys, pretesting was performed using three interested groups: university colleagues, interior designers and architects. Further, a pilot test was performed in which patients and staff were surveyed in the hospital to be used for the survey. A report from the pilot test is in Appendix G. Minor corrections were made to the instruments before proceeding to the full survey of the two groups of subjects.

In the pilot test, physical data relating to the amount of pain medication taken by the patient, the vital signs of the patient, and the length of hospital stay were taken from hospital records and recorded on a form (see Appendix H). The information was recorded anonymously by the staff nurse in order to protect the privacy of the patient. Due to the short length of stay for obstetrics

patients, the data was deemed not complete enough to be evaluated as an indicator of the effect of physical factors on color preferences. The staff nurse of the obstetrics ward concurred with this decision. She suggested that long term patients would be more appropriate for this type of study.

Data Collection

Data from patients were collected twice a week over a period of three months. The number of patients assigned to the hospital rooms varied, due to length of stay, complications, etc. The average length of stay for obstetrics patients was three days, so that at least two patients could be encountered in each room in a week's time. The stay for Caesarean section patients was slightly longer, ranging from three to five days. Some repeat encounters among the Caesarean section patient subjects were expected during the survey, and did occur.

The data for this research were collected from patients in the months of January, February, and March, 1991. Data was collected between the hours of 10 am and 2pm, in order to assure daylight evaluations. Some data were collected on Mondays and Thursdays, and some data were collected on Tuesdays and Fridays in order to further randomize the collection of data. Week-end days were avoided since patients are generally released from the

hospital on Fridays whenever possible to be home with their families for the week-end. Some holidays occurred within the time frame of data collection: Martin Luther King Day, January 21, and Washington's birthday, February 18. Room occupancy was lower on those days than on other days.

Data were collected from the staff during the month of April, 1991. The times for collection of data from nursing staff were planned during the afternoon, after the end of the first work shift (7am-3pm) and before the beginning of the second work shift (3pm-11pm). Some times were also made available during lunch hours and after work hours for the clerical staff.

The survey instrument was presented to subjects on a clipboard, convenient for writing for both the bed patient and the standing staff. The survey completion took approximately 15-20 minutes. A short letter explaining the study was given to each subject with the questionnaire (see Appendix D and E). Subjects could decline to participate in the study if they wished. An open ended question at the end of the questionnaire allowed subjects to comment about the study in general.

A local department store donated perfume samples to be given to patients who participated in the study. A uniform company donated a three piece scrub suit to be given to staff participants. The researcher also donated a $100 prize to be given to staff participants. Names of the

winners of the uniform and money prize were drawn by the staff nurse from a coupon entry box at the end of the survey period. The uniform was awarded to a nurse who worked in the emergency room of the hospital; the $100 was awarded to a clerical employee who worked in the accounting department of the hospital.

Methods of Analysis

Several methods of statistical analysis were used to analyze the data. Factor analysis and analysis of variance were used to analyze the variables of the environmental scale. Variable patterns were compared with those found important in Hershberger's research. Factor analysis was also used to analyze the results from Wexner's mood-tone scale. Findings were compared to Schaie's factor groupings (Appendix F).

The chi square statistic and analysis of variance were used to analyze the effect of the independent variables (environmental, psychological, preferences) on the dependent variable (preference for room color) for the patient and staff samples. A post hoc test, Duncan's multiple range test was used after the analysis of variance evaluation of the preference data in order to establish which preferences for room color were significant. The chi square statistic was used to assess the association among the demographic data (Appendix I). An analysis of

data chart is included in Appendix J, which lists the five objectives of the research plan as well as methods of statistical analysis used to analyze data related to each objective.

CHAPTER IV

EVALUATION OF A HOSPITAL ENVIRONMENT

BY PATIENTS AND STAFF

Proposed Article for Environment and Behavior

ABSTRACT: CHAPTER IV

EVALUATION OF A HOSPITAL ENVIRONMENT

BY PATIENTS AND STAFF

Hospital environments need to be comforting and supportive of patients as well as efficient and responsive to the work needs of staff. Two primary user groups, consisting of 147 patients and 176 staff users evaluated the patient room environment in a Southwestern university teaching hospital. A semantic scale of bi-polar adjectives was used to evaluate the meaning of the environments. Factor analysis was used to analyze the data. Factors loaded in seven factor groups for patient data, six factor groups for staff data and six factor groups for combined data. Some variation occurred in the loading of variables within factor groups for each data group. However, a common group of five factors evolved; they were named aesthetics, social, design, physical and comfort factors. Analysis of variance between the five factors and seven colored rooms revealed that the aesthetic and social factors were significantly related to the room color. Seven colored rooms were surveyed: the primary colors (blue, red, yellow), the secondary colors (green, orange, purple), and the ivory color currently used on the hospital ward. Further analysis of variance revealed that color preferences were significantly related to environmental factors. Subjects evaluated one color room in detail, and also evaluated the other six colors with the use of a color board. Values of purple, blue, and red were preferred; values of yellow and ivory were least preferred.

CHAPTER IV

EVALUATION OF A HOSPITAL ENVIRONMENT BY PATIENTS AND STAFF

Introduction

In twentieth century America, the hospital environment is used by a cross section of the population on a regular basis. The hospital has become the universally accepted site for the administration of patient care. The period of hospitalization is often a stressful time for the patient and the family of the patient (Volicer & Bohannon, 1975). Patients are naturally concerned about the status of their health, and the expected tests, treatments, and/or surgery which might occur. The hospital is filled with large and unusual technical equipment which may be strange and frightening to patients. In order to reduce patient stress levels, it is extremely important that the hospital environment be as comforting and supportive for the patient as possible.

Equally crucial are considerations for the needs of the hospital staff, whose daily work space is the hospital environment. Porter (1982) suggests that programmed thoughtful interior design can increase the satisfaction and efficiency of the staff. These two populations, the patients and the staff, in addition to the public, including visitors and families, make up the three major groups of users of hospital spaces (Carpman, Grant, & Simmons, 1986).

If users of hospital environmental spaces are comfortable with the surroundings, the experiences and behavior of patient users in those spaces could be more satisfying. Likewise staff duties should move with ease and become rewarding experiences. The interface between patients and staff must not be overlooked; the whole hospital experience is based upon this relationship. This exploratory study is concerned with the environment, and particularly the effect of color in the environment on users of the space.

Color expert, Frank Mahnke (1981), believes that the skillful use of color in hospital spaces can provide comfort and assurance for the users of the spaces. Birren (1979) rejects the use of white in hospitals, suggesting a need for variety in the colors of patient accommodations, in order to provide interest and stimulation for the sensory needs of the user. The impact of color on the

healing and work environment of the hospital is one of the concerns of architects and interior designers.

The purpose of this study was to evaluate factors of the environment and to explore the effects of the preferences of patients and staff on these environmental factors. The dependent variables, environmental factors, were compared with the independent variables, preferences of patients and staff for the color of the patient room.

Previous Environmental Research

Hershberger (1972) after assessing instruments used by seven architectural researchers developed a semantic scale for the measurement of the meaning of architectural spaces. Hershberger suggested that words are frequently predictors of action, and that they give insight into what is going on inside people. Osgood, Suci, and Tannenbaum (1967) verified the validity and reliability of semantic scales for use in measuring perceptions and behavior of subjects.

Norris-Baker, Stephens, and Willems (1982) in their study of two methods for reporting behavioral research in hospital environments found that patients have different behavioral patterns in public spaces, therapy spaces, and ward spaces. These researchers felt their findings confirmed the environment-behavior setting patterns within an institution (hospital), which had been proposed by Barker and Wright (1978).

Barker (1978) studied the relationship between people and things in environmental settings. People are the most basic element of behavior settings and are capable of change; things within the behavior settings do not change as easily or often. Barker said people are affected by things of the environment. People should be affected by things in the hospital room, like color, and other environmental factors. This study explores the effect of environmental factors upon people in the hospital room.

Sommer and Dewar (1963) found that even though the time spent in hospitals by hospital staff exceed that spent by patients, at least the staff can move about the hospital spaces, and are allowed to leave after an eight hour shift. The patient conversely is obliged to remain in an unfamiliar restricted space for days at a time. The invasion of patients' personal space is drastic while confined in a hospital. "Often he must lie in a bed and permit a host of strangers to observe, move and even operate on his body" (Sommer & Dewar, 1963, p. 323). Certainly Hall (1969) would find this kind of treatment an unacceptable violation of the personal spaces of patients in the normal context of life situations.

Taylor (1979) suggests that as a result of the depersonalization of hospital environments, patients assume either "good patient behavior (cooperative), or bad patient behavior (non-cooperative) while in the hospital. The

patient room environment including color is an important factor in the sense of well being of patients, and affects their behavior. Strufert and Strufert (1970) questioned whether hospital colors would inspire good recovery attitudes, aid in visual acuity during surgery, appeal to all ages and types of users, aid in evaluation of patient skin colors, and generally add to the aesthetics of the hospital.

Architectural educator Lang (1987) notes three major dimensions of the aesthetic experience of the environment; sensory aesthetics, dealing with perceptions; formal aesthetics, focused on visual qualities; and symbolic aesthetics, concerned with associational meanings. Lang cites a lack of research in the sensory aesthetics dimension, important to human response to the environment. Lang states, "A broad definition of aesthetic experience would encompass all the goals of design because "pleasure" is derived from the fulfullment of each of them" (1987, p.186). Lang explains:

> Cognitive psychology deals with the acquisition, organization, and storage of knowledge. It focuses on the issues, thinking, learning, remembering, feeling and mental development. Affect deals with emotion and is concerned with likes and dislikes. It involves an understanding of values and attitude formation. An understanding of the processes of cognition and affect

> can make a major contribution to the understanding of environmental aesthetics and the choices people make in the use of the environments (1987, p.93).

Lang, discussing the patterns of environmental design as well as behavioral interpretation and usage, suggests that Izumi's (1968) classification of building types is germaine to environmental design. Izumi proposed that some buildings are designed primarily for the successful functioning of machines and equipment, and are called anthropozemic; other buildings are designed primarily for the use of people and are called anthropophilic. Izumi proposed that people have to adapt to the conditions of anthropozemic buildings, and thah equipment has to be adapted to the conditions of anthropophilic buildings.

The hospital should be considered primarily an anthropophilic type of building; and therefore should be designed for the convenience of people. However, because the hospital environment also includes much diagnostic equipment, it could also be considered anthropozemic. It is the anthropozemic (equipment) nature of hospitals which is often frightening to users.

There is little empirical research related to the subject of color in the hospital environment. The largest body of design related hospital research in the last decade was performed at the University of Michigan, prior to the replacement of their university hospital in the mid-1980's.

Carpman (1984, 1986) reported on the Michigan program called, "Patient and Visitor Participation Project" in which some 33 studies were completed, several dealing with the patient room, and revealed that none of the studies addressed the subject of color. Carpman (personal communication, September, 1989) urged further research into the use of color in hospital spaces

Color Preference Studies

Empirical research in the area of hue or color preferences began in the early twentieth century. By 1941 Eysenck at the University College, London, performed color preference research and reviewed the work of fifty other color researchers. Eysenck (1941) found disagreement about the general order of preferences for color. Investigators had previously included the saturated primary colors (red, yellow, blue) and the secondary colors (orange, green, violet) in their studies.

An averaged ranking of color preferences found by 17 researchers placed these six colors in the order of blue, red, green, violet, orange and yellow. Eysenck found no differences in color preferences between sexes or races. Burnham, Hanes, and Bartleson (1969), citing the results of 26 research studies, found a close correlation (.95) between the color preferences of males and females.

Walton, Guilford, and Guilford (1933) in their color preference studies of 1279 students at the University of Nebraska, reported color preference patterns for blue, red, green, orange, and yellow. The secondary hue violet was not included in their studies. The Milton Bradley series of chromas was used in these early studies. Guilford and Smith (1959) used the Munsell system of colors in later studies at the University of Southern California. Garth, Ikeda, and Langdon (1931) studied the color preferences of white, black, American Indian, Mexican, and Japanese subjects and found some differences in color preferences among races.

There have been studies into color preferences of different age groups (Dorcus, 1926; Spruiell and Jernigan, 1982; Tate and Allen, 1985). Two major color preference systems have evolved which relate to color preferences and personality: the Luscher Color Test, (Scott, 1969) and the Pyramid Color and Personality Test (Schaie and Hess, 1964). Significant differences in color preferences have been found between criminals and noncriminals (Akhtar and Singh, 1974). Simon's (1971) "Blue Seven Phenonmenon" studies revealed that Americans think of the color blue and the number seven before other colors and numbers.

Methodology

This study is considered exploratory in nature, since few controlled color studies of hospital environments have been conducted. The study is also considered quasi-experimental in nature, because subjects were exposed to a treatment, color in the patient room environment.

Study Setting

Within the study setting a control for the variable of hue was established. The study involved seven two-bed patient rooms; six of which were painted in different hues, representing the three primary and three secondary colors. Munsell colors R (red), Y (yellow), B (blue), G (green), P (purple) and YR (yellow red) were used. The Munsell system does not have a color called orange; YR (yellow red) was used to represent orange. The seventh room remained in the ivory color currently used on the hospital ward. Subjects evaluted the color of one room in detail, and used a sample color board to evaluate other room colors.

Three values of each hue were introduced within each patient room. The values of the hues were selected from the Munsell (1946) standardized color notation system, using the Munsell student color charts. In each room the wall behind patient beds was painted a shade of the color (Munsell 6 value/4 chroma). The wall opposite patient beds

and the exterior wall to the side of the patients were painted a tone of the color (Munsell 8 value/2 chroma). The ceiling of the rooms was also painted using this tone (Munsell 8 value/2 chroma) mixed with an equal part of white, which produced a tint of the color.

The rooms included in the survey were located along the south side of the hospital on the fourth floor. One large window on the wall opposite the beds provided natural light. The rooms had two sources of artificial light: a fluorescent fixture (80 watts) mounted on the wall above each patient bed providing both up and down light; and an incandescent quartz spot light (500 watts) mounted directly over the lower portion of the patient beds which was used as an examination light by physicians.

Sample

Subjects for the study included patients on the obstetrics ward and a cross section of staff in a university hospital in a Southwestern state. The staff provided special knowledge of the patient environment, since it is their daily workspace.

The patient is a short term periodic user of the hospital room, whereas the staff are long term constant users of the space. It might also be noted that the patient views the space from a restricted reclining position on the bed. The staff view the space from an

unrestricted standing and/or moving position. The patient is the receiver of services; the staff are the givers of services.

Patients were assigned by the staff to a room on the obstetrics ward following delivery on an occupancy available basis. Since this method of selection was not random, and since all patient subjects were female, some bias could occur in the sample. Efforts were made to randomize the sampling order of patients using a Latin square technique in the 7 X 7 format (Fisher and Yates, 1963), since there were seven patient rooms used in the study. The purpose of this random arrangement is to reduce error from variability due to differences in the survey order of rooms on different days. The Latin square has been used as an organizational research tool in the scientific laboratory, in industry and in the social sciences.

The systematic selection of the staff sample was made using every fourth entry, from a composite list (n=1230) of hospital jobs and names of employees holding those jobs in the various departments of the hospital. Staff were assigned to the patient rooms for the survey using a 7 X 7 Latin square technique.

A total of 323 subjects participated in the survey, including 176 patients and 147 staff. Approximately 25 patients and 21 staff were surveyed in each color room.

Instrument

The self completed survey questionnaire consisted of three primary sections: (1) a semantic scale of 20 bi-polar adjectives (Hershberger, 1972) used to evaluate the patient room environment, (2) questions related to color preference and (3) questions related to demographic information. Most of the questions were the same for both subject groups. The staff survey included some questions related to the workplace; the patient survey included questions related to their personal use of the space.

