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Color Theory: The Effects of Color in Medical Environments

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The University of Southern Mississippi

Color Theory:

The Effects of Color in Medical Environments

by

Sarah Babin

A Thesis

Submitted to the Honors College of
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in Partial Fulfillment
of the Requirements for the Degree of
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Abstract

The relationship between color and the environments we live in is one of great dynamics. It not only helps us to define our personal spaces, but it can also affect our temperaments and our reactions. In the medical field, color is equally as important, as it has the ability to heal and to comfort. A combination of literature review and a short survey were utilized in order to find out exactly how color can influence our mood. While previous studies and other research have been conducted, the use of a new survey helped to confirm the findings. In previous studies, researchers have found that using cool colors create a calm and comfortable environment for patients. Students and professionals who took part in the survey supported these findings, saying that blues and greens evoked feelings of cleanliness, happiness, and rest. These results, along with many others, help to create an ideal medical environment. This research can be applied to future redesign of existing medical spaces and forming a solid base plan for new medical offices as well.

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Introduction

“Since the beginning of recorded time (and probably before) man has believed in the healing power of color. The power of the sun and rainbow were related to divine forces. In many primitive religions the sun was worshiped. Sunbathing was even practiced in ancient times. Early in time our ancestors observed that sunlight sustains all life, and that without it there would be death” (Mahnke 29).

An article entitled “Color in Office Environments” by Dr. Nancy Kwallek and published by *InformeDesign*, a design journal published online by the University of Minnesota and the American Society of Interior Designers, explains that the “use of color to define our environment and experiences are an important aspect of human existence” (Kwallek 1). The journal further explains that people adapt their own tastes and the way things look around them in order to give them significance or emotion, and to define and regulate space and behavior. The journal gives the example of wearing black in mourning as an emotional tie to color. The same may be said of associations with the colors red, white, and blue; for Americans, these may instill a sense of pride, identity, significance. People who study color theory and color psychology have found that colors that are used in both residential and commercial spaces can affect the moods of the people who use them. For example, the color orange is believed to evoke feelings of hunger, while the color purple is readily associated with royalty. All colors have meaning and can be correlated with certain moods and temperaments. In efforts to find solid evidence, a content analysis will be conducted upon previous research articles and studies, books, and new surveys focused on the way we perceive color, the relationship between color and our environment, and how color is used on an everyday scale.

C.R. Horsburgh, Jr. of InformedDesign also presents the theory that “psychological and physical stress levels of patients and their family members may be elevated by the hospital environment, which can interfere with cognitive functioning and the healing process” in his article, “Healing by Design.” In acknowledging this, as well as taking into consideration that “appropriate facility design can positively influence wellness, the healing process, and management of patient care,” there could be some validity to the theory that the use of color, as well as knowing its effects, can be used both psychologically as well as therapeutically (Horsburgh).

Purpose

This project is based upon the effects of visible color on a person’s mental and physical state, especially in a medical setting. Color has long been studied and used all over the world. While most people do not consider the effects that color can have on a day to day basis, researchers have discovered just how much of an impact color can have on our lives. As a result of studying this research, as well as doing original studies, an original project will be developed in order to clearly outline the most accepted and ideal use of color in a particular space. The purpose of this study is to solidify the connection between color and mood and to use this information to determine a color palette utilized in a medical environment with which the general population is most comfortable. Upon doing so, the outcome of this research will result in the redesign of a medical space, such as a hospital patient room or a doctor’s office.

Literature Review

Relationships between Color and the Mind

In an article titled “How Does Color Affect Us?” published by Pantone, a leader in proprietary color space research, “color is light and light is energy.” According to this article, “scientists have found that actual physiological changes take place in human beings when they are exposed to certain colors,” and that “colors can stimulate, excite, depress, tranquilize, increase appetite and create a feeling of warmth or coolness” (“How Does Color Affect Us?”).

While the research on color therapy and interaction may not be plentiful, the information on color associations is abundant. Beginning with John Gage’s book, *Color and Meaning: Art, Science, and Symbolism*, he describes the associations of warm colors. Gage explains his thoughts:

“Yellow is thought of as ‘warm’, because it is associated with the sun, whereas red is thought of as ‘warm’ because it is associated with fire. It seems plausible, therefore, that although people do not necessarily think of the color of fire as red, nonetheless they do associate red color with fire. Similarly, they do not necessarily think of the color of the sun as yellow, and yet they do think of yellow, on some level of consciousness or sub consciousness, as of a ‘sunny color’” (Gage 23).

In addition to color associations, Gage discusses the effects of colored light on the human body. “The belief that exposure to variously colored lights could have a direct and variable effect on human bodily functions was perhaps first proposed in the quantified experiments by the French psychologist Charles Féré in the 1880s,” he states.

Interestingly, but believably enough, Féré found that red light had the most stimulating effect and violet the most calming...” (Gage 31).

Author Faber Birren studies color more generally in his book, *Color Psychology and Color Therapy: a Factual Study of the Influence of Color on Human Life*. Here, he begins to describe how people tend to react to color in a more universal sense. He gives the example, found in the Rorschach test, that “an emotionally responsive person will react quite freely to color in general,” yet “an emotionally inhibited person may be shocked or embarrassed by the intrusion of color into his inner life” (Birren 138). In other words, Birren states “that normal persons who are or attempt to be well adjusted to the world, and hence ‘outwardly integrate,’ like color in general and warm colors in particular” whereas ‘inwardly integrated’ persons may favor cool colors and be none too enthusiastic about them- or about any other colors, for that matter” (Birren 138). In addition to describing these reactions, Birren discusses passive and active colors, provides a chart of colors described in their general appearance, and associations and impressions of those colors by the human mind.

Following along the same lines, yet more detailed than Birren’s observations, “The Manchester Color Wheel: development of a novel way of identifying color choice and its validation in healthy, anxious and depressed individuals,” an article released by the BioMed Central Medical Research Methodology, narrows the topic of color theory and the effects color choice has on an individual’s mood by focusing upon the comparison of color choices of “healthy, anxious, and depressed individuals.” This topic is important in understanding how color affects the temperaments of individuals,

therefore creating a better understanding, a possible template of certain colors used in specific environments, and the opportunity for color therapy.

Frank H. Mahnke, president of the International Association of Color Consultants/Designers and author of *Color, Environment, and Human Response*, writes that “there is a fallacious belief among some designers that prescribing passive environments for extroverted temperaments will calm them down, and active environments for subdued and introverted personalities will draw them out of their introspection and boost their spirits” (27). On the contrary, he says, “quite the opposite will occur” (Mahnke 27). In fact, Mahnke states, “people will not be happier in surroundings that conflict with their personalities” (27). For example, “the nervous system of the introvert is more excitable than that of the extrovert...in other words, there is a difference in the amount of stimulation passing through the cerebral cortex for each of these personality types” (Mahnke 27).

Moving past the introvert and extrovert categorizations, color selections and associations can be tested with more specific groups of people with precise needs or backgrounds. Perhaps one of the most detailed studies of color among different people groups was done by art therapist Dee Spring, author of *Image and Mirage: Art Therapy with Dissociative Clients*. Spring sought to find ways to use art and color in order to help treat patients with Dissociative Identity Disorder (also known as DID). She details her full study as follows:

“The color study in my research included 225 drawings quantified in three groups. The use of red and black combinations emerged as: Rape Group, 42.6%; Multiple Abuse Group, 60%; Control Group, 26.6%. The use of red and black

was compared...Red was expressed as rage by both victim groups; controls used red to designate happy events. Black was an expression of depression by victims, but controls used black for objects and outlines. Victim groups used more combinations of red and black in single drawings than control. Victim groups used colors abstractly; controls used colors realistically...Within the maze of intense feelings surrounding rage, or numbed feelings surrounding depression, there is a ray of hope symbolized by yellow, particularly by a sun with wedge rays, ancient religious symbols. Victims often attach suns to spirituality, religious faith, and hope” (Spring 113).

After reviewing a few different studies, there may be a possible explanation for why humans perceive color in a certain fashion. In *Theory and Practice of Color: a Color Theory Based on Laws of Perception*, author and famed Dutch scientist, Frans Gerritsen, explains the correlation between certain colors and our perception, saying that “psychological color contrasts and psychological reactions to seen colors are producing emotional values” and “common emotional values regarding different colors are bound to time, place, national character, degree of culture and development, age, gender and fashion” (Gerritsen 168).

Charles A. Riley, author of *Color Codes: Modern Theories of Color in Philosophy, Painting and Architecture, Literature, Music and Psychology*, delved deeper into the physiological response to color. Rather than discuss the mental aspects of our correlation, he further describes the chemical procedures which our bodies undergo. He writes that:

“The processes which underlie our experience of a color are likely to be chemical reactions in which certain molecules are formed and others destroyed. Now the chemist can analyze such reactions; but there is a natural limit to this procedure, because at least one whole specimen involved in their interaction must be included. Beyond this limit the concept “this specific reaction” loses its meaning, particularly in psychological theory, where colors are related to reactions. We are therefore compelled to recognize the occurrence of somewhat extended dynamic realities which would be destroyed by an analysis which goes too far. If this is so in chemistry, the same fact cannot surprise us when we face it in a sensory field” (Riley 300).

Edwin D. Babbitt disagrees in his book, *The Principles of Light and Color; the Classic Study of the Healing Power of Color*, stating that there may indeed be a way to measure reactions to color based on medicine and mathematics. He writes:

“We saw the wonderful power of color repulsions and color affinities, and saw also that all things manifest their potencies by means of color. This being true, then, we may construct a more exquisite and exact *Materia Medica*, and erect a standard of medical practice based on principles of almost mathematical precision. Not only may we, by means of the principles, already laid down, judge of the medical potencies of the coarser mineral elements, but of the finer potencies of the vegetable world, of water, air, electricity, and magnetism, and the still finer forces of the sunlight” (Babbitt 17).