Data Collection

Patient surveys were conducted during the months of January, February, and March, from 10 AM to 2PM, in order that colors would be seen in daylight. Surveys of staff were conducted in April from 2 PM to 4 PM, after the end of the day shift and before the beginning of the evening shift. Survey instruments were presented to subjects on a clipboard for the convenience of writing in a reclining position for patients and the standing position for staff. The researcher was present to answer questions when necessary during the survey.

Discussion of Findings

The 20 variables represented by bi-polar adjective pairs were factor analyzed and then rotated using the Varimax rotation method. Factor analysis was performed for the patient data and the staff data separately, and then for combined patient and staff data.

Factor analysis revealed seven factors from the patient data, six factors from the staff data, and six factors from the combined data. Some variation occurred in the patterns of factor groupings within subject groups. However, a common group of five major factors evolved and were designated aesthetics, social, design, physical and comfort factors.

In the patient data, the bi-polar variables unique/common, colorful/subdued, ornate/plain, friendly/hostile, and old/new made up the first factor group which was named aesthetic (see Table 1).

Insert Table 1 about here

Both patients and staff responded positively to the uniqueness of the environment, as well as to color and ornateness of the space. Patients placed friendly/hostile among the aesthetic variables, whereas both staff and combined data placed that variable in the physical factor group. Findings for all data groups were negative for the

variable old/new, indicating that they considered the building to be relatively new.

For all data groups, the factor called social was composed of the bi-polar variables private/public, large/small, and loose/compact. The positive findings for these variables indicate that all groups were interested in a private and adequate space in the patient room. In both staff and combined data the variable quiet/noisy was in the social factor. For staff data, the social factor split into social I and social II.

For all data groups the design factors were composed of the variables rough/smooth, formal/casual, rigid/flexible, and rugged/delicate, except for the combined data which placed rugged/delicate in the physical factor. For patient and combined data the design factor split into design I and design II; for staff data, design was a single factor. Variables of the design factor group described the surface qualities and ambiance of spaces.

For patient data, the physical factor consisted of the bi-polar variables angled/curved, clean/dirty, light/dark and useful/useless. Combined data placed angled/curved with the design II factor group; staff data placed angled/curved with the aesthetic factor group, making it the only variable which placed in three different factor groups. In the staff data, clean/dirty was in the physical factor group, useful/useless was in the design factor

group, and light/dark was in the comfort factor group. There were more differences in the physical factor variables for staff than in any other factor grouping.

In patient data two comfort factors were named: comfort I was composed of the bi-polar variables warm/cool and quiet/noisy; comfort II was composed of drafty/stuffy and ordered/chaotic. For both staff and combined data the ordered/chaotic variable was in the physical factor group. For both staff and combined data, comfort was a single factor group.

It should be noted that the order of importance in which the factor groups emerged in the process of factor analysis was differed in some aspects for each sample group (see Table 2).

Insert Table 2 about here

It is noteworthy that aesthetics factored first for both patients and staff. The social factor was second for patients and fourth for staff, indicating that staff we less concerned with social considerations than were patients. The design factor was second for staff and third for patients. For combined data the physical factor unexpectedly emerged first, since it has been third for staff and fourth for patients. Comfort was the last factor to emerge for all data groups.

Significant Findings

Observations of the maximum factor loadings across the three data groups analyzed reveal that all of the five major factor groups have significant factor loadings (see Table 1). Factor loadings above .7 were considered to be significant. Patient data revealed ten significant variables; staff data revealed eight significant variables, indicating that both individual subject groups felt strongly about many of the variables. However, within the combined data only seven variables were significant, indicating mixed opinions related to several factors.

Assessing the loadings of factors across subject groups the study revealed that all three data groups analyzed were significantly concerned with the aesthetic variable unique/common, with the two social variables private/public and loose/compact and with the design variable formal/casual. This data suggests that users are seeking a private unique environment in the patient room. Patients were seeking aesthetically pleasing spaces for their hospital stay; staff were seeking an attractive space in which to work. For both staff and combined data there is significant interest in the variable ornate/plain.

The social variable, large/small was significant for patient data but not for staff data, indicating that patients were more concerned with the actual size of the patient room than were staff. Loose/compact was

significant for patients and combined data groups. A number of subjects asked about the meaning of loose/compact, which was explained to be related to the organization of space within the patient room.

The design variable, rough/smooth was considered significant for patient data. Angled/curved fell within the design factor variables for combined data, and was considered significant. Rigid/Flexible was significant for patient and staff data. This variable is important to the changeability of space for various uses in the patient room environment.

Among physical factor variables, angled/curved was significant for patient and combined data, although in combined data, this bi-polar variable was considered to be a design variable. Among comfort factor variables, warm/cool and drafty/stuffy was significant for patient data; patients were concerned with body comfort. The variables, quiet/noisy and ordered/chaotic were significant for staff; the staff wanted quiet and order in the patient room.

Environmental Factors as affected by Room Color

Using the combined patient and staff data, the variance explained by the bi-polar adjective variables was added together to form a summed factor score for the five common factor groups. An analysis of variance between the

five factor groups and the seven room colors then revealed that the aesthetic and social factors were significantly related to the room colors (see Table 3).

Insert Table 3 about here

Note that the mean values for the aesthetic factor differed significantly, at the .0001 level, between the seven colors. Mean values for the social factor also differed significantly at .0384 level, between the seven colors. None of the other factors showed any significant effect of color.

In order to further explore the effect of colors by room, consider Table 4 below which reports Duncan's Multiple Range statistics.

Insert Table 4 here

The findings presented in Table 4 reveal that there was a wide range of mean scores among the colors affecting the aesthetic factorogroup. The highest mean scores (A) were recorded for the colors purple, blue, and red; high mean scores (B) were recorded for blue, green and orange; middle mean scores were recorded for red, green and orange; and the lowest mean scores (D) and (E) were recorded for the colors yellow and ivory respectively. Findings affecting

the social factor mean scores were not significantly different; (A) mean scores were recorded for all colors, except for the (B) mean scores for the color yellow, which was the lowest. Yellow and ivory mean scores are then both significantly different from the means of all other colors for the aesthetic factor. Yellow mean scores were also significantly different from the means of all colors for the social factor.

These findings have implications for the importance of color as it relates to the aesthetic and social considerations of hospital environments. The yellow room was the most disliked by all users. Yellow as it was used in this study should not be used by hospitals for patient rooms. Other yellows could be studied. The next most disliked color was ivory, the color traditionally used by the research hospital. These results of this study suggest that the university research hospital offer more interesting colors to their clients. Users were affected by color as an integral part of the environment and were pleased or displeased by the use of color. Users felt that colors had a decided effect on aesthetic and social considerations of the space.

Environmental Factors as affected by Color Preference

In order to further analyze the effect of color preferences on environmental factors an analysis of

variance was performed using the five environmental factors as dependent variables and color preferences for the seven color environments as independent variables. Analysis of combined data revealed that the environmental factors were affected significantly by preferences for color environments (see Table 5).

Insert Table 5 about here

Response to the color boards revealed that there were significant color environments, or treatments, within all factor groups; Five color environments were significant in both the aesthetics and social factor groups. Two colored environments were significant within the design factor group. Three colored environments were significant in the both the physical factor and comfort factor groups. Indications are that color in the environment did affect the factor responses.

Ivory, orange, yellow, and green, less preferred color environments, as well as purple, a preferred color environment, significant for aesthetics, indicated mixed opinions. High mean scores for ivory and orange indicated strong dislike for these colors. Subjects commented that the orange color environment was too neutral in feeling. There were also mixed opinions within the social factor; the least preferred yellow and green color environments had

highly significant mean scores; blue, red and orange environments were also significant, but less decidedly so.

Mean scores for orange, less preferred, and blue, a preferred environment. were significantly different from other color environment scores for the design factor group. There were fewer significant color findings in the design factor. Perhaps subjects did not place importance of color on the design variables rough/smooth, formal/casual, rigid /flexible, rugged/delicate and angled/curved.

Orange and green, less preferred color environments, were highly signficant in the physical factor group; purple, a preferred color environment, was also significantly related. Ivory, least preferred color environment, as well as purple and red, preferred colors environments were also significant for the comfort factor. The data has revealed that the mixed color preferences seem to have affected all environmental factors.

Implications of Findings

Hershberger (1972), in a factor analysis of the bi-polar environmental scale, revealed six dominant variables; including aesthetics, friendliness, organization, potency, space, and ornateness. Other variables including coloring, neatness, size, temperature, light, privacy, shape,

ventilation, noise, rigidity, formalness, texture, time and utility were also deemed necessary for the evaluation of architectural spaces.

Within all three data groups factored in this study, the patterns of the eigenvalues of the 20 bi-polar variable scale followed the same descending order which Hershberger reported. This constant pattern for the order of the variables of the scale serves as a validity check for the Hershberger scale used in this study.

This study profited from the use of Hershberger's scale of variables to measure the meaning of architectural environments. The bi-polar variables applied to patient room spaces in a hospital loaded into five factor groups which were called aesthetic, social, design, physical and comfort. These five factors are especially applicable to the analysis of various kinds of interior environments. Future research could be expanded through the use of Hershberger's scale in future studies of the hospital environment.

This study has found that the users of hospital patient rooms, both patients and staff, perceive significant differences in the environmental setting represented by the various color environments. Aesthetics and design components were considered important in the patient room. Social factors are important to the use of hospital environments for the giving and receiving of care.

Both physical and comfort factors affected the two user groups of the space studied, especially the patient user.

Designers today are charged with the responsibility for the health, safety and welfare of clients. They must address the physical and comfort issues of users. This study confirms the vital importance of this mission. From a design point of view, these findings also confirm the importance of aesthetics and social considerations in the design process of architects, interior designers, and builders as they design for users of hospital environments. Findings of this study should be useful to hospital administrators to enhance hospital patient room environments, in order to attract clients.

Future studies are suggested in the area of the effect of color on behavior in environmental spaces. Since environmental variables have been found to be affected by color, a further extension of this study would be to study how color effects behavior in different environments. Barker's theory (1978) states that certain environments will invoke predicted behavior patterns from the people. The hospital patient room should dictate specific behavioral patterns from people. Future studies could address these behavioral patterns. Future research could also include studies of the use of color in more general areas of hospital environments, and studies which include

both male and female subjects. Future studies might also be useful in other types of public buildings.

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TABLE 1

FACTOR ANALYSIS OF ENVIRONMENTAL VARIABLES

Factor loadings for Patient, Staff and Combined data sets
In order of factors created by the patient data set.
Loadings above .7 were considered signigicant.

	PATIENTS	STAFF	COMBINED
AESTHETIC			
Unique/Common	.7246	.7955	.7979
Colorful/Subdued	.6844	.6822	.6612
Ornate/Plain	.6529	.7642	.6995
Friendly/Hostile	.4973	.5860(1)	.6313(6)
Old/New	-.4648	-.5864	-.6099
SOCIAL			
Private/Public	.7651	.8043	.6995
Large/Small	.7355	.6462	.6529
Loose/Compact	.7038	.8554	.7376
DESIGN I			
Rough/Smooth	.7582	.5620	.6265
Formal/Casual	.7515	.7459	.7702
PHYSICAL			
Angled/Curved	.7262	-.4979(2)	.8083(7)
Clean/Dirty	.5802	.5861	.6841
Useful/Useless	.5658	-.4661(3)	.6304
Light/Dark	.5397	.5564(4)	.6551
DESIGN II			
Rigid/Flexible	.8158	.7393	.5229
Rugged/Delicate	.5855	.5346	-.5262(6)
COMFORT I			
Warm/Cool	.7706	-.5558	-.6413
Quiet/Noisy	.5594	.7421(5)	.5699(5)
COMFORT II			
Drafty/Stuffy	.8336	.6112	.7118
Ordered/Chaotic	.4214	.8247(1)	.6455(6)
VARIANCE EXPLAINED	.6280%	.6370%	.6050%

(1) In PHYSICAL factor for STAFF.
(2) In AESTHETIC factor for STAFF.
(3) In DESIGN factor for STAFF.
(4) In COMFORT factor fo STAFF.
(5) In SOCIAL factor for STAFF and COMBINED.
(6) In PHYSICAL factor for COMBINED.
(7) In DESIGN II factor for COMBINED.

For STAFF SOCIAL split into SOCIAL I and SOCIAL II.
For STAFF DESIGN was a single factor.
For STAFF and COMBINED, COMFORT was a single factor.
For COMBINED DESIGN split into DESIGN I and DESIGN II.

TABLE 2

ORDER OF FACTOR LOADINGS BY DATA GROUPS

Including variance explained by factors

TOTAL VARIANCE EXPLAINED BY DATA GROUPS

PATIENTS	STAFF	COMBINED
AESTHETIC	AESTHETIC	PHYSICAL
2.3150	2.9424	3.3546
SOCIAL	DESIGN	AESTHETIC
2.2452	2.876	2.047
DESIGN I	PHYSICAL I	SOCIAL
1.8655	2.5393	2.1761
PHYSICAL	SOCIAL	DESIGN I
1.6967	2.500	1.8431
DESIGN II	SOCIAL II	DESIGN II
1.6008	1.6616	1.2736
COMFORT I	COMFORT	COMFORT
1.5718	1.4036	2.100
COMFORT II		
1.2645		
Variance 12.56	12.73	12.10
Factors 20	20	20
Variance Explained .6280	.6370	.6050

TABLE 3

ANOVA OF ENVIRONMENTAL FACTORS BY COLOR OF PATIENT ROOM

COMBINED PATIENT AND STAFF DATA

Source	Number of Subjects	Mean Square Treatments	F Value	PR>F
AESTHETICS	322	167.2134	14.22	.0001 ***
SOCIAL	322	29.5496	2.22	.0384 *
DESIGN	320	7.4572	.80	.5718
PHYSICAL	322	43.6410	1.95	.0739
COMFORT	321	2.7849	.94	.4693

Treatment: Seven room colors =6 DF

* Significant at .05.

*** Significant at .0001.

TABLE 4

MEANS OF ENVIRONMENTAL FACTORS BY PATIENT ROOM COLOR

COMBINED PATIENT AND STAFF DATA

DUNCAN'S MULTIPLE RANGE TEST

FACTOR: AESTHETICS

Color:	Purple	Blue	Red	Green	Orange	Yellow	Ivory
Number	52	45	44	43	48	50	41
Mean	12.75	11.93	11.61	10.88	10.21	8.74	7.27
	A	AB	ABC	BC	C	D	E

FACTOR: SOCIAL

Color:	Green	Red	Orange	Blue	Purple	Ivory	Yellow
Number:	43	44	48	45	52	41	50
Mean:	13.14	12.79	12.79	12.60	12.36	12.31	10.74
	A	A	A	A	A	A	B

Harmonic mean of cell sizes 45.85
Mean scores with same letters/not significantly different.

TABLE 5

ANOVA: ENVIRONMENTAL FACTORS X ROOM COLOR PREFERENCE
For COMBINED PATIENT AND STAFF DATA
Data analyzed using 5 point Likert type scale:4DF

Room Color	# Sub.	Mean Square Treatment	F value	Pr>F	
	AESTHETICS				
Orange	43	55.6649	7.59	.0001	****
Blue	40	28.8981	2.50	.0580	
Purple	47	34.8386	3.38	.0164	*
Yellow	45	43.3595	5.27	.0014	***
Green	38	41.4178	4.80	.0031	**
Red	39	24.7306	1.97	.1182	
Ivory	36	38.4269	8.12	.0001	****
	SOCIAL				
Orange	42	31.2318	2.94	.0311	*
Blue	40	37.8647	4.24	.0059	**
Purple	47	30.8216	2.06	.1010	
Yellow	45	68.1512	8.54	.0001	****
Green	38	75.2327	11.24	.0001	****
Red	39	32.0374	3.50	.0176	*
Ivory	36	16.7298	1.25	.3076	
	DESIGN				
Orange	42	16.9661	3.30	.0193	*
Blue	39	19.7625	3.09	.0265	*
Purple	47	14.4429	1.77	.1512	
Yellow	45	8.9853	.78	.5422	
Green	37	21.9309	2.50	.0591	
Red	39	7.6768	.60	.6664	
Ivory	36	10.2569	1.10	.3728	
	PHYSICAL				
Orange	43	105.1701	7.50	.0001	****
Blue	40	38.8982	1.89	.1312	
Purple	47	55.1624	3.74	.0100	**
Yellow	45	60.2632	2.37	.0670	
Green	38	123.4941	6.33	.0005	***
Red	39	26.1496	1.90	.1294	
Ivory	36	31.5192	1.42	.2487	
	COMFORT				
Orange	43	.2878	.13	.9686	
Blue	39	1.2034	.41	.7975	
Purple	47	6.6549	2.76	.0386	*
Yellow	45	3.4315	1.41	.2455	
Green	38	4.7211	1.07	.3832	
Red	39	7.4739	3.14	.0249	*
Ivory	36	11.9655	4.04	.0083	**

* Sig./.05, ** Sig./.01, *** Sig./.001. **** Sig./.0001.