In order to further prove that reactions to color can, indeed, be measured, Babbitt then goes on to list the seemingly “healing power” of reds, yellows and oranges (in

combination), blues and violets (also in combination) in full detail, also describing the full spectrum of people's reactions (positive as well as negative). Most interestingly, he describes how color is used in the medical field on a case by case basis, including color treatment for everything from treating lunacy and nervous irritability, even down to cholera infantum and marasmus, baldness, paralysis, and inflammation, supporting the theory that color may, in fact, have a place as a possible treatment in medical facilities today.

Use of Color in the Medical Field

Perhaps Faber Birren, also the author of *Light, Color, and Environment*, described it best in his book when he said that "lighting for emotional, psychological, and psychic effects has suddenly become a new art form. For the most part, man has been an observer of environments created by other; now he would participate in environments and form them himself. Man responds to his environment and at times may be helpless within it" (Birren 45). If this is true in daily life, how much more does it affect those in the medical environment? Observing this, Birren wrote the following:

"One of the problems with color in hospitals is that it has such a strong emotional content. In viewing it, people experience subjective impressions which vary according to human temperament. This confuses the issue of color and often clouds a logical and practical attitude towards it. There seems to be no middle course- the spectrum is either magical or impotent, and opposing forces are lined up...Here is where color is significant and where its role in hospital planning and decoration is important. Man is responsive to his environment and is affected by it. If there may be no direct therapy in color, there is much indirect

psychotherapy that could be applied. Enough research has been conducted in recent years to warrant a fairly rational specification of colors in hospitals.

Unfortunately, because human reactions to colors are emotional, clinical data are not easy to gather, and facts are difficult to quantitate” (Birren 83).

After this description, Birren expounds with many paragraphs of useful information regarding color control for patient accommodations, as well as suitable tones for interiors in the medical environment.

Many studies have been done on the subject of color theory, only proving that color and mood have some correlation. However, no previous method of study had been done on this specific topic, and countless searches through the academic search engines prove the same: only a few have studied the connection that color has with a person’s temperament, especially in the medical field.

Thus, in order to study the relationship of color to patients in the medical world in two parts, two key questions must be asked. First, how does color affect the moods of people walking around in everyday life? The associations that people make between color and the way that they feel are important when it comes to gauging how much influence color has on the mind. Secondly, how do these associations translate in doctors’ offices, hospitals, and other medical facilities?

Methodology

Measures

An article by writer Kelly Porter, published by Sherwin-Williams, entitled “Living Style: Do Color Quizzes Pass the Test?,” states that “asking a client only general

lifestyle questions is not a reliable way to understand his or her ideal decorating palette.” In a study of her own, Porter found that “too many vague and abstract questions can muddle the overall color results” of a questionnaire or survey that is simply designed to determine color preference. She gives examples of questions such as “What culinary craze are you dying to try?” and “What time of year do you feel the happiest?” (Porter). Because “color preferences can change over time and be influenced by current trends,” we must look on the surface and take a more straightforward approach (Porter). Instead of asking abstract questions, it is easier and more practical to focus on color preference and aesthetic appeal.

Performing a color experiment in a medical setting poses the possible problem of having patients respond differently to color based upon varying illnesses and their effects. In lieu of such an experiment, a survey of color preference and sensory reactions to doctor’s offices, clinics, and other medication environments was performed. This helped to develop a more accurate model of the ideal medical environment.

Procedures

Data was collected through the distribution of an 18 question survey. After approval from the Institutional Review Board (IRB), the survey was distributed immediately, and it took no longer than one week to collect this information.

Risks and Benefits

There were no benefits or rewards that came from taking this survey. Taking part in this study imparted no risks on participants. The only possible inconvenience was the 5-10 minutes that the participants spent taking the survey.

Population

Persons taking part in this survey ranged in age between 18 and 55 years, yet the largest age range represented was between 21-30 years old. In total, 55 participants were surveyed, and the subject population for this survey consists of many different types of people. The survey was presented to students on the campus of The University of Southern Mississippi, male and female alike, with varying majors (including, but not limited to, interior design and architecture) and professionals in the work force with varying occupations.

Setting

Procedures took place in classrooms, in meeting rooms, and in office buildings.

Survey Results

The purpose of this part of the project was to determine how color may affect a person's perception of medical environments. A survey was conducted to determine color preference and sensory reactions to doctor's offices, clinics, etc., in order to help to develop a more accurate model of the ideal medical setting. The results included several aesthetic preferences as well as characteristics of a desirable medical facility.

The survey first focused on the overall perception of medical environment. Next, the survey honed in on personal color preference and how that might influence a person's ideal medical environment. Beginning most generally, each person surveyed wrote that they believe that color has the ability to have an effect on a person's mood. Roughly 80 percent of people surveyed mentioned that they noticed the aesthetic appeal of a medical

environment, yet, even more so, 85 percent wrote that they notice the comfort or discomfort of the furniture present.

More specifically, about 87 percent of people surveyed prefer paint to wallpaper or wall covering. The same amount of persons also prefers separate seating over chairs that are closer together and connected. Those who prefer connected or a combination of the two stated that they like to be closer to their family members when visiting the doctor’s office, yet they would rather be farther away from strangers or other patients when they are alone. Just over 54 percent preferred tile over the 39 percent that would rather have carpet. The remaining seven percent said that they would choose a combination of the two options.

Question 10 Preferences				
	Wallpaper/Wall Covering	Paint	Combination	Total
Responses	5	48	2	55
Percentage	9.2%	87.2%	3.6%	100%
	Separate Seating	Connected Seating	Combination	Total
Responses	48	3	4	55
Percentage	87.2%	5.5%	7.3%	100%
	Carpet	Tile	Combination	Total
Responses	21	30	4	55
Percentage	38.2%	54.5%	7.3%	100%

Survey participants were then asked which colors they would associate with certain adjectives or characteristics. The color yellow was overwhelmingly chosen by 64 percent of people surveyed as the color associated with the word “happy.” Similarly, 55 percent chose the color white when asked about the word “clean.” This was followed by the color blue, chosen by 27 percent of the surveyed population. Over half of the survey participants chose the color blue when describing rest. “Hunger” was associated most

with the color red (by 44 percent) followed by yellow with 19 percent. These two colors are, not surprisingly, often used in many restaurants, including fast food chains, across the United States.

Survey participants were given the choice of four categories to choose a color preference: warm, cool, bright, and muted. As a result, about 49 percent selected the cool category, followed by 29 percent choosing the warm, nearly 14 percent muted, and just over 7 percent bright. When asked to list their least favorite color, participants wrote down variants of 13 different colors, with warm colors like orange, pink, and red topping the list.

Question 13 Preferences					
	Warm	Cool	Bright	Muted	Total
Responses	16	27	4	8	55
Percentage	29.1%	49.1%	7.3%	14.5%	100%

The ideal medical environment, according to those surveyed, consists of several, very defined, elements. As evident by the somewhat split percentages, both tile and carpet have their advantages in a medical environment. Carpet, when used correctly, such as in waiting and counseling areas, can help to control the acoustics in a doctor’s office. Tile, on the other hand, is easier to maintain and promotes quicker cleanup. Paint is the overwhelming choice, a fairly good one at that. Many varieties of paint today have antimicrobial capabilities and can also be washable and scrubbable.

Field Study

Photographs of two separated campuses of The Pain Management Center in Hattiesburg, Mississippi captured two very different medical environments. The newest

campus, located at Lincoln Center, features a more updated space with a comfortable and calming aesthetic appeal. Not only does this medical office have newer finishes, but it also features a better overall layout of the facility. The waiting room offers patients mostly separate seating, with the exception of a few longer benches. The furniture is streamlined, fitted with easily cleanable fabrics, and is arranged in a way that promotes good circulation about the space.



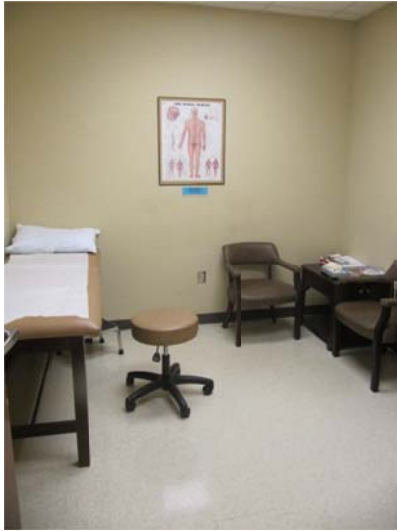
Figures 1 and 2: Images of waiting room at the Institute for Spinal Pain Treatment at Lincoln Center

In the recovery hub, located in the back of the office, patients are given a decent-sized space, separated by walls on three sides. The fourth side features a curtain for easy accessibility by the staff. The central work stations are located in such a way that attendants may observe each patient at all times.



Figures 3 and 4: The recovery hub of the Institute for Spinal Pain Treatment at Lincoln Center

The finishes chosen for the examination room consist of several earth tones, including the paint color chosen for the wall, the natural-colored leathers of the seating upholstery, and the warm wood tones of the cabinetry. It is simple, yet very clean.



Figures 5 and 6: An examination room in the Institute for Spinal Pain Treatment at Lincoln Center

On the other hand, the older location on Asbury Circle, presented a very different interior. The finishes are outdated, and there is a harsh contrast between the paint color and the furnishings. Despite efforts to incorporate more “homey” elements in order to create a more comfortable atmosphere, these components do more harm than good. The fabric appears to be residential grade and not easily cleanable. Furthermore, the layout of the entire room is awkward and difficult to navigate, divided by old, gray cubicle walls.