CHAPTER V

INTERIOR DESIGN FOR HOSPITALS: PREFERENCES OF PATIENTS AND STAFF FOR COLOR IN THE ENVIRONMENT

Proposed article for JIDER

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ABSTRACT CHAPTER V

INTERIOR DESIGN FOR HOSPITALS:

PREFERENCES OF PATIENTS AND STAFF

FOR COLOR IN THE ENVIRONMENT

The purpose of this study was to explore the preferences of two subject groups, patients and staff, for color in the hospital patient room. The study was conducted in a Southwest university hospital. The research was exploratory in nature since no previous studies have studied color in this way; it was quasi-experimental because subjects were exposed to a treatment, color in the environment. Six rooms were each painted in a different hue or color, including the three primary colors (red, yellow, blue) and the three secondary colors (green, orange, purple). A seventh room evaluated, was left in the ivory color currently used in the hospital for patient rooms. Three values of each color were used within the room; a shade on one wall, a tone on two walls, and a tint on the ceiling. Four of five color preference indicators were significantly related to room colors; an overall color preference color index indicator using summed scores of the five preference indicators was established. Preferences for values of the colors purple, blue and red were found. Yellow and ivory were the least liked colors. A total of 323 subjects were surveyed.

CHAPTER V

INTERIOR DESIGN FOR HOSPITALS: PREFERENCES OF PATIENTS AND STAFF FOR COLOR IN THE PATIENT ROOM

Introduction

Color is an important design element. Interior design for any space is concerned with color and it's effect upon the users of the space. Hospital environments are often sterile and frightening to patients; they can also be stressful work environments for the hospital staff. Color experts (Mahnke, 1981) believe that the carefully planned use of color in hospital spaces can provide interest as well as comfort and reassurance to patients, the primary users of hospital spaces. Porter (1982) writing about hospital design and construction suggests that carefully executed interior design of hospital spaces can increase staff satisfaction and efficiency.

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The purpose of this study was to explore the preferences of patients and staff for color in the patient room. Specifically the objectives of the study were: to analyze the effects of individual color preferences on the preferences of the patient and staff for different color environments, and to assess the preferences of patients and staff for different values of color.

Previous Research

Color and Health Care Design

In the prosperous years following World War II, the American hospital industry was greatly expanded as a result of the Hospital Survey and Construction Act, or Hill-Burton Act of 1946, passed by Congress which granted or loaned money to the states for new hospital facilities. Medicare and Medicaid legislation followed in 1966, expanding federal medical expenditures further. Douglas (1972) declared health care to be the fastest growing industry in the country.

By 1983, the federal government declared medical costs to be out of control and passed legislation mandating price ceilings on reimbursement procedures for hospital costs. Due to these controls hospitals have gone from overcrowded to underused with vacancy rates as high as 69% (Shumaker and Piquemat, 1989). Hospital construction also has steadily

fallen off beginning in 1985 and continuing through the decade (Powills, 1987).

As a result of these changes many services previously provided in hospitals are now being provided in other kinds of treatment centers and clinics. The market for hospital care has become a buyer's market. Health care providers, in order to attract customers, are seeking ways to humanize hospital spaces. The trend is toward more homelike spaces with comfortable furniture and colorful surroundings. One of the first areas within hospitals to embrace this residential trend was the obstetrics ward (Gaskie, 1986). Ruga (1989), founder of the National Symposium of Health Care Interior Design, writes on behalf of design that supports healing and urges interior designers to strive to create environments which promote the well being of the patient.

In studies of a mental hospital ward, Sommer and Dewar (1963) suggested that careful attention be given to the physical environment of the hospital. Findings indicated that long term patients were significantly less likely to complain about their surroundings than short term patients. Katz (1931) found that short term mental patients prefer colors from the short wavelengths of the spectrum (blue, green, violet) while long term patients prefer colors from the long wavelengths of the spectrum (red, orange, yellow).

The concept of color and its influence on the interior design environment of hospitals was the topic of the National Bureau of Standards special workshop called, "Color in the Health Care Environment" in 1978.
Marcella Graham, interior design speaker, equated the skillful and educated use of color to the skillful and educated use of any language. Graham (1978) suggested that color plays an important role in the human perception of the world, and in feelings of health and well being. Graham identified six areas in which color effects the user and the environment: physiological, visual, cognitive, mood, impressionistic, and associative areas.

Malkin (1982), discussing health care design, points to color theory and research revealing some generalities about the use of color: longer wavelength colors at the warm end of the spectrum (red, orange, yellow) are exciting and advancing colors, while shorter wavelength color at the cool end of the spectrum (blue, green, purple) are quieting and retreating colors. Malkin suggests that all hospital environments should include both warm and cool colors in order to keep the spaces interesting to users. Birren (1983) also felt that color schemes should include warm and cool colors. Birren indicated that after short periods of response people adapt to color in a space. The use of more than one color or value of colors in spaces should be more interesting and less tiring to users.

Birren (1949, 1969) proposed that warm colors, since they are stimulating, would be appropriate for convalescent types of patients, and that cool subdued colors would give a more relaxed mood for chronic patients. Birren suggested that soft tones are best for patients room whether in warm or cool hues, and proposed the use of light green and blue-green for cool color usage and light oranges or yellows for warm color usage. Sloan (1944), early twentieth century editor of The Modern Hospital, summarized earlier publications in the book Hospital Colors and Decoration. Sloan proposed planned color schemes for hospital spaces with the four exposures of north, south, east and west in mind.

Mahnke and Mahnke (1987) suggested that five colors in particular should be rejected for use in hospitals: (1) white, due to glare and the emotional sterility of the hue, (2) red, due to overstimulation if used in pure intensity, (3) purple, due to the afterimage of yellow-green, (4) blue, which causes depression in light values and (5) yellow-green, which is not complementary to human complexions.

The warmth and coolness of colors was studied by Newhall (1941) at John Hopkins University. His findings supported the common beliefs that green and blue seem to be cool colors, and that red and yellow suggest warmth. Smets (1969) found that the perception of time spent under warm

color stimulus was perceived to be shorter than time spent under cool color stimulus. The results of these two studies could impact the patient's perception of temperature and time spent in a color environment.

Rabin (1981), a health design consultant in New York, suggests that color is universally misused in hospitals, because it is generally selected in a haphazard manner. "It has become nothing more than a hit-or-miss proposition, because designers and hospital personnel entrusted with its magical powers know little about human response to color" (Rabin, 1981, p.78).

The largest body of recent empirical research related to health care design was performed at the University of Michigan prior to the replacement of their teaching hospital in the mid 1980's (Carpman, 1984, 1986). In a program called the "Patient and Visitor Participation Project", 33 different studies explored all phases of hospital design. Although several of these studies dealt with the patient room and bath, color in the patient room was not addressed. Carpman, J. R. (September, 1989, personal communication) citing the lack of color research dealing with health care facilities, urged further research into that phase of the hospital environment.

Tetlow (1989) reported the success of the Rudolph Steiner Seminary in Jarna, Sweden, which uses the properties of architecture, color and art in the process of healing.

Patients are assigned to rooms of cool or warm hues according to the nature of their illness. Cancer patients are assigned warm colored accommodations.

In some cultures, colored lights are used in the process of healing. Physicians in England and India are the most experienced in the use of colored light therapy. Copen (1975) explains the use of colored treatment lamps and light filters reflecting seven different colors each of which heals a particular part of the body. Colored light treatments deal with additive light theory. This study is concerned with pigment color applied to interior surfaces, which is a part of subtractive color theory. If the findings of this study do show implications for the effects of pigment color usage in the patient room, it would be interesting to know if there are correlations between pigment color usage and colored light therapy.

Color Preferences

Empirical research in the area of color preferences began in the late nineteenth century. In 1941, H.J. Eysenck of University College, London, performed color preference research and was able to review the work of fifty other color researchers. There was disagreement about the general order of preferences for color.

Eysneck averaged the rankings of the findings of 17 researchers, which placed color preferences in the order of

blue, red, green, violet, orange, and yellow. Eysenck found that all previous investigators had included the saturated primary colors (red, yellow, blue) and the secondary colors (orange, green, violet) among the colors studied. Eysenck found that there are no differences in color preferences between sexes or races and that the factor of color saturation was secondary to the color preference factor.

Walton, Guilford, and Guilford (1933) at the University of Nebraska involved 1279 students in color preference research over a period of 14 years (1920-33). The Milton Bradley series of chromas was used in these studies. General patterns of preferences were for blue, red, green, orange, and yellow. Violet was not shown in these studies. Guilford and Smith (1959) used the Munsell system of colors in later studies at the University of Southern California.

Dorcus (1926) at Johns Hopkins University, was one of the first researchers to explore the color preferences of different age groups. He studied children, college age students and two groups of adults. The most unusual finding among aged adults was the preference for violet. Spruiell and Jernigan (1982) studied women over 65 and found blue to be the most popular color for clothing. Tate and Allen (1985) studied older males and females and found that both sexes prefer light colors to dark colors.

Two major color preference systems have evolved in the twentieth century which relate to color preferences and personality, the Luscher Color Test (Scott, 1969) and the Pyramid Color and Personality Test devised by Schaie and Hess (1964). Looking for differences in personality traits, Akhtar and Singh (1974) in India revealed a significant difference in the order of color preferences between criminals and noncriminals.

The "Blue Seven Phenonmenon" study by Simon (1971) asked college aged subjects to write the name of a color, as well as a number between one and nine; blue was the most often mentioned color and seven the most often mentioned number. Further "Blue Seven" studies have been performed in other countries. Findings have revealed that in Australia (Trueman, 1979) and in East Africa (Philbrick, 1976) the blue phonomenon held, but with lower percentages.

In the Netherlands and India the color red replaced blue as the first color chosen (Wiegersma & Van der Elst, 1988, Krishna, 1972). D'hondt and Vandewiele (1983) found West African primary students liked brown and five; secondary students liked black and nine. These differences in other countries seem to indicate that there are differences in color preference by race and culture. The recent American studies of Silver, McCulley, Chambliss and Charles (1988) at Tulane University support Simon's "Blue Phenomenon". Subjects of both sexes and races (black and white) chose the color blue and the number seven most often.

Methodology

This research may be considered exploratory because no controlled studies involving color in the hospital environment has been performed. It may also be considered quasi-experimental since subjects were exposed to a treatment, different colors and values of color within the patient room environment.

Setting for the Study

The setting for this study was a group of seven two-bed patient rooms in a hospital in the Southwest. The patient rooms were painted in the three primary colors (red, yellow, blue) and the secondary colors (green, purple, orange). One room in the ivory color currently used by the hospital was also evaluated.

The internationally standardized Munsell (1946) color notation system was used to standardize the research. All hues were taken from the Munsell student color charts; hues included were the Munsell colors R (red), Y (yellow), B (blue), G (green), P (purple), and YR (yellow red). The Munsell system does not have an orange; therefore YR (yellow red) was used to represent the hue O (orange).

Within the patient rooms of the study, three values of each hue were used. The wall behind the patient beds was

painted in a shade of the hues (6 value/4 chroma). The wall opposite the beds and the exterior wall beside the beds were painted a tone of the hues (8 value/2 chroma). The ceiling was painted with the same tone (8 value/2 chroma) mixed with half white which produced a tint of the hues. A spectrometer was used to analyze the student color chips and mix reproducable paint values of each hue.

Patient rooms used in the study were located on the South side of the hospital on the fourth floor. Natural light entered the rooms through one large window on the wall opposite the beds. There were two sources of artificial light: (1) a fluorescent fixture (80 watts) mounted on the wall above each patient bed provided both up and down light; (2) an incandescent quartz spot light (500 watts) mounted directly over the patient beds served as an examination light for physicians.

Subjects

Subjects in the study were patients on the obstetrics ward and a cross section of staff in a university hospital in a Southwestern state. Approximately 25 patients and 21 staff subjects were surveyed in each color environment. A total of 323 subjects were surveyed; 176 patients and 147 staff.

The selection of the patients occurred due to their assignment to a room on the obstetrics ward following delivery of their babies. Since all patients on the obstetrics ward were female and not selected randomly, some bias could occur within the findings. All subjects were of the same gender and fairly young in age. The birth of a child is a happy event; other patients with more serious illnesses might have more depressing attitudes.

In order to randomize the order of the survey of the subjects the use of the Latin square technique was employed (Fisher and Yates, 1963). A Latin Square in the 7 X 7 format was chosen, because there were seven patient rooms involved in the study. The purpose for using the arrangement dictated by the Latin square was to reduce the error which could occur as a result of differences in the order of rooms and also the time at which the rooms were visited to collect data.

The systematic selection of staff was made using every fourth entry from a list of hospital employees (n=1230). This composite list was made up of lists of the various types of jobs by department, with the names of employees holding those jobs. The Latin square technique was also used to assign staff to different rooms for environmental color evaluation.

Instrumentation

Subjects were asked to evaluate the hue of one patient room environment in detail and to rate the other six hues using a color board. Questions relating to preferred values of the hues used within the rooms were included. Subjects were also asked to name their favorite colors. Patient questions related to their use of the space as a client/consumer; staff questions related to their use of the environment as a workplace.

Data Collection

Patients were surveyed in the room color environments between the hours of 10 AM and 2 PM, so that colors would be evaluated in daylight. Patients were surveyed during the months of January, February and March. The staff was surveyed between the hours of 2 PM and 4 PM, after the end of the day shift and before the beginning of the evening shift. Staff surveys were conducted during the month of April. The researcher was present to answer questions during the completion of the questionnaire.

Discussion of Findings

The chi square statistic was used to analyze the color preferences of subjects for the hues of the seven rooms, their preferences for the three values of hues (tint, tone,

shade) used in the patient room spaces and for an overall choice between the three values used. These five color preferences were called color preference indicators.

Patient data was analyzed separately from staff data; the two data sets were then merged and analyzed together. Results (see Table 6) from the analysis of all three groups of data revealed that four of the five findings for the color preference indicators related to room color were highly significant in all three groups of data analyzed.

Insert Table 6 about here

Findings related to preference for room color, the shade behind the bed, the tone opposite the bed and an overall choice between the values were all significant at .000 for all groups surveyed. Findings related to the preference for the ceiling color were not significant (P=.296).

The findings related to color preference are explained in more detail by the Table 7 which is composed of the chi square tables for merged patient and staff data, and report the responses to the color preference questions by room color (see Table 7).

Insert Table 7 here

The significance of the preference for room color for merged data was related to the very high scoring of three hues: P (purple), B (blue) and R (red), and to the very low scoring of two hues: Y (yellow) and I (ivory). Note that 34% of all colors evaluated were given the highest score of 5 on the Likert scale; purple, blue and red were the three highest rated colors. Conversely 25% of all colors evaluated were given the lowest score of 1 on the Likert scale, yellow and ivory were the two lowest rated colors. Colors were liked very much or not at all.