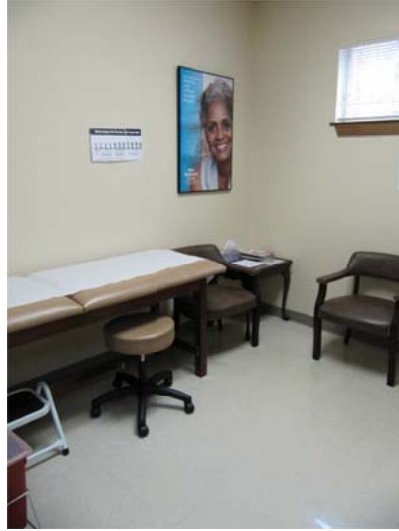
Figures 7 and 8: The waiting room of the Pain Management Center on Asbury Circle

In the back portion, where patients are placed before and after going into surgery, there is virtually no privacy. Unlike the first office, a flimsy curtain is the only material that separates each patient's bed from another.



Figures 9 and 10: The recovery hub of the Pain Management Center on Asbury Circle

Unlike the examination rooms at the Lincoln Center location, the finishes in this office are old and outdated. The walls are a colder shade of white, and the combination of laminate countertops with the wooden cabinets is unpleasant. Though the natural light helps to bring in something warm and familiar from the outdoors, it is not enough to offset the poor furniture layout and the all too sterile environment.



Figures 11 and 12: An examination room in the Pain Management Center on Asbury Circle

Analysis of Different Medical Spaces

According to Margaret Portillo, author of *Color Planning for Interiors: An Integrated Approach to Color in Designed Spaces*, “color triggers innate biological responses: heart rate increases, breathing quickens, and involuntary perspiration begins” (140). This is especially important to take into consideration in medical environments as it may have an effect on a patient’s responses, both conscious and subconscious, during a medical exam. Portillo goes on to specify that, “in empirical studies, researchers have found reds to increase emotional and motor responses more than greens and blues;” more explicitly, “a study of color and emotionality indicated that green elicits the strongest positive emotions of calm, peace, and happiness, but yellow-green associates with disgust and sickness” (140). It is then important for the designer to be aware of certain shades and combinations that may bring about reactions adverse to those desired. “Some colors,” Portillo writes, “evoked both positive and negative emotional reactions; red associated

with excitement, happiness, love and also anger” (140). These reactions must also be taken into consideration before utilizing certain colors in a space.

“The question of how color influences behavior in interiors does not lend itself to easy answers,” according to Portillo (143). She further explains that, “color perceptions change according to lighting variations, spatial configuration of the interior, primary tasks occurring in the space, and differences among the people using the space” (Portillo 143). Similarly, she found that “color also is affected by materials, textures, and patterns in the interior environment,” and that these “effects may attenuate or strengthen with the passage of time” (Portillo 143). Despite the fact that “individual and age differences in color acuity exist...color guidelines *can* improve environments where humans spend the majority of their time” (Portillo 143).

Portillo discusses in detail the stereotypes of certain medical settings, such as hospitals, trying to explain the effects of bland, cold environments. She writes:

“Color, for example, helps create a residential atmosphere within an institutional hospital setting. General consensus exists on eliminating “hospital white” and “hospital green.” Environmental color specialists Frank Mahnke and Rudolf Mahnke argue that predominately white, brightly lit interior environments contribute to eye fatigue and psychological discomfort. In settings dominated by hard surfaces, white does not enhance sensory variety. It is not difficult to identify human needs and problems related to color use in settings with little tactile stimulation, but posing effective alternatives is. Color findings derived from empirical research may be hard to generalize in actual living spaces. Color formulas cannot address variations in illumination, materials, and the design of

architectural space. However, criteria on the behavioral objectives for color can guide decision making” (143).

While the general surveyed population may have arrived at a consensus for what a medical setting should look like, it actually very much depends on the age group and the specific usage of the space. In fact, “environmental color...can reinforce or counter the effects of age-related decrements in color vision” (Portillo 144). For example, older adults have trouble discriminating between blues and greens; thus, creating color contrast with other hues is essential. While the concept of color has been the main focus, contrast is the real issue at hand. According to Portillo, “this approach serves as a practical as well as an aesthetic purpose in highlighting potential environmental hazards –for example, on staircases, where treads and risers must be clearly delineated” (144). In this case, the colors must not only be different in hue, but in shade or texture as well. On the other hand, experts “suggest that in environments for elderly users, color can be used to organize a series of rooms so they appear to be grouped in some way; it can signify change, suggest outlines or emphasize contours, signal an alert, or work as a background surface on which a focal object can be easily distinguished” (Portillo 144). Here, the use of color becomes more important than making a room aesthetically appealing. Instead, it helps the elderly to safely and more easily navigate certain spaces. When we choose these colors, it is important to take into account how the body reacts as it gets older. Portillo presents this case in point:

“in normal aging, the lens of the human eye yellows, hardens, and scatters more light. Typically, older adults need reading glasses to see near distances and are more sensitive to glare. Color vision remains fairly normal, but the lens (cornea)

of the eye gradually yellows. These changes result in shifts in color perception.

Blues and greens appear more similar; blues look darker, and purples appear more like reds. Night vision decreases as the rods receive less light, which also results in more scattering of light and reduced luminance sensitivity” (144).

After addressing the issues of color involving aging individuals, we must examine how color might affect patients on the other end of the spectrum: infants. In hospitals across the world, many infants are found within the Neonatal Intensive Care Unit known as the NICU. It is important to carefully consider the needs of the patients and people utilizing this area because “within the NICU, mothers and families frequently spend large quantities of time with the infants, often six hours and more each day, confronting the many stresses of a baby born before full term” (Portillo 154). “Likewise, the NICU staff works under emotionally strained conditions,” therefore, “a comfortable, relaxing, and appealing environment is needed” (Portillo 154). Portillo gives the details of the design of the NICU at Shands Hospital in Gainesville, Florida. She writes that “Maria-Luisa Riviere, lead project designer, recalls discussions with the staff about their vision for the space” (154). In the beginning, “the staff made a strong case for increasing the natural lighting in the unit” which was achieved by “increasing the number of windows and creating a large circular skylight in the waiting area” (Portillo 154). Time spent in nature was used as inspiration and a method for tension relief; this led the designer to utilize “curving shapes and tonal greens and blues” (Portillo 154).

Portillo explains it best when she says that in order “to minimize the disruption of materials upkeep and replacement, the coloration had to be limited in this critical care unit, so Riviere focused on the concept of blue water, reinforced by form and materiality”

(155). In special circumstances such as this one, color must be used strategically. To achieve this look, the designer “selected a light tonal blue from one of Shands’ approved standards; in hospitals, such regulations ensure consistency and ease of maintenance” (Portillo 155). For example, “this blue relates to other areas in the hospital, and the specified blue paint and fabric can be easily replaced when needed” (Portillo 155). Blue seems to be the best choice for this space because, “psychologically, blue is calming and is often cited as the most widely preferred color,” and, “more critically, a neutralized or high-key coloration would not influence an accurate reading of the infants’ skin color—an indicator of health—by medical staff members” (Portillo 155).

Not only should a designer focus on choosing the right color, but how that color is utilized can be equally important. In this case, “Riviere carefully considered where to apply the blue in the space” and “decided to incorporate an accent of blue on the ceiling plane, forming a curvilinear ribbon that pulls attention up and away from the vast array of medical equipment” (Portillo 155). This information coincides with Frank H. Mahnke’s work which states that “the location (top, sides, bottom) of a color within the interior space can make a great deal of difference in influencing a room’s character, the way it is perceived psychologically, and subsequent reactions to it. A particular hue that is perfectly suitable on the floor may elicit an entirely different reaction when applied to the ceiling” (66).

In a third and final case, *Color Planning for Interiors* highlights the design of a pediatric clinic. “The client for this project, Affinity Health System (AHS), is a leading healthcare provider in the Midwest” (Portillo 158). According to Portillo, “the community-based clinic project shows the central role of color and materials in creating

pediatric spaces” (158). Before planning out the color schemes of this space, the designer “recognized the unique needs of the adolescents, children, and their families seeking care as well as the staff working in the clinic” (Portillo 158). “For the pediatric clinic, the design strategy was to adapt this well accepted prototype for younger patients, their families and staff,” taking into consideration all of the wishes of the people who utilize the spaces (Portillo 158). Portillo clearly states that “the overall plan for the 12,000-square-foot facility would incorporate essentially the same spatial organization and materials as other AHS clinics, but colors, finishes, furnishings, and artwork would be tailored to a new population of users” (158).

Patient demographics played a large role in the design of this building. “Pediatric clinics serve newborns, children, and teenagers through age 18, though 75 percent of the patients are under age 15,” Portillo writes (158). “This challenged the designers to develop an environment that is inviting for older children and teenagers as well as the youngest patients,” in order to make every space both comfortable and functional for all ages (Portillo 158).

In order to create a space that is welcoming to the general population, designers incorporated a variety of different elements. The following excerpt from *Color Planning for Interiors* explains:

“People entering the space encounter a vaulted, wood-paneled ceiling, a curtain wall of glass, natural stone, and a freestanding aquarium. Patients check in at a large custom-built maple reception desk. Immediately, the interior design accommodates different age groups of patients and their families with clear color and materials designations. The designers specified lighter woods, such as maple,

for the reception desk and other millwork, gray work surfaces, and a stained pine paneling to define the ceiling treatment. All clinics use the standard eggshell wall color seen in the lobby, but the wall color in the examination rooms and adjacent hallways differs markedly. Varied in hue, the color palette here is more highly saturated. In the hallway outside the exam rooms, projecting doorframes of yellow, blue-purple, and green identify specific exam rooms for patients and family members. These more saturated colors exude a youthful quality, but the designers deliberately did not juxtapose them to control the level of contrast in the space” (159).

As previously mentioned, “the staff, instrumental in the color planning process, warned the designers not to use saturated hues that influence skin tone, creating a colored cast on patients’ complexions” (Portillo 160). This was remedied when “the designer specified an accent wall at the end of the exam room that was flanked by off-white walls” (Portillo 160). In doing so, “this facilitates patient diagnosis while creating an inviting comfort level for patients” (Portillo 160). For example, “the involved staff believed red was not an appropriate color for the exam rooms, given its association with blood (,) yet the clients supported the idea of introducing red in smaller quantities on benches and stools and related the space to the red AHS logo” (Portillo 160).