Mixed opinions were also related to the preference for the shade behind the bed, where the high scoring colors: P (purple), B (blue) and R (red) were opposed by the low scoring colors: Y (yellow) and G (green). Here 33% of all colors evaluated were given the highest score of 5 on the Likert scale; purple, blue and red were the highest rated colors. Conversely 29% of the colors evaluated were given the lowest score of 1 on the Likert scale; yellow and green were the lowest rated colors.

Preferences for the tone opposite the bed was also significant. However, the preferences were similiar in nature: 38% of all scores were the highest score 5 on the Likert scale. The tone opposite the bed was highly preferred in five of the seven room colors. The preference for the tone overall (41%) among the three values used in the room also confirmed the preference for tones.

A majority of 48% of all subjects liked the tint of the ceiling, but these scores did not prove to be significant.

In order to understand the full impact of the wide variance of color preference scores, it is interesting to look at the scores of individual room color preferences by percentages (see Table 8).

Insert Table 8 about here

The hue P was highly preferred by 58% (30) of the subjects surveyed in the purple environment, the hue B by 50% (22) of subjects surveyed in the blue environment and the hue R by 48% (21) of the subjects surveyed in the red environment. These three colors: purple, blue and red were the most popular colors in the patient room environments.

The hue Y was least preferred by 66% (30) of the subjects surveyed in the yellow environment; the hue I by 37% (15) of the subjects surveyed in the ivory environment. The yellow room was the most disliked of all color spaces. The Y hue in the Munsell system is a yellow with green in its mixture; perhaps the public would call it yellow-green. The I hue was disliked but not so decidedly.

The preference for shade values (6 value/4 chroma) of the walls behind the beds was also significant. The P shade values were highly preferred by 54% (28) of the subjects surveyed in the purple environment, R shade values by 45% (20) of the subjects surveyed in the red environment and B

shade values by 44% (20) of the subjects surveyed in the blue environment. Conversely two of the hues were least preferred: Y by 80% (40) of subjects surveyed in the yellow environment and G by 43% (18) of the subjects surveyed in the green environment.

The preferences for the tone values (8 value/ 2 chroma) of the walls opposite the patient beds were decided. Subjects in five of the seven hues preferred the middle tone value of the hues: by 57% (25) in the B room, by 50% (22) in the R room, by 48% (25) in the P room, by 42% (20) in the O room and by 33% (13) in the G room. The tone of the opposite wall was the lowest on the Likert scale in the I room: ratings were mixed in the Y room,

The overall choice among the three wall values also revealed a preference for the tone of the wall opposite the bed in five of the seven color environments, which reinforced the finding for the middle tone values. Yellow and ivory were the only environments in which the middle value was not preferred. For yellow, the wall behind the bed was preferred; for ivory the ceiling, which was white, was preferred.

The preferences for ceiling values were not significantly related to room color. The lack of significance related to ceiling colors could be related to the fact that the ceiling values were very high (or light); so light that some subjects did not realize that they were not white like other ceilings in the hospital.

To further examine the overall phenomenon of color preferences the scores of the five preference indicators were summed to form a color preference index score for each subject. These average or mean scores should be a stronger overall indicator of color preferences. The analysis of variance was used to compare the individual color preference index scores with the room color variable. Findings resulting from this analysis were highly significant at the .0001 level (see Table 9).

Insert Table 9 and 10 about here

Duncan's multiple range test was used to find which color preferences were significantly different (see Table 10). The color group of blue, purple and red (A mean scores) were the most preferred colors, and were significantly different from green (D mean score) and yellow (E mean score). The color group of purple, red, and orange (B mean scores) as well as the color group of red, orange and ivory (C mean scores) were also significantly different from green (D mean score), and yellow (E mean score). The individual color blue (A) is also significantly different from ivory (C). It is important to note that yellow and green are statistically different from all other groups of colors.

The chi square analysis of room color preference indicator scores had shown blue, purple and red to be the

most preferred hues, and yellow to be the least preferred hue. The means of the color preference index scores as analyzed by Duncan's multiple range test fell into similiar most liked and least preferred groupings. Individual color preferences and the color preference index scores were essentially the same; the color index scores reinforced the individual color preference findings.

The favorite colors listed by patient and staff subjects were blue (43.8%), red (24.1%) and purple (10.6%). These favorite colors are the same as the colors preferred by patients and staff for patient room colors in this study, but were not found to be significantly related. For room color preferences, three hues were highly preferred: red by 56.2%, purple by 54.8% and blue by 50.8% of all subjects surveyed.

Implications of Findings

Findings for the study have profound implications for the color usage in hospital spaces. The hues preferred by patients and staff for patient rooms were established (purple, blue and red) and it was found that these preferences are the same as the favorite colors of subjects (blue, red and purple), although not exactly in the same order. The findings of the study therefore suggest that the hospitals would please patients and staff by using these

preferred colors in patient room spaces. Significant findings were also found for colors least preferred by subjects (yellow and ivory). These findings suggest that these colors should not be used in hospital spaces.

There were significant findings supporting the preference of subjects for the use of tone values of hues (wall opposite bed) in the patient room. The preference of subjects for the use of shade values (wall behind bed) was also significant, but opinions were mixed. Findings related to ceiling tint values were not significant. The more complex color preference index findings confirmed the findings for individual colors most and least preferred for the patient room.

The study findings for blue as favorite color and red as second favorite color is consistent with previous color preference research. Findings for purple as third favorite color are not consistent with previous empirical color preference research. It is important to note that there are fashion trends which are believed to affect color preferences; the color purple is currently a trend color.

Historically, studies have found green to be the most common third color preferred. The color green has had a prominent place in hospital color usage in previous decades, but is not in fashion at present. Most previous color preference studies have found yellow to be the least

preferred color; the findings of this hospital study were consistent with previous studies of color preferences in general.

Trend colors and their cycles of usage would be an interesting subject for future empirical studies. Other future studies might address color usage in the more general areas of the hospital, for example in nursing station areas, examination areas, treatment rooms and waiting rooms. Visitors and family, the third population who are users of the hospital, were not addressed in this study, but should be considered in future studies.

The findings of this study can serve as a foundation for further color research in other areas of interior design. Further research is particularly needed for institutional types of buildings which serve large groups of the public.

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TABLE 6

COLOR PREFERENCES OF PATIENTS AND STAFF

CHI SQUARE STATISTIC

Five Color Preference Indicators By Seven Room Colors

INDICATOR	DF	X VALUE	PROBABILITY
Merged Patient and Staff Data:			
Like Room Color	24	108.772	.000
Like Shade Behind Bed	24	117.649	.000
Like Tone Opposite Bed	24	73.915	.000
Like Tint of Ceiling	24	27.190	.296
Overall Value Preference	12	94.583	.000
Patient Data:			
Like Room Color	24	54.984	.000
Like Shade Behind Bed	24	96.942	.000
Like Tone Opposite Bed	24	59.607	.000
Like Tint of Ceiling	24	26.138	.346
Overall Value Preference	12	62.929	.000
Staff Data:			
Like Room Color	24	79.209	.000
Like Shade Behind Bed	24	53.165	.000
Like Tone Opposite Bed	24	67.498	.000
Like Tint of Ceiling	24	23.450	.493
Overall Value Preference	12	47.221	.000

24 DF:7 room colors X 5 point Likert scale.

12 DF:7 room colors X 3 value choices.

TABLE 7

COLOR PREFERENCES OF PATIENTS AND STAFF

Chi Square Statistic

Merged Patient/Staff Data Likert Scale (5 Point)

Expected values in parenthesis. All values in whole numbers

S	Orange	Blue	Purple	Yellow	Green	Red	Ivory	Total	%
Do you like the color of the room?								Sig. at .000	
1	8(12)	2(11)	7(13)	33(13)	10(11)	7(11)	15(10)	82	25
2	7 (5)	4 (4)	4 (5)	6 (5)	5 (4)	1 (4)	5 (4)	32	10
3	10 (8)	5 (8)	7 (8)	6 (8)	5 (7)	7 (7)	13 (7)	53	16
4	9 (7)	12 (6)	4 (7)	3 (7)	6 (6)	10 (6)	2 (6)	46	14
5	14(16)	22(15)	30(18)	2(17)	15(15)	21(15)	6(14)	110	34
T%	48(15)	45(14)	52(16)	50(15)	43(13)	44(14)	41(13)	323	
Like the shade of the wall behind the bed?								Sig. at .000	
1	11 (4)	4(13)	6(15)	40(14)	18(12)	6(13)	7(12)	92	29
2	5 (3)	3 (3)	1 (4)	5 (3)	3 (3)	3 (3)	2 (3)	22	7
3	10 (7)	7 (6)	6 (7)	1 (7)	6 (6)	8 (6)	6 (6)	44	14
4	13 (9)	11 (8)	11(10)	3 (9)	4 (8)	7 (8)	10 (8)	59	18
5	9(16)	20(15)	28(17)	1(16)	11(14)	20(14)	16(13)	105	33
T%	48(15)	45(14)	52(16)	50(16)	42(13)	44(14)	41(13)	322	
Do you like the tone on the opposite wall?								Sig. at .000	
1	3 (6)	3 (6)	3 (7)	12 (6)	5 (5)	2 (6)	14 (5)	42	13
2	2 (4)	1 (3)	3 (4)	5 (4)	5 (3)	0 (3)	8 (3)	24	8
3	12(10)	8 (9)	7(11)	13(10)	5 (8)	13 (9)	9 (8)	67	21
4	11(10)	7 (9)	14(10)	10(10)	12 (8)	7 (9)	2 (8)	63	20
5	20(18)	25(17)	25(20)	9(19)	13(15)	22(17)	7(15)	121	38
T%	48(15)	44(14)	52(16)	49(15)	40(13)	44(14)	40(13)	317	
Do you like the tint on the ceiling?								Not Sig. at .296	
1	3 (4)	2 (4)	4 (4)	3 (4)	6(3)	2 (3)	5 (3)	25	8
2	5 (3)	3 (2)	3 (3)	3 (3)	0(2)	2 (2)	1 (2)	17	5
3	11(10)	8 (9)	8(11)	11(10)	5(9)	10 (9)	14 (8)	67	21
4	10 (8)	8 (8)	12 (9)	6 (9)	11(7)	3 (8)	6 (7)	56	18
5	19(23)	24(22)	24(25)	26(24)	19(20)	26(21)	15(20)	153	48
T%	48(15)	45(14)	51(16)	49(15)	41(13)	43(14)	41(13)	318	
Choice of overall value: Shade/Tone/Tint								Sig. at .000	
1	10(13)	6(12)	8(15)	31(14)	15(10)	9(11)	7(11)	86	29
2	27(19)	20(17)	23(21)	15(19)	16(14)	19(16)	3(16)	123	41
3	9(14)	16(12)	20(15)	1(14)	4(10)	10(11)	28(11)	88	30
T%	46(16)	42(14)	51(17)	47(16)	35(12)	38(13)	38(13)	297	

TABLE 8

CHI SQUARE STATISTIC

COLOR PREFERENCES BY PATIENT ROOM COLOR

MOST AND LEAST PREFERRED COLORS AND VALUES

For Merged Patient and Staff Data

Color	Likert Score	Percent (Number)	Number in Room
Do you like the color of the room?			Sig. at .000
Purple	5	58% (30)	52
Blue	5	49% (22)	45
Red	5	48% (21)	44
Yellow	1	66% (33)	50
Ivory	1	37% (15)	41
Like the shade of the wall behind the bed?			Sig. at .000
Purple	5	54% (28)	52
Red	5	45% (20)	44
Blue	5	44% (20)	45
Yellow	1	80% (40)	50
Green	1	43% (18)	42
Do you like the tone on the opposite wall?			Sig. at .000
Blue	5	57% (25)	44
Red	5	50% (22)	44
Purple	5	48% (25)	52
Orange	5	42% (20)	48
Green	5	33% (13)	40

TABLE 9

COLOR PREFERENCES OF PATIENTS AND STAFF

ANOVA Analysis of Variance

Color Preference Index Scores By Room Color

Patient and Staff Data (323 subjects)

Source	DF	Sum/Squares	Mean Square	F. Value	PR>F
Color Preference Index Scores	6	1827.8144	304.6357	17.98	.0001

TABLE 10

COLOR PREFERENCES OF PATIENTS AND STAFF

DUNCAN'S MULTIPLE RANGE TEST

Main Effect: Color Preference Index Scores

Patient and Staff Data (323 subjects)

Color:	Blue	Purple	Red	Orange	Ivory	Green	Yellow
Number:	45	52	44	48	41	43	50
Mean:	18.11	18.05	17.43	15.93	14.53	14.30	11.22
	A	AB	ABC	BC	C	D	E

Means with similiar letters not significantly different.
Means with different letters are significantly different
Harmonic Mean of cell sizes: 45.85363

CHAPTER VI

IMPLICATIONS OF FINDINGS

General evaluation of the Patient Room

This study performed a general evaluation of the hospital patient room environment using Hershburger's (1972) scale of twenty bi-polar adjectives. Hershburger called these adjectives a set of semantic scales to measure the meaning of architectural environments. The twenty variables represented by bi-polar adjectives were factor analyzed, and then rotated using the Varimax rotation method. Factor analysis was performed for patient data and staff data separately, and for combined patient and staff data after merging the data groups.

Factor analysis revealed seven factors for patient data, six factors for staff data and six factors for the combined data. Some variation occurred in the placement of variables into factor groups within data groups. However, a common group of five factors evolved which were called: aesthetics, social, design, physical and comfort factors.

Table 11 gives the placement of variables into factors by data group. Note: the variable angled/curved placed by three data groups in three different factors.

Insert Table 11 about here

In factor analysis the most important factor emerges first. In this study the order in which factors emerged for each data group varied somewhat (See Table 2, Chapter IV). In both patient and staff data the aesthetic factor was first. Both groups of subjects were concerned with the uniqueness of the patient room. The social factor ranked second for patients and fourth for staff. Patients were more concerned with the social activities within the space; staff were more concerned with professional activities. The design factor placed second for staff and third for patients. This high placement of the design factor by both groups indicates the importance of design to all users of the patient room space.

The physical factor placed third for staff and fourth for patients when the data was analyzed separately. However, when the patient and staff data were combined and analyzed, the physical factor surprizingly emerges first. The combined data showed that all subjects were first concerned with the physical accomodations of the patient room space. In combined data the aesthetic factor drops to second and the social factor to third place. The design factor which had been second for staff and third for patients then drops to fourth place. Comfort issues fell last for all data groups. These observations should be tempered by the knowledge that some factors were split within data groups, which might affect their value and also the amount of variance explained by the factors.

This study then found that there were decided differences in the findings when user groups were analyzed separately. Architects, interior designers, and hospital administrators will want to evaluate these findings related to the evaluation of the environmental space both in the light of separate opinions and combined opinions of the subject users. The opinions of patients and staff should be both useful and informative to the design community. Hospitals may use the results of this study to discern what elements of design were pleasing and attractive to users of hospital spaces.

Effect of Color on Environmental Factors

An analysis of variance between the five environmental factors and the seven color rooms evaluated revealed that two of the factors, the aesthetic and social factors were significantly related to room color. The significance for the aesthetic factor could be due to the wide variance of means among the colored rooms; some colors (purple, blue, and red) were liked extremely well, and others (yellow and ivory) not well at all. The significance for the social factor can be explained by the fact that the means for all colored rooms, with the exception of one (yellow), are not significantly different. The yellow room was disliked by most subjects. Subjects felt that the social environment of the yellow room was not desirable. (See Table 4 from Chapter IV.)

An analysis of the effect of the preference for colors on environmental factors, (See Table 5 from Chapter IV.) revealed significant findings for all environmental factors. Findings were mixed, especially for the aesthetic factor. There were three sets of color preference groups, the most preferred group of purple, blue, and red, the middle group of green and orange and the least preferred group of yellow and ivory. There seemed to be patterns of these groups of variables in findings of significance within the factors.

Color Preferences in the Patient Room

An indepth study of color preferences of subjects was facilitated by a group of five color preference indicators or choices. These five questions were:

1. Do you like the room color?
2. Do you like the shade of the color behind the bed?
3. Do you like the tone of the color opposite the bed?
4. Do you like the ceiling tint?
5. Do you prefer the shade/tone/tint best?

The chi square statistic was used to analyze the preferences of subjects for the colors of the seven room environments. Findings for four of the five color preference indicators were significant for all data groups. The ceiling tint was the only indicator which showed no significance. Table 7 from Chapter V reveals the statistical inferences for each question.

A color index score was established using the summed scores of the five color preference indicators. Analysis of variance findings were highly significant for a comparison between the color preference index scores and the room color variable. These findings confirmed the chi square findings.

The most preferred patient room colors were red (56.2%), purple (54.8%) and blue (50.8%). Here it is interesting to compare the colors which were listed as the favorite colors of subjects with the room colors preferred by subjects. The favorite colors of blue (42.8%), red (24.1%) and purple (10.6%) were the same colors preferred by subjects for room environments. However, the favorite colors and preferred room colors were not found to be significantly related. Regardless, this correlation would be useful information for designers to know.

There was significance relating to the shades and tones of colors used in patient room environments. The preference of subjects was for the tones on the walls opposite the beds was significant. The significance among shades was as a result of extreme preferences at both ends of the Likert scale. The overall preference for the tones (on the wall opposite the bed) from among the three color values used was also significant.

These findings reveal the subjects to be generally conservative in their preference for values of colors. They liked the middle tones best of all. Subjects were less

interested in the impact of the darker shade on the walls behind the bed, or in the tint of a colored ceiling above. They were looking directly at the tone on walls opposite the bed, and could not see the wall behind or the ceiling as well. Perhaps they found the middle value of the tone to be comforting and soothing.

Findings from this study should be most useful to the design community as they design for healing spaces. The environmental variables grouped into five decided factor groups, called aesthetic, social, design, physical,and comfort. There were significant findings related to all factor groups. These factors could be applied to the analysis of other types of environmental spaces. The color preferences for patient room environments, as well as the preference for the middle values of colors used is important information for the design community and for hospital administrations.

The findings of this study should serve as a foundation for further color research in other types of buildings and interiors. The study has emphasized the importance of aesthetic and design factors, as well as the physical, social, and comfort factors to the design and everyday use of environmental spaces.

TABLE 11

FACTOR GROUPS OF BI-POLAR ENVIRONMENTAL VARIABLES

After Factor Analysis and Varimax Rotation

Aesthetics	Social	Comfort
Unique/Common 3	Private/Public 3	Warm/Cool 3
Colorful/Subdued 3	Loose/Compact 3	Drafty/Stuffy 3
Ornate/Plain 3	Large/Small 3	
Old/New 3	Quiet/Noisy 2 (I-C)	
Angled/Curved 1 (II)		

Physical	Design
Clean/Dirty 3	Rough/Smooth 3
Usefull/Useless 2 (II-D)	Formal/Casual 3
Light/Dark 2 (II-C)	Rigid/Flexible 3
Friendly/Hostile 2 (I-A)	Rugged/Delicate 2 (III-P)
Ordered/Chaotic 2 (I-C)	Angled,/Curved 1 (III)
Angled/Curved 1 (I)	

DATA GROUPS: I=PATIENTS, II=STAFF, III=COMBINED

Aesthetic=A, Social=S, Design=D, Physical= P, Comfort=C

Number 3 indicates placement in factor by all data groups

Number 2 denotes placement in factor by two data groups.

Number 1 denotes placement in factor by one data group.

The parenthesis denotes the variable placement by the third data group and into which factor.

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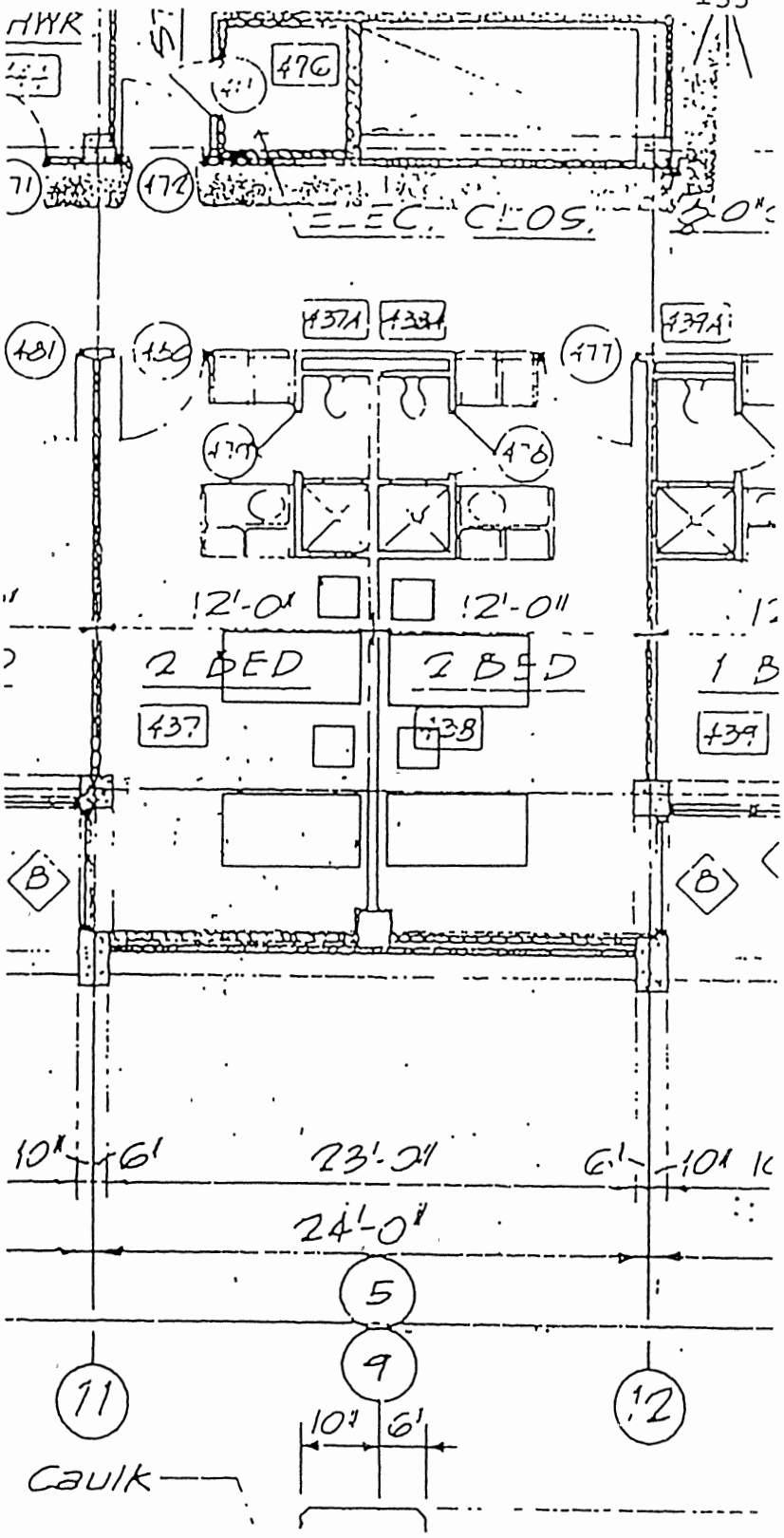
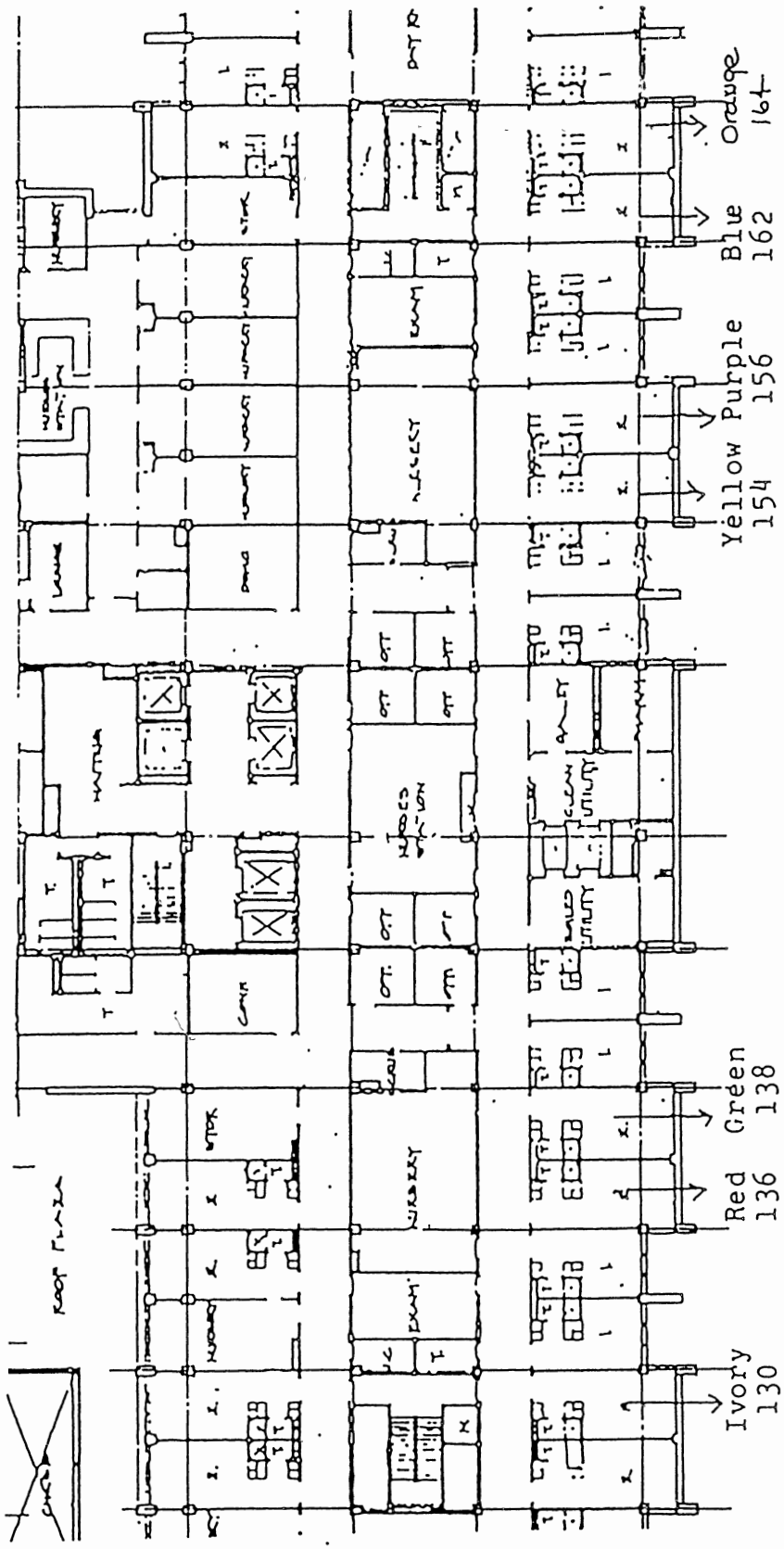
APPENDIX A