Mahnke’s work supports this, saying “in practical situations, pure red is seldom used as the dominant color (on walls), but more as an accent” (67). “Although physiological arousal may be temporary,” he writes, “red psychologically exhibits emphatic characteristics so far discussed” (Mahnke 67). According to Mahnke, “the

overuse of saturated red adds to the complexity within a space,” therefore, “modifications of pure red are much more suitable” (67).

Recommendation

After much comparison between literature research and survey results, there are a few key elements that are commonalities between the two. These attributes would not only alter the aesthetic qualities of the Pain Management Center on Asbury Circle in order to create a more suitable environment, but would also serve to create a generically well-designed medical space.

First, the color palette must be balanced. This means that there can be no surplus of color, nor can a range of neutrals take over the spectrum. More cool tones, such as a range of blues and greens, should be introduced to the space and balanced with natural elements. The combination of these natural tones and cool colors can make a space appear clean and controlled. As many researchers have found, these hues help to create a calm and comfortable environment for patients.

Additionally, the furniture should be timeless, classic, and, above all, easy to clean. However, several different pieces should be used to create a variety of connected and separate seating. It should also be organized in such a way that promotes optimal accessibility and good circulation patterns. Likewise, the flooring materials must be used in combination, utilizing both the acoustics of carpeting and the easy upkeep of tile. All of these materials should be continually updated in order to appear modernized and to retain cleanliness.

Conclusion

“We must beware of drawing erroneous conclusions. Perhaps a study tells us that schizophrenic patients love green. In practical situations it doesn’t mean that a mental facility should now be painted green, or a schizophrenic patient’s room should have green walls. Perhaps tomorrow a manic-depressive will occupy that space. Then what? That is not to say that if nonconflicting research points to a group profile, those findings should not be incorporated into the design scheme. Under special circumstances, with careful analysis and possible color modification such findings may be a useful guide.” (Mahnke 165).

What author Frank H. Mahnke writes here speaks volumes. Just because one study produces certain results does not mean that we can base all future design upon it. While our studies may create a good base, each design must be taken on a case by case basis. We have learned, however, what not to do. A room cannot be filled with color, producing a sensory overload. On the opposite end of the spectrum, we cannot only use neutral colors and paint every room a shade of white. Mahnke reminds us that, “for years, the use of white and off-white in interiors was so common that it reached epidemic proportions,” so much so that “an orgy of neutrality (became) evident in homes offices, banks, restaurants, ice-cream parlors, retail stores, and even health-care facilities” (80). He recommends that while they may seem bright and clean, “white and gray need not be used as predominant colors” (Mahnke 82).

Therefore, we must create a balance. Recognizing what we know about color and how it affects the temperaments of people, we must use that psychology to create calm, comfortable medical environments that put patients at ease. Light, cool colors are safe,

and, when balanced with neutrals and modern finishes, they create the best, most generic environments for people of all ages and conditions. Yet, this is something that may continue to develop. Just as people age and new discoveries are made, we must come to fully understand color in order to continuously adapt our environments with the changing times. “Color in itself is a tool for the ambience we wish to choose,” and finding a way to use it is the key to separating a functional space from good design (Mahnke 130).

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Appendix A: Survey Instrument

THE UNIVERSITY OF SOUTHERN MISSISSIPPI
AUTHORIZATION TO PARTICIPATE IN RESEARCH PROJECT

Participant's Name: _____

Consent is hereby given to participate in the research project entitled "Color Theory: The Effects of Color in Medical Environments." I understand that the general purpose of this research survey is to determine how color may effect a person's perception of medical environments in order to develop a more accurate model of the ideal medical setting. All procedures and/or investigations to be followed and their purpose, including any experimental procedures, were explained by Sarah Babin. Information was given about all benefits, risks, inconveniences, or discomforts that might be expected.

The opportunity to ask questions regarding the research and procedures was given. Participation in the project is completely voluntary, and participants may withdraw at any time without penalty, prejudice, or loss of benefits. All personal information is strictly confidential, no names will be disclosed, and all evidence will be shredded upon the completion of the project. Any new information that develops during the project will be provided if that information may affect the willingness to continue participation in the project.

Questions concerning the research, at any time during or after the project, should be directed to Sarah Babin at 225-270-4858. This project and this consent form have been reviewed by the Institutional Review Board, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research participant should be directed to the Chair of the Institutional Review Board, The University of Southern Mississippi, 118 College Drive #5147, Hattiesburg, MS 39406-0001 or at (601) 266-6820.

Signature of Participant

Date

Signature of Person Explaining the Study

Date

1. Age: 18-20 21-24 25-30 31-40 41-50 51+
2. Gender: Male Female
3. Occupation:
4. How often do you visit the doctor/medical facility?
5. How does going to the doctor make you feel?

6. Do you notice aesthetics (appearance or artistic detail) when visiting a medical facility?
7. Do you experience other sensory feelings (lighting/smell/etc.)? If so, which ones?