FLOOR PLANS OF OKALAHOMA MEMORIAL HOSPITAL



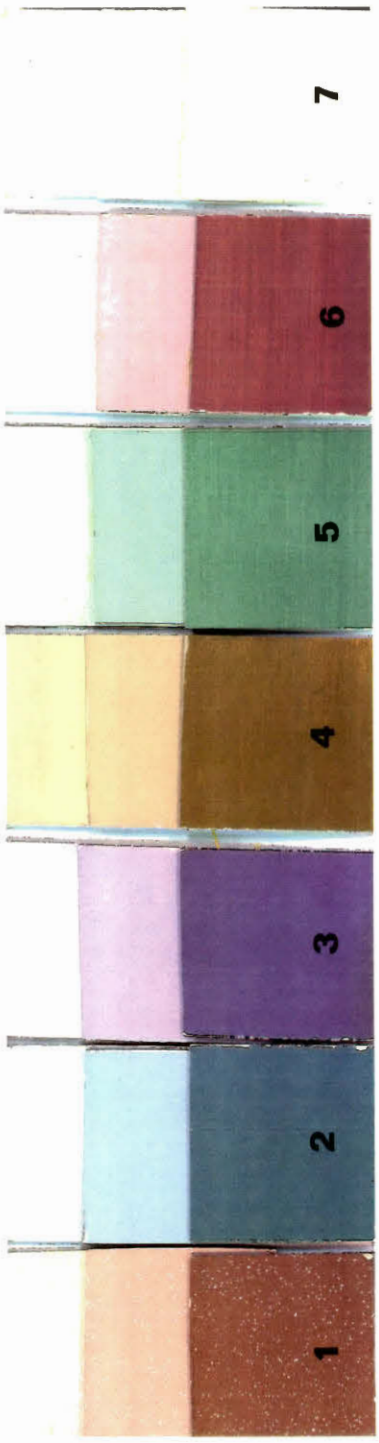
Patient Room



Hospital Ward

APPENDIX B

COLOR SAMPLE BOARD


7
6
5
4
3
2
1

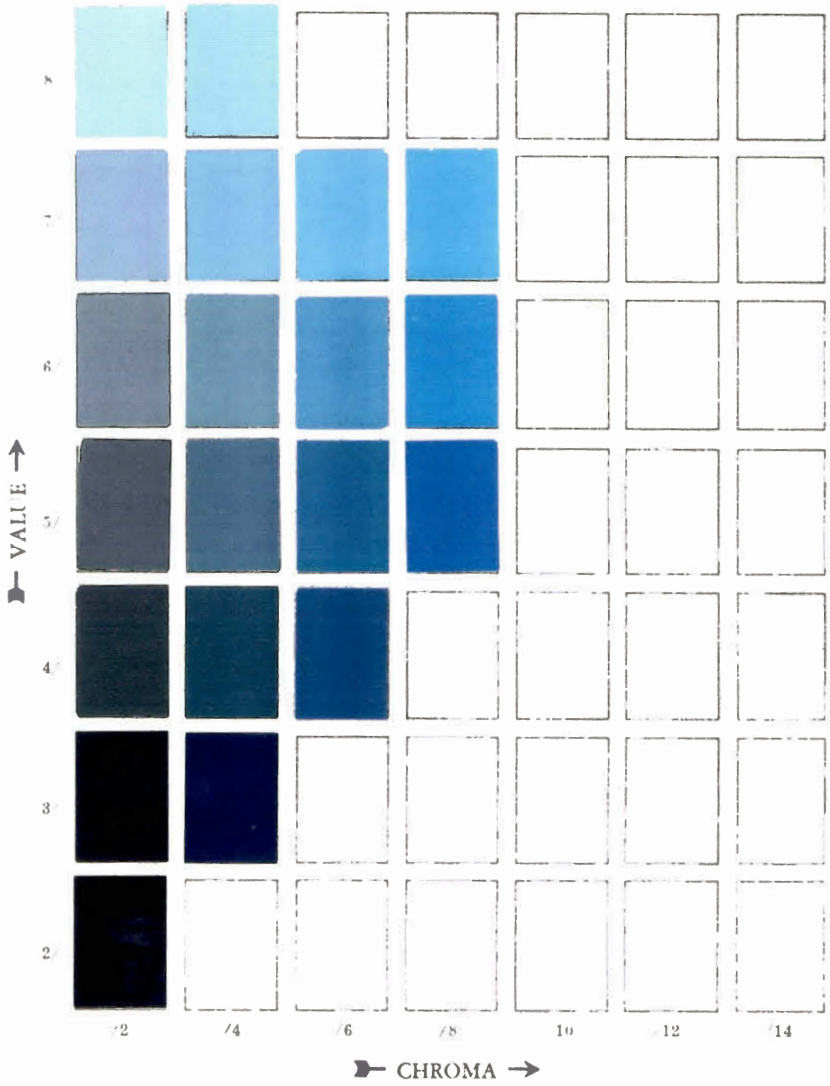
APPENDIX C

MUNSELL COLOR CHARTS

MUNSELL® STUDENT CHART

HUE

5.0 B

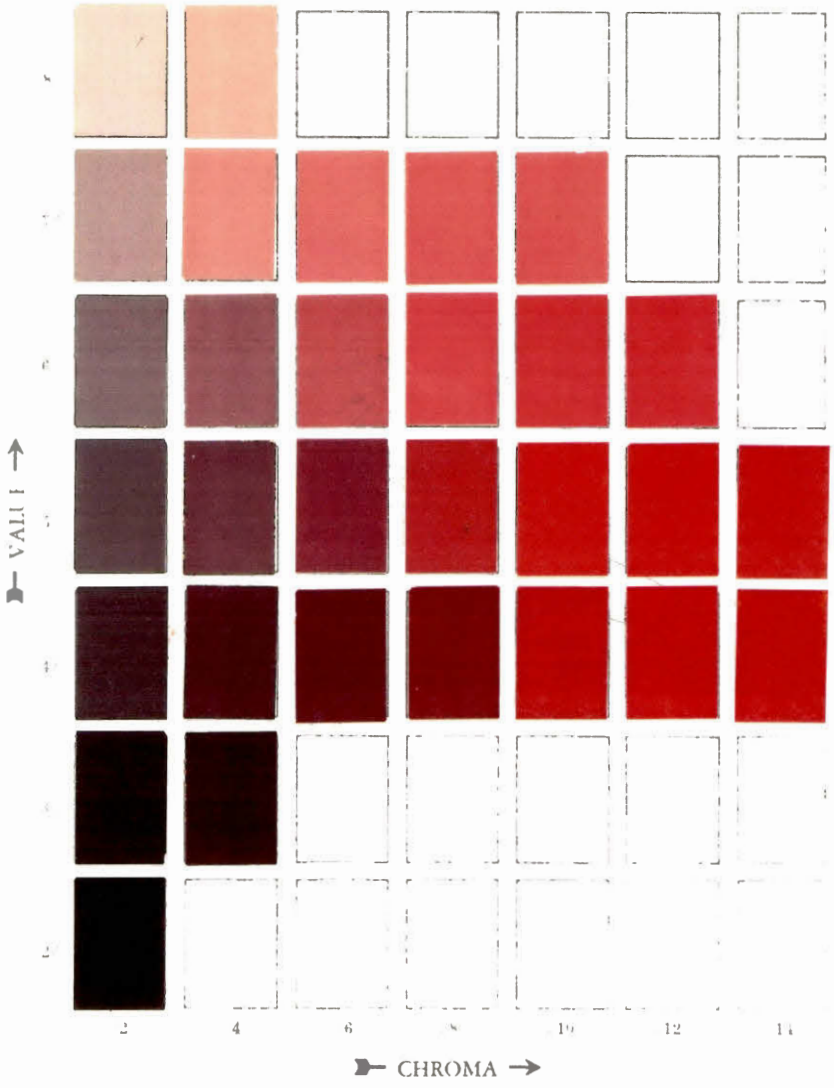


Place the colors of weakest chroma in the vertical column marked /2, and arrange them in the proper value sequence; then build out from these to the strongest chroma on each value level. All spaces will not be filled nor will the shape of the completed charts be the same for all hues. But each completed chart will show visual scales of value and chroma in one particular hue.

MUNSELL® STUDENT CHART

HUE

5.0 R

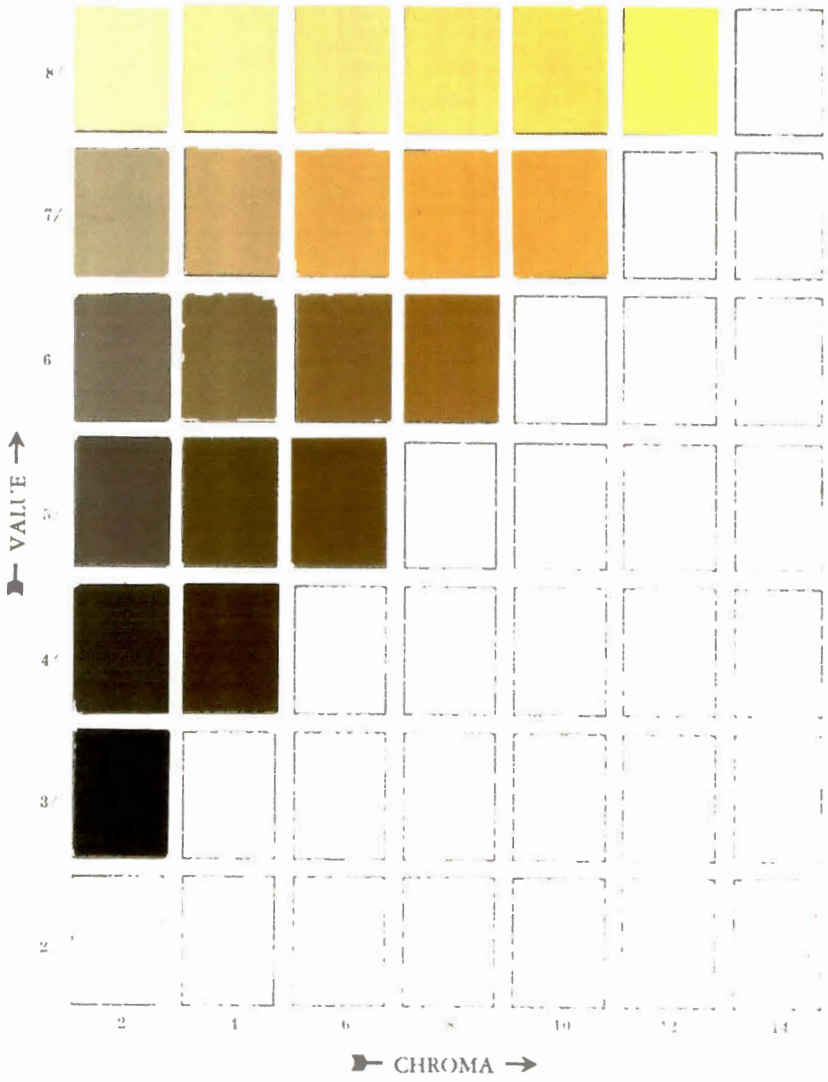


Place the colors of weakest chroma in the vertical column marked /2, and arrange them in the proper value sequence; then hand out from the stock the strongest chroma on each value level. All spaces will not be filled, but all the steps of the completed chart be the same for all hues. But each completed chart will show visual color of value and chroma in one particular hue.

MUNSELL® STUDENT CHART

HUE

5.0 Y

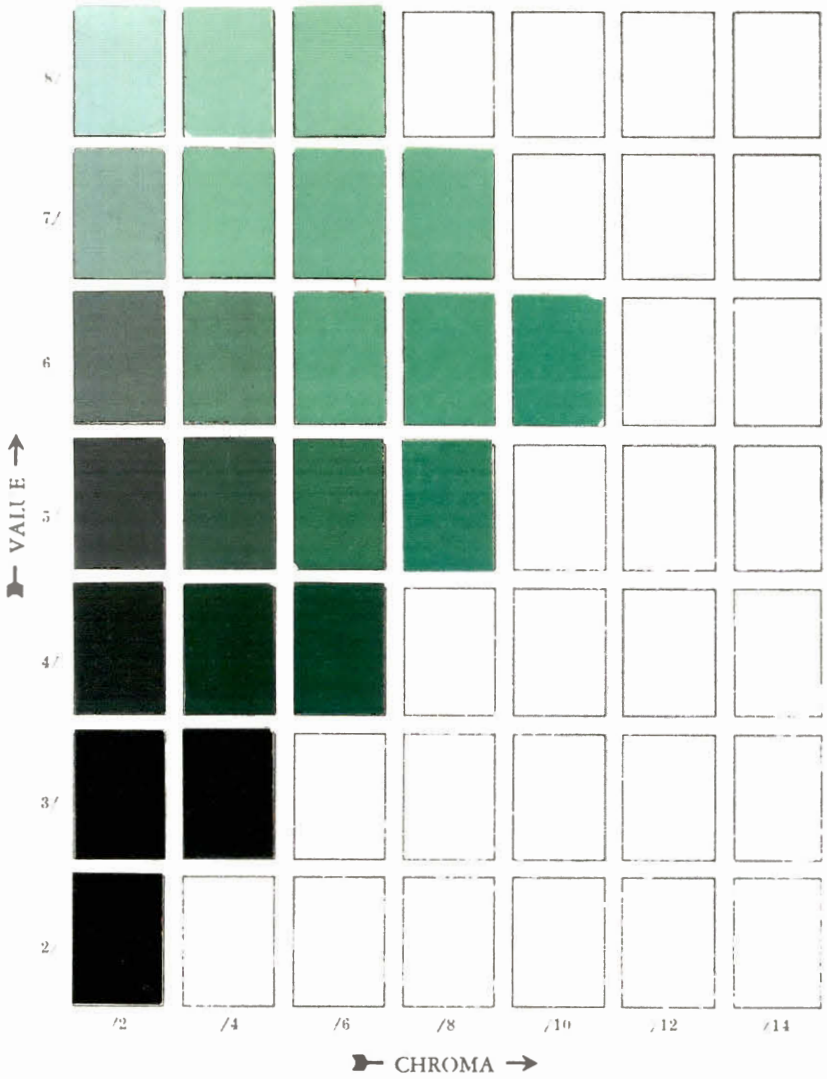


Place the colors of weakest chroma in the central column marked 2 and arrange them in the proper value sequence. Then build out from the 2 on strongest chroma on each value level. All spaces will not be filled. The shape of the completed chart is the same for all hues. But each completed chart will have a unique color at value and chroma in one particular hue.

MUNSELL® STUDENT CHART

HUE

5.0 G

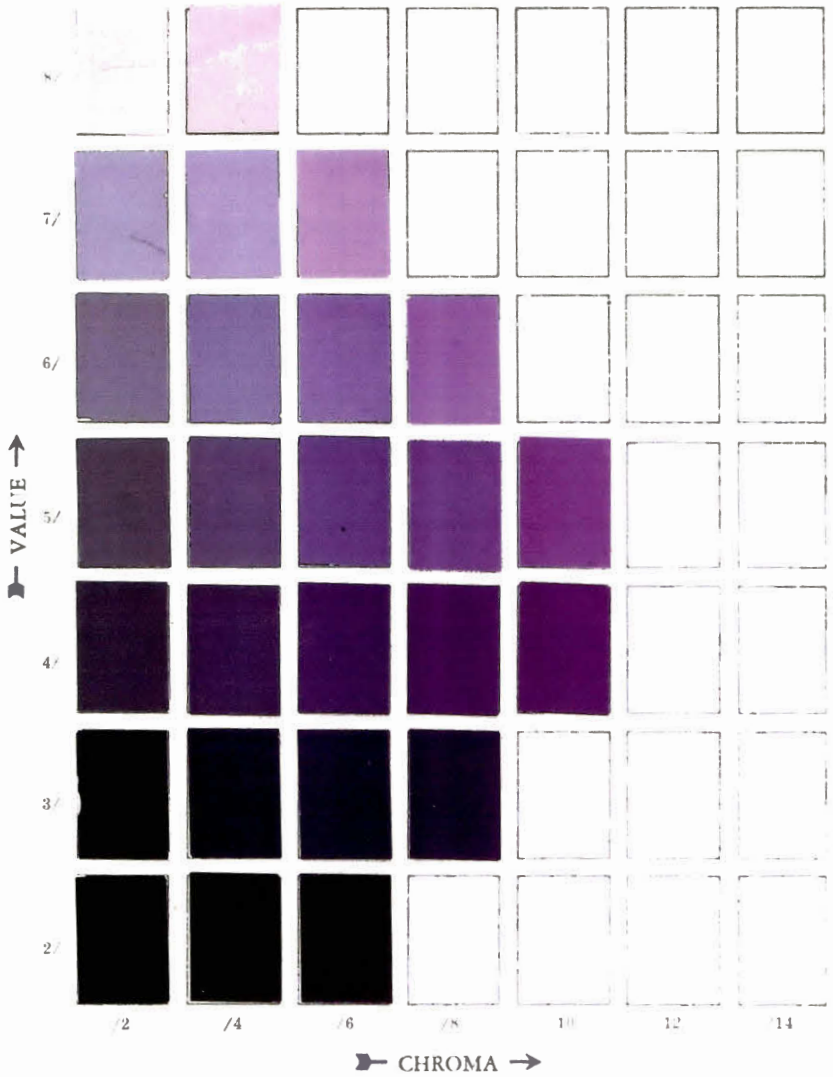


Place the colors of weakest chroma in the vertical column marked /2, and arrange them in the proper value sequence, then build out from these to the strongest chroma on each value level. All spaces will not be filled nor will the shape of the completed charts be the same for all hues. But each completed chart will show visual scales of value and chroma in one particular hue.

MUNSELL® STUDENT CHART

HUE

5.0 P

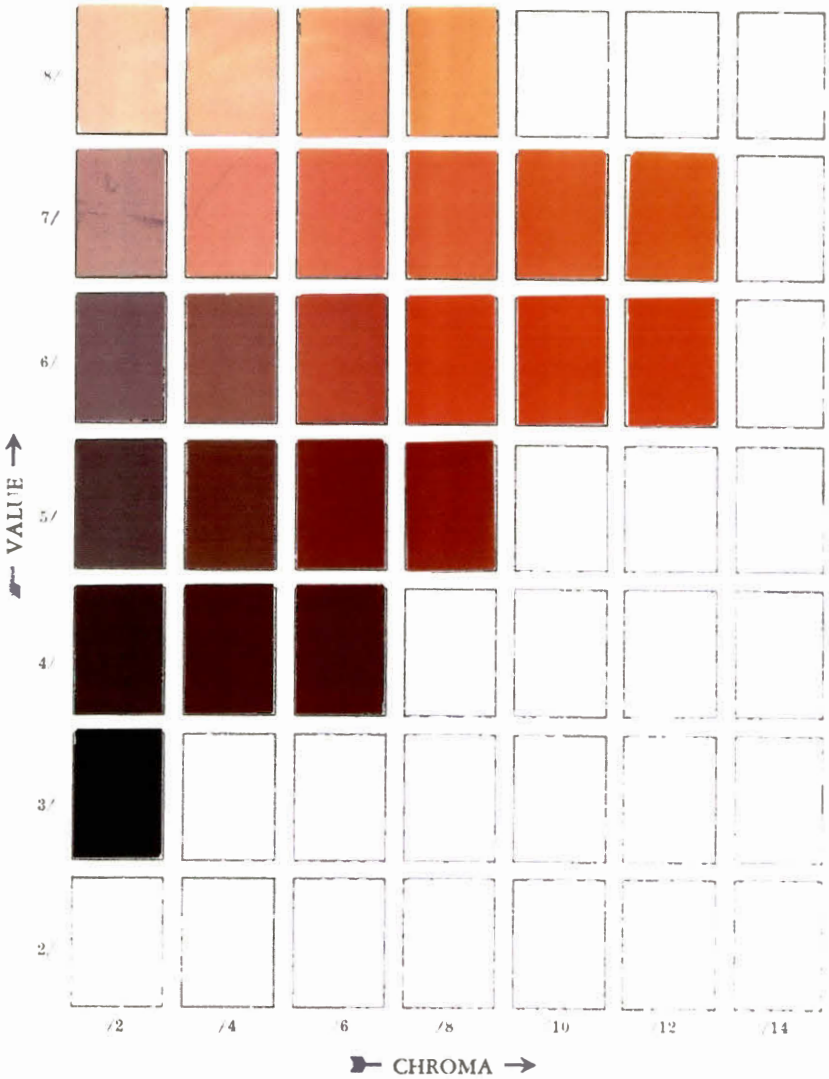


Place the colors of weakest chroma in the vertical column marked /2, and arrange them in the proper value sequence; then build out from these to the strongest chroma on each value level. All spaces will not be filled nor will the shape of the completed charts be the same for all hues. But each completed chart will show visual scales of value and chroma in one particular hue.

MUNSELL® STUDENT CHART

HUE

5.0 YR



Place the colors of weakest chroma in the vertical column marked /2, and arrange them in the proper value sequence; then build out from these to the strongest chroma on each value level. All spaces will not be filled nor will the shape of the completed charts be the same for all hues. But each completed chart will show visual scales of value and chroma in one particular hue.

APPENDIX D

PATIENT QUESTIONNAIRE

Date _____ Time _____ (1)

Room # _____ Bed # _____ (Applies to patients only)

I. GENERAL EVALUTAION: Please evaluate this hospital room using the following scale. Place an X on the scale at the point which best describes your feeling for the room

EXAMPLE: PERFECT_____:_X___:_____:_____:_____ IMPERFECT

Do you feel this room is:

1. UNIQUE _____:_____:_____:_____:_____ COMMON
2. FRIENDLY _____:_____:_____:_____:_____ HOSTILE
3. ORDERED _____:_____:_____:_____:_____ CHAOTIC
4. RUGGED _____:_____:_____:_____:_____ DELICATE
5. LOOSE _____:_____:_____:_____:_____ COMPACT
6. ORNATE _____:_____:_____:_____:_____ PLAIN
7. COLORFUL _____:_____:_____:_____:_____ SUBDUED
8. CLEAN _____:_____:_____:_____:_____ DIRTY
9. LARGE _____:_____:_____:_____:_____ SMALL
10. WARM _____:_____:_____:_____:_____ COOL
11. LIGHT _____:_____:_____:_____:_____ DARK
12. PRIVATE _____:_____:_____:_____:_____ PUBLIC
13. ANGLED _____:_____:_____:_____:_____ CURVED
14. DRAFTY _____:_____:_____:_____:_____ STUFFY
15. QUIET _____:_____:_____:_____:_____ NOISY
16. RIGID _____:_____:_____:_____:_____ FLEXIBLE
17. FORMAL _____:_____:_____:_____:_____ CASUAL
18. ROUGH _____:_____:_____:_____:_____ SMOOTH
19. OLD _____:_____:_____:_____:_____ NEW
20. USEFUL _____:_____:_____:_____:_____ USELESS

II. PERSONAL PREFERENCES: (2)
Please fill in the blanks below.

1. What is your favorite color?

#1_____#2_____ #3_____

2. What colors do you wear most often?

#1_____ #2_____ #3_____

3 What colors have you used in your bedroom at home?

#1_____ #2_____ #3_____

4. What colors have you used in your living room at home?

#1_____ #2_____ #3_____

5. What colors seem cool to you?

#1_____ #2_____ #3_____

6. What colors seem warm to you?

#1_____ #2_____ #3_____

7. What colors make you happy?

#1_____ #2_____ #3_____

8. What colors make you sad?
#1_____ #2_____ #3_____

III. Please rate the colors on the sample board:
Place an X at the point that best describes your like or dislike of the colors.

EXAMPLE:COLOR:LIKE _____:_____:_____:__X___:_____DISLIKE

COLOR #1 LIKE _____:_____:_____:_____:_____DISLIKE

COLOR #2 LIKE _____:_____:_____:_____:_____DISLIKE

COLOR #3 LIKE _____:_____:_____:_____:_____DISLIKE

COLOR #4 LIKE _____:_____:_____:_____:_____DISLIKE

COLOR #5 LIKE _____:_____:_____:_____:_____DISLIKE

COLOR #6 LIKE _____:_____:_____:_____:_____DISLIKE

COLOR #7 LIKE _____:_____:_____:_____:_____DISLIKE

8. Are you color blind? (3)

   Circle answer. NO YES UNCERTAIN

9. If YES, blind to what colors?

   Circle answers. REDS GREENS YELLOWS BLUES ALL

IV. EVALUATION OF PATIENT ROOM

Please rate the color of this patient room with the following mood descriptions:

Place an X at the place on the scale which best describes your mood or feeling for the room color. If you feel the words do not describe the room color, leave the line blank.

	HIGH		MED.		LOW
EXAMPLE: HAPPY	____	__X_	____	____	____
1. PLEASANT	____	____	____	____	____
2. EXCITING, STIMULATING	____	____	____	____	____
3. SECURE, COMFORTABLE	____	____	____	____	____
4. DISTRESSED, DISTURBED, UPSET	____	____	____	____	____
5. TENDER, SOOTHING	____	____	____	____	____
6. PROTECTIVE, DEFENDING	____	____	____	____	____
7. CALM, PEACEFUL, SERENE	____	____	____	____	____
8. DIGNIFIED, STATELY	____	____	____	____	____
9. CHEERFUL, JOVIAL, JOYFUL	____	____	____	____	____
10. DEFIANT, CONTRARY, HOSTILE	____	____	____	____	____
11. POWERFUL, STRONG, MASTERFUL	____	____	____	____	____
12. DESPONDANT, DEJECTED, MELANCHOLY, UNHAPPY	____	____	____	____	____

13. Do you like the color used in this hospital room? Mark with X.

    LIKE _____:_____:_____:_____:_____DISLIKE

14. Or would you prefer another color for this room? Circle your answer. YES NO

15. If YES, what other color? Circle answer. (4)

COLOR #1	COLOR #2	COLOR #3	COLOR #4	COLOR #5	COLOR #6	COLOR #7	OTHER:list. #8
							_____

16. Do you like the color of the wall behind the bed? Mark with X.

LIKE _____:_____:_____:_____:_____DISLIKE

17. Would the color of the wall behind the bed be better if it were: Circle answer

LIGHTER DARKER DULLER BRIGHTER SAME

18. Does the color of the wall behind the bed seem to: Circle answer

COME CLOSER STAY THE SAME MOVE AWAY

19. Do you like the color of the wall opposite the bed? Mark with X

LIKE_____:_____:_____:_____:_____DISLIKE

20. Would the color of the wall oposite the bed be better if it were: Circle answer.

LIGHTER DARKER DULLER BRIGHTER SAME

21. Does the color on the opposite wall make it seem to: Circle answer.

COME CLOSER STAY THE SAME MOVE AWAY

22. Do you like the color of the ceiling of this room? Mark with X.

LIKE _____:_____:_____:_____:_____DISLIKE

23. Would you like the color of the ceiling better if it were: Circle answer.

LIGHTER DARKER DULLER BRIGHTER SAME

24. Does the color of the ceiling make it seem: Circle answer.

HIGHER THE SAME LOWER

25. Overall, do you prefer the color of the: Circle answer.

WALL BEHIND THE BED WALL OPPOSITE THE BED CEILING

26. Does the color in this room make you feel: Mark with X.

COLD _____:_____:_____:_____:_____ HOT

V. DEMOGRAPHIC INFORMATION (5)
Please circle answers to these questions: (P)

1. What is your race? WHITE BLACK ORIENTAL
AM.INDIAN HISPANIC OTHER

2. What is your age? -20 20-29 30-39 40-49 50+

3. What is the color of your hair? BROWN BLONDE BLACK RED GREY

4. What is the color of your eyes BLUE BROWN HAZEL GREEN

5. What type of delivery did you have? VAGINAL C-SECTION

6. What was the date of birth_____
time of birth_____

7. Sex of child: Circle answer MALE FEMALE

8. Order of birth 1 2 3 4 5 6

9. Are you nervous about being in the hospital? Mark X.

VERY NERVOUS_____:_____:_____:_____:_____NOT NERVOUS

10. Do you consider yourself to be:

Mark X. SHY_____:_____:_____:_____:_____OUTGOING

VI. DO YOU HAVE ANY COMMENTS?

A. About the color of your room:

B. About the study:

APPENDIX E

STAFF QUESTIONNAIRE

Date _____ Time _____ (1)

Room # _____ Bed # _____ (Applies to patients only)

I. GENERAL EVALUTAION: Please evaluate this hospital room using the following scale. Place an X on the scale at the point which best describes your feeling for the room

EXAMPLE: PERFECT_____:_X___:_____:_____:_____ IMPERFECT

Do you feel this room is:

1. UNIQUE _____:_____:_____:_____:_____ COMMON
2. FRIENDLY _____:_____:_____:_____:_____ HOSTILE
3. ORDERED _____:_____:_____:_____:_____ CHAOTIC
4. RUGGED _____:_____:_____:_____:_____ DELICATE
5. LOOSE _____:_____:_____:_____:_____ COMPACT
6. ORNATE _____:_____:_____:_____:_____ PLAIN
7. COLORFUL _____:_____:_____:_____:_____ SUBDUED
8. CLEAN _____:_____:_____:_____:_____ DIRTY
9. LARGE _____:_____:_____:_____:_____ SMALL
10. WARM _____:_____:_____:_____:_____ COOL
11. LIGHT _____:_____:_____:_____:_____ DARK
12. PRIVATE _____:_____:_____:_____:_____ PUBLIC
13. ANGLED _____:_____:_____:_____:_____ CURVED
14. DRAFTY _____:_____:_____:_____ _____ STUFFY
15. QUIET _____:_____:_____:_____:_____ NOISY
16. RIGID _____:_____:_____:_____:_____ FLEXIBLE
17. FORMAL _____:_____:_____:_____:_____ CASUAL
18. ROUGH _____:_____:_____:_____:_____ SMOOTH
19. OLD _____:_____:_____:_____:_____ NEW
20. USEFUL _____:_____:_____:_____:_____ USELESS

II. PERSONAL PREFERENCES: (2)
Please fill in the blanks below.

1. What is your favorite color?

#1_____#2_____ #3_____

2. What colors do you wear most often?

#1_____ #2_____ #3_____

3 What colors have you used in your bedroom at home?

#1_____ #2_____ #3_____

4. What colors have you used in your living room at home?

#1_____ #2_____ #3_____

5. What colors seem cool to you?

#1_____ #2_____ #3_____

6. What colors seem warm to you?

#1_____ #2_____ #3_____

7. What colors make you happy?

#1_____ #2_____ #3_____

8. What colors make you sad?
#1_____ #2_____ #3_____

III. Please rate the colors on the sample board:
Place an X at the point that best describes your like or dislike of the colors.

EXAMPLE:COLOR:LIKE _____:_____:_____:__X___:_____DISLIKE

COLOR #1 LIKE _____:_____:_____:_____:_____DISLIKE

COLOR #2 LIKE _____:_____:_____:_____:_____DISLIKE

COLOR #3 LIKE _____:_____:_____.____:_____DISLIKE

COLOR #4 LIKE _____:_____:_____:_____:_____DISLIKE

COLOR #5 LIKE _____:_____:_____:_____:_____DISLIKE

COLOR #6 LIKE _____:_____:_____:_____:_____DISLIKE

COLOR #7 LIKE _____:_____:_____:_____:_____DISLIKE

8. Are you color blind? (3)

   Circle answer. NO YES UNCERTAIN

9. If YES, blind to what colors?

   Circle answers. REDS GREENS YELLOWS BLUES ALL

IV. EVALUATION OF PATIENT ROOM

<u>Please rate the color of this patient room with the following mood descriptions</u>:

Place an X at the place on the scale which best describes your mood or feeling for the room color. If you feel the words do not describe the room color, leave the line blank.

		HIGH		MED.		LOW
	EXAMPLE: HAPPY	____	__X_	____	____	____
1.	PLEASANT	____	____	____	____	____
2.	EXCITING, STIMULATING	____	____	____	____	____
3.	SECURE, COMFORTABLE	____	____	____	____	____
4.	DISTRESSED, DISTURBED, UPSET	____	____	____	____	____
5.	TENDER, SOOTHING	____	____	____	____	____
6.	PROTECTIVE, DEFENDING	____	____	____	____	____
7.	CALM, PEACEFUL, SERENE	____	____	____	____	____
8.	DIGNIFIED, STATELY	____	____	____	____	____
9.	CHEERFUL, JOVIAL, JOYFUL	____	____	____	____	____
10.	DEFIANT, CONTRARY, HOSTILE	____	____	____	____	____
11.	POWERFUL, STRONG, MASTERFUL	____	____	____	____	____
12.	DESPONDANT, DEJECTED, MELANCHOLY, UNHAPPY	____	____	____	____	____

13. Do you like the color used in this hospital room? Mark with X.

    LIKE _____:_____:_____:_____:_____DISLIKE

14. Or would you prefer another color for this room? Circle your answer. YES NO

15. If YES, what other color? Circle answer. (4)

COLOR #1	COLOR #2	COLOR #3	COLOR #4	COLOR #5	COLOR #6	COLOR #7	OTHER:list. #8
							_____

16. Do you like the color of the wall behind the bed? Mark with X.

LIKE _____:_____:_____:_____:_____DISLIKE

17. Would the color of the wall behind the bed be better if it were: Circle answer

LIGHTER DARKER DULLER BRIGHTER SAME

18. Does the color of the wall behind the bed seem to: Circle answer

COME CLOSER STAY THE SAME MOVE AWAY

19. Do you like the color of the wall opposite the bed? Mark with X.

LIKE____:_____:_____:_____:_____DISLIKE

20. Would the color of the wall oposite the bed be better if it were: Circle answer.

LIGHTER DARKER DULLER BRIGHTER SAME

21. Does the color on the opposite wall make it seem to: Circle answer.

COME CLOSER STAY THE SAME MOVE AWAY

22. Do you like the color of the ceiling of this room? Mark with X.

LIKE _____:_____:_____:_____:_____DISLIKE

23. Would you like the color of the ceiling better if it were: Circle answer.

LIGHTER DARKER DULLER BRIGHTER SAME

24. Does the color of the ceiling make it seem: Circle answer.

HIGHER THE SAME LOWER

25. Overall, do you prefer the color of the: Circle answer.

WALL BEHIND THE BED WALL OPPOSITE THE BED CEILING

26. Does the color in this room make you feel: Mark with X.

COLD _____:_____:_____:_____:_____ HOT

27. Rate your ability to evaluate the skin color of patients in the color of this room. (5) (S)
Mark with X.

EXCELLENT_____:_____:_____:_____:_____POOR

28. Evaluate patient room colors: Use the sample board.
Mark X to describe use of colors in a hospital room.

COLOR #1 EXCELLENT _____:_____:_____:_____:_____POOR

COLOR #2 EXCELLENT _____:_____:_____:_____:_____POOR

COLOR #3 EXCELLENT _____:_____:_____:_____:_____POOR

COLOR #4 EXCELLENT _____:_____:_____:_____:_____POOR

COLOR #5 EXCELLENT _____:_____:_____:_____:_____POOR

COLOR #6 EXCELLENT _____:_____:_____:_____:_____POOR

COLOR #7 EXCELLENT _____:_____:_____:_____:_____POOR

V. DEMOGRAPHIC INFORMATION
Please circle the answers to these questions:

1. What is your race? WHITE BLACK ORIENTAL AM.INDIAN HISPANIC OTHER

2. What is your age? -20 20-29 30-39 40-49 50-59 60+

3. What is the color of your hair? BROWN BLONDE BLACK RED GREY

4. What is the color of your eyes? BLUE BROWN HAZEL GREEN

5. What is your sex? MALE FEMALE

6. What is your position on the hospital staff?
NURSE DOCTOR STUDENT ADMIN. MAINTENANCE VOLUNTEER

7. How much time do you spend in patient rooms each day?
15 MIN 30 MIN 1 HR 2 HRS 4 HRS 8 HRS

VI. DO YOU HAVE ANY COMMENTS?
A. About the color of the room:

B. About the study:

APPENDIX F

SCALING THE ASSOCIATION BETWEEN COLORS AND MOOD-TONES

K. Warner Schaie

These values may be contrasted with the intercorrelations among scales for each single group of raters shown in Table II, which for all color-mood combinations average 0 051 and 0 079 for the two groups of judges respectively It appears, then, that the variance common to the two groups of raters for any given scale is much in excess of the average relation among a sample of scales originating from the same judges