8. Do you notice the comfort/discomfort of the furniture?
9. What is your ideal medical environment?
10. In a doctor's office, do you prefer:
 - a. Wallpaper or paint?
 - b. Connected or separate seating?
 - c. Carpet or tile?
11. Do you have a background in/have you ever studied color theory?
12. Do you believe that color can have an effect on your mood?
13. What colors do you prefer?
 - a. Warm (red, orange, yellow)?
 - b. Cool (green, blue, purple)?
 - c. Bright
 - d. Muted
14. What colors are your personal spaces?
15. What are the first 3 colors that come to mind?
16. What is your least favorite color?
17. What color(s) do you associate with:
 - a. Happy?
 - b. Clean?
 - c. Expensive?
 - d. Rest?
 - e. Hunger?
18. Are there any colors that have great significance/strong ties to you? Why?

Appendix B: Request for Approval of Research Involving Human Subjects

**Human Subjects Research Application
The University of Southern Mississippi
Institutional Review Board
irb@usm.edu**

Name Sarah Babin Phone 225-270-4858

E-Mail Address sarah.babin@eagles.usm.edu Campus ID # w771240

Mailing Address (address to receive information regarding this application):

118 College Drive #8019 Hattiesburg Mississippi 39406

Street City State Zip Code

College/Division Science and Technology-School of Construction Dept. Interior Design

Department Box # 5113 Phone 601-266-6437

Title "Color Theory: The Effects of Color in Medical Environments"

Funding Agencies or Research Sponsors N/A

Grant Number (when applicable) N/A

New Project

Dissertation Thesis

Renewal or Continuation: Protocol # _____

Change in Previously Approved Project: Protocol # _____

Sarah Babin

2-19-2013

Researcher Name (type)

DATE

Janice Medina

Advisor Name (if applicable) (type)

Claire Hamilton

Department Chair Name (type)

IRB PROPOSAL NARRATIVE

1. **Project Goals:** The purpose of this project is to determine how color may effect a person's perception of medical environments. Through determining color preference and sensory reactions to doctor's offices, clinics, etc., this project will help to develop a more accurate model of the ideal medical setting.
2. **Protocol:**
 - a. **Procedures:** Data will be collected through the distribution of a survey. I plan to explain the survey, distribute it, and collect it after completion.
 - b. **Number and age range:** Persons taking part in this survey will range in age between 18 and 55 years.
 - c. **Subject population:** The subject population for this survey consists of many different types of people. The survey will be presented to students on the campus of The University of Southern Mississippi, male and female alike, with varying majors (including, but not limited to, interior design and architecture) and professionals in the work force with varying occupations.
 - d. **How long will the procedures take?:** After IRB approval, the survey will be distributed immediately, and it should take no longer than one week to collect this information.
 - e. **Where will the procedures be done?:** Procedures will take place in classrooms, in meeting rooms, and in office buildings.
 - f. A 20 question survey will be used to gather the information.
 - g. **Special situations:** No special situations are foreseen here.
 - h. For data that is collected in classrooms: students will be given the option to participate in the survey. Everyone will be given the short oral presentation and will decide whether or not to take the survey. Those who choose not to participate will simply continue on with their own tasks.
3. **Benefits:** There are no benefits or rewards that will come from taking this survey.
4. **Risks:**
 - a. Taking part in this study imparts no risks on participants. The only possible inconvenience is the 5-10 minutes that the participants will spend taking the survey.
 - b. There are no conditions under which subjects would terminate participating in the survey.
 - c. The only instance of a participant's name being attached to the survey appears on the consent form. These names are otherwise unnecessary, will not be looked at or associated with the answers or the content of the survey, and they will not have any effect or influence on the study or its outcome.
 - d. The data, though not confidential by nature, will be kept in a file in my home, under lock and key, and they will only be viewed and transcribed by myself (the researcher) and my advisor.

- e. After completion of the study, the surveys will either be filed away with the advisor or shredded, as per her discretion.
5. **Informed Consent** (see attached form and oral presentation for further information)

Appendix C: Institutional Review Board Approval Letter



THE UNIVERSITY OF
SOUTHERN MISSISSIPPI.

INSTITUTIONAL REVIEW BOARD

118 College Drive #5147 | Hattiesburg, MS 39406-0001
Phone: 601.266.6820 | Fax: 601.266.4377 | www.usm.edu/irb

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months.
Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: **13022601**

PROJECT TITLE: **"Color Theory: The Effects of Color in Medical Environments"**

PROJECT TYPE: **Thesis**

RESEARCHER(S): **Sarah Babin**

COLLEGE/DIVISION: **College of Science & Technology**

DEPARTMENT: **School of Construction (Interior Design)**

FUNDING AGENCY/SPONSOR: **N/A**

IRB COMMITTEE ACTION: **Expedited Review Approval**

PERIOD OF APPROVAL: **03/01/2013 to 02/28/2014**

Lawrence A. Hosman, Ph.D.
Institutional Review Board