Since the scales shown in Table I are ratio-scales (by definition of our scaling model) the assumptions for Pearson product-moment correlation are met, and intercorrelations can be computed among all the scales for both groups of judges These correlations are shown in Table II, the correlations for Group I being above, and those for Group II below, the diagonal Another test of the hypothesis that the scale-structure for the two groups of judges is identical was made by means of an adaptation of the Kolmogorov-Smirnow test [11] The largest discrepancy fails to reach significance at the 1% level of confidence, and there is every reason to believe that differences in the magnitude of the intercorrelations are due to chance

Interpretation of the scale values obtained in this experiment suggests that the mood exciting, stimulating has its strongest association with yellow and orange, secure, comfortable' with blue, 'distressed, disturbed, upset' with black, 'tender, soothing with blue, 'protective, defending' with red; 'despondent, dejected, melancholy, unhappy' with gray and black, 'calm, peaceful, serene' with blue, white, and gray, 'dignified, stately with purple, black, and blue, cheerful, jovial, joyful' with yellow, 'defiant, contrary, hostile with black, and powerful, strong, masterful' with black

A descriptive schema ordering the mood-descriptions with respect to each color is summarized in Table III These findings confirm in part the results reported by Wexner although transpositions occur, particularly where the colors added in the present study assume a significantly high or low scale-position

Reliability of scale-values While there is good replication of scale-values from one sample of judges to the next, the question still remains as to how reliable our scales would be when scaling is repeated by the same judges Such a repetition was carried out by the judges in Sample II after a 3-mo interval Scale-values obtained on the two occasions were correlated and Table IV lists the stability coefficients for the repeated scaling These were found to range from 0 78 for protective, defending' to 0 98 for 'pleasant' and 'exciting, stimulating

Factorial structure of the system of color-mood scales A centroid factor-

[11] K W Schaie, Tests of hypotheses about differences between two intercorrelation matrices, *J exp Educ*, 26, 1958, 241 245

TABLE III

DESCRIPTIVE SCHEME FOR THE ASSOCIATION BETWEEN COLORS AND MOOD TONES

Color	Strong association	Little or no association
Red	protective, defending, powerful, strong, masterful, (exciting, stimulating)*	Calm, peaceful, serene; tender, soothing
Orange	exciting, stimulating	calm, peaceful, serene, tender, soothing; dignified, stately
Yellow	exciting, stimulating, cheerful, jovial, joyful, pleasant	dignified, stately, despondent, dejected, melancholy, unhappy; protective, defending, powerful, strong, masterful
Green		dignified, stately; protective, defending, powerful, strong, masterful; despondent, dejected, melancholy, unhappy
Blue	pleasant, secure, comfortable, tender, soothing, (calm, peaceful, serene, exciting, stimulating)	distressed, disturbed, upset, despondent, dejected, melancholy, unhappy, defiant, contrary, hostile
Purple	dignified, stately, (despondent, dejected, melancholy, unhappy)	exciting, stimulating; cheerful, jovial, joyful
Brown	(secure, comfortable)	cheerful, jovial, joyful; defiant, contrary, hostile; exciting, stimulating, powerful, strong, masterful, pleasant
White	tender, soothing, (calm, peaceful, serene)	exciting, stimulating; despondent, dejected, melancholy, unhappy, defiant, contrary, hostile; distressed, disturbed, upset; powerful, strong, masterful
Gray	despondent, dejected, melancholy, unhappy (calm, peaceful, serene)	exciting, stimulating, defiant, contrary, hostile; powerful, strong, masterful, cheerful, jovial, joyful
Black	distressed, disturbed, upset, defiant, contrary, hostile, despondent, dejected, melancholy, unhappy, dignified, stately, powerful, strong, masterful	exciting, stimulating, secure, comfortable; tender, soothing; cheerful, jovial, joyful, calm, peaceful, serene, pleasant

* Parentheses indicate moderate associations or mood-tones whose scalar order varied between the two groups of judges.

TABLE IV

STABILITY COEFFICIENTS FOR SCALE-VALUES FROM REPEATED RATING BY THE SAME JUDGES (N = 20)*

(1) Exciting, stimulating	.98
(2) Secure, comfortable	86
(3) Distressed, disturbed, upset	90
(4) Tender, soothing	.95
(5) Protective, defending	78
(6) Despondent, dejected, melancholy, unhappy	86
(7) Calm, peaceful, serene	91
(8) Dignified, stately	86
(9) Cheerful, jovial, joyful	94
(10) Defiant, contrary, hostile	.84
(11) Powerful, strong, masterful	.92
(12) Pleasant	.98

* One of the original judges was unavailable for the repeat experiment.

analysis was next performed on the correlation matrix for Group I, leading to the extraction of six factors, four of which could be interpreted after appropriate orthogonal rotation. The second matrix was then factored and rotated to the structure suggested by the first matrix, resulting in essential replication, even though there were some minor differences. No direct comparison or exact test of significance seemed available, but the outcome of the test of the differences between the two correlation-matrices would tend to suggest that any differences between the samples in factor loadings are predominantly a function of chance variability.

Factor I was identified as an activity-passivity factor. The cluster at the active extreme included the mood tones 'exciting, stimulating', 'cheerful, jovial', and 'pleasant.' At the passive extreme the mood-tones were 'distressed, disturbed', 'despondent, dejected', 'calm, peaceful', 'dignified, stately.' The second factor seemed to relate to the positive or negative quality of the emotional tone of the mood state. At its positive end it included the descriptions 'calm, peaceful', 'secure, comfortable', 'tender, soothing', 'dignified, stately', and 'pleasant.' The mood tones having negative qualities included 'distressed, disturbed', 'despondent, dejected', and 'defiant, contrary.' Factor III was identified as a factor of strength or power. It included the scales 'secure, comfortable', 'protective defending', 'dignified, stately', 'defiant, contrary, hostile', and 'powerful strong masterful.' Factor IV seemed to be concerned with emotional control or mastery of the situation with 'protective, defending' at the positive and 'despondent, dejected' at the negative extreme.[12]

It should be stressed that the factors described above do not refer to a clustering of mood-tones *per se* but rather to the clustering of color-associations to mood-tones. To clarify this matter, scale values were summed for each color over the scales having substantial loadings on each factor. Factor I (activity-passivity) is positively associated with yellow and negatively associated with black and purple and to a lesser extent with gray and brown. Factor II (quality of emotional tone) is positively associated with blue, somewhat positively with gray, white and yellow, and negatively associated with black. Factor III (mood strength) is positively associated with black, blue, purple, and red and negatively associated with green and yellow. Factor IV (emotional control) is positively associated with black, somewhat positively with purple, and negatively associated with yellow and green.

These findings invite comparison with Tannenbaum and Osgood's

[12] Contributions of these factors to the common variance are approximately as follows: Factor I, 26%, Factor II, 27%, Factor III, 21%, Factor IV, 15%.

data.[13] Our activity-passivity factor seems to match their activity factor. In both studies yellow appears at the active and purple at the passive end. The match is not as good for some of the other colors. Our factor involving quality of emotional tone would seem to correspond to Osgood's evaluative factor. Here there is a distinct discrepancy, since these authors report yellow to be at the positive extreme, while in the present study it was found to be at the negative end of the factor. The disagreement on the evaluative dimension may well be a function of the particular stimulus-objects selected for the study. Our factor of mood strength could correspond to their potency-factor, for which ordering of colors in terms of saturation is reported, which seems to be supported by our findings.

Summary

The association between 11 adjectival mood descriptions as well as the term 'pleasant' with 10 colors was scaled by means of a variation of the constant sum method using the constant stimulus model. Scale values were obtained for each color on each mood term from two groups of judges, one of which repeated judgments after a three month interval. Scale-values show reasonably good replication from one group of raters to the other and for the same group over time. Low and high scale values are well replicated but many changes of position occur for intermediate values. Some colors are found to be associated with several mood tones and some mood tones are associated with more than one color.

Intercorrelations of scale values between colors and mood tones were factored and four factors were identified. These factors were interpreted as the dimensions of activity-passivity, quality of emotional tone, mood-strength and emotional control.

Previous findings of associative relations between colors and mood-tones as well as some of their semantic dimensions are confirmed. A methodology producing reasonable stable scales is described. Findings of scalar consistencies as well as a wide range of individual differences suggest the desirability of future normative studies.

[13] Tannenbaum and Osgood, *op. cit.*, 282-285.

APPENDIX G

REPORT OF PILOT STUDY

INTERIOR DESIGN FOR HOSPITALS: PREFERENCES OF PATIENTS AND STAFF FOR COLORS IN THE PATIENT ROOM

Results of Pilot Study:

Questionnaire Survey was performed at a Southwestern hospital on January 3 and January 9, 1991.

18 patients & 10 staff surveyed; Total of 28 subjects.

Demographics of two populations surveyed.

PATIENTS:

Age:	-20	20-29	30-39
	8	8	2

Race:	White	Black	Hispanic	Am. Indian
	10	6	1	1

Type of Delivery:	Vaginal	C-Section
	14	4

Non-Response:	Unable to read English	Incomplete
	1	1

Colors Evaluated:

Orange	Blue	Violet	Yellow	Green	Red	Neutral
3	2	4	2	3	2	2

STAFF:

Age:	20-29	30-39	40-49	50-59
	4	4	1	1

Race:	White	Black	Hispanic	Am. Indian
	6	2	1	1

Position on staff:

Nurse	Student	Adm.	Main.	Interior Designer
4	3	1	1	1

Non-Response:	Refusals
	2

Colors Evaluated:

Orange	Blue	Violet	Yellow	Green	Red	Neutral
2	2	1	0	3	2	0

APPENDIX H

PHYSICAL DATA FORM FOR PATIENT DATA

STUDY OF COLOR IN THE PATIENT ROOM

RECORDS OF PHYSICAL DATA FOR PATIENTS: Date _____

Room #_____

Bed # _____

I. Record of Vital Signs:

	Day #1	Day #2	Day #3
Temp.	_____	_____	_____
Pulse	_____	_____	_____
B.P.	_____	_____	_____

II. Record of Medications:

	Amt.	Amt	Amt.
Med:	_____	_____	_____
Med:	_____	_____	_____
Med:	_____	_____	_____
Med:	_____	_____	_____

Amt. of Med: Below Av._____ Average _____ Above Av._____

III. Length of Stay in Hospital:

Date and time of entry: _____

Date and time of discharge:_____

IV. Nurse Notes Concerning Progress of Patient:

_____

_____

_____

APPENDIX I

DEMOGRAPHIC DATA FOR PATIENTS AND STAFF

BASIC DEMOGRAPHIC DATA RELATED TO PATIENTS AND STAFF

SEX:	Male	Female	Total
Patients		100.0 %	147
Staff	10.3%	89.7 %	176

RACE	White	Black	Orien.	Am.Ind.	His.	Other
Patients	56.1	31.8	1.2	.6	9.8	.6 %
Staff	69.0	20.0	2.1	3.4	2.1	3.4 %

AGE	-20	20-29	30-39	40-49	50-59	+60
Patients	32.2	55.6	9.9	2.3		%
Staff	2.1	22.8	38.6	22.1	10.3	4.1 %

The subjects of this study were primarily female due to the fact that patients were obstetrics patients. In addition, the nursing profession is primarily a female profession, as is the clerical staff of the hospital. Traditionally empirical studies have found no appreciable difference in color preferences by sex, therefore the findings of the study should be applicable to both sexes.

The majority of patients were white (56.1%) with the second largest group being black (31.8%) and the third group being Hispanic in racial make-up (9.8%). The staff were predominantly white (69.0%) with the second largest group being black (20.0%).

The age of patient was younger than that of the staff of the hospital. Most patients were in the 20-29 age group (55.6%). The second largest group was less than 20 years old (32.25%). Patients came from the inner city neighborhoods of Oklahoma City as well as from other cities across the state. The university teaching hospital also cares for patients with special problems.

The staff were older generally than the patients. The largest group of staff (38.6%) were in the 30-39 age group, followed by 22.8% in the 20-29 age group and 22.1% in the 40-49 age group. There were some nursing students among the staff who were not fully professional in status.

The Chi Square statistic was used to analyze the merged patient and staff data. There were a number of significant findings within the data. Following is a brief discussion of these findings:

Sex X Rate the Yellow Room Color:

Significant at the .027 level.

Both males and females rated yellow as the least preferred color on the five point Likert scale.

Males by 60% and females by 66.41%.

Sex X Rate the Ivory Room Color:

Significant at the .017 level

Extreme opinions: males rated higher generally

females rated lower generally.

Race X Rate Yellow Room Color:

Significant at the .018 level.

Most races rated yellow as least preferred on the five point Likert scale (65.73% overall).

Age X Rate Red Room Color:

Significant at the .002 level

All age groups rated the red room as most preferred on the five point Likert scale (52.08%).

Favorite Color X Rate Orange Room Color:

Significant at the .044 level.

Ratings were middle to low generally.

Like the Room Color X Room Color:

Significant at the .000 level.

Yellow found to be least preferred by 66%

Blue found to be most preferred by 50%

Purple found to be most preferred by 57.6%

Red found to be most preferred by 47.73%

This pattern the overall important color preference findings of the study (see Chapter V).

Favorite Color X Color worn:

Significant at .000

Favorite Colors: Blue 43.95%, Red 24.2, Purple 10.19%

Colors worn: Blue 44.45, Red 20.70, Black 16.24.

Findings Indicate that favorite colors are also worn most often. Exception: Black, a wardrobe basic color.

Favorite Color X Bedroom Color:

Significant at .000

Favorite Colors: Blue 43.55%, Red 24.19%, Purple 10.32%

Bedrooms Colors: Blue 30.32%, White 24.84%, Red 13.23%

Findings indicate that favorite colors were also chosen for bedroom usage. Exception: The color white; neutral colors were found to be an important part of the pattern of color usage in interior design spaces. Exception: Purple was not an important bedroom color preference.

Favorite Color X Living Room Color:

Significant at .002 level.

Favorite Color: Blue 43.63%, Red 24.20%, Purple 10.51%

Living Room Colors: Beige/Brown 30.57%, White 22.29%, Blue 19.11%.

Findings indicate that the favorite color blue was chosen for living room usage. Exceptions: Beige/brown and white; neutrals were found to be an important part of the pattern of color usage in interior design spaces. Exception: Red

and purple were not important choices for living room spaces.

APPENDIX J

ANALYSIS OF DATA CHARTS

ANALYSIS OF DATA CHART

Below is a chart listing the five objectives of the research plan as well as methods of statistical analysis used to analyze data related to each objective.

Objectives	Statistical Test
Number 1:	
Assess the effect of environmental factors on preferences of the patient and staff for colors of the patient room	Means Factor Analysis ANOVA for Patients and Staff
Number 2:	
Assess effects of psychological factors on preferences of the patient and staff for colors of the patient room	Means Factor Analysis ANOVA for Patients and Staff
Number 3:	
Analyze impact of personal color preferences on preferences of the patient and staff for hues of colors of the patient room	Means Chi Square ANOVA, Duncan's MR for patients and staff

Number 4:	
Assess the impact of preferences of patients and staff for three values of color hues within the patient room	Means Chi Square ANOVA, Duncan's MR for patients and staff
Number 5:	
Assess the effects of demographic factors on the preferences of the patients and staff for colors of the patient room	Chi Square Frequencies for Patients and Staff

VITA 2

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Doctor of Philosophy

Thesis: INTERIOR DESIGN FOR HOSPITALS: PREFERENCES OF PATIENTS AND STAFF FOR COLORS IN THE PATIENT ROOM

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Business Experience:
Maconi Homes, Clearwater, Florida (2 years), Color coordinator and interior designer.

Tete a Tete (2 years), Interior design consultant business.

Teaching Experience:

Pinellas County School Board (9 years)
Clearwater, Florida Adult Home Economics
Instructor: Basic & advanced interior design

Skadron Business College (4 Years)
San Bernardino, California
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