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Using Positive Visual Distractions and Color in Healthcare Settings to Reduce Patient Stress & Increase Patient Satisfaction

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ABSTRACT:

This review of literature focuses on the effects of both color and positive visual distraction on reducing anxiety and increasing satisfaction in healthcare settings. Healthcare settings can be extremely stressful environments for patients, families, and caregivers. Growing scientific research shows that thoughtfully-designed healthcare environments can reduce patient anxiety, create patient satisfaction, and improve outcomes. The successful design of a healthcare setting depends on a wide range of factors, such as: air quality, lighting, space planning, furniture, color, and positive distraction. Positive distraction is defined as, "an environmental feature that elicits positive feelings and holds attention without taxing or stressing the individual, thereby blocking worrisome thoughts" (Ulrich, 1991, p. 102). Positive distractions come in many forms, including visual images, music, animals, and digital media. This research focuses on positive distraction in the form of art, graphics, and finishes. Notable trends in the literature revealed that age, preconceived associations, and personal preferences of the viewer, as well as the context or content of the color and/or positive visual distraction played a large role in the effect of the design feature on the viewer. Although research on the effects of both color and positive visual distraction are still growing fields, there is a clear relationship between choice of color and choice of visual distraction in healthcare environments with the reduced stress and improved satisfaction of users.

Introduction: Causations of stress in Healthcare environments.

Stress and anxiety are inevitable results of illness. Reduced body function, pain or anticipation of pain, fear of the unknown, and lack of understanding are just some examples of factors that may induce stress in a healthcare setting (Eisen, Ulrich, Shepley, Varni, & Sherman, 2008; Ulrich, 1991). Unfortunately, the building environment of healthcare settings can often exacerbate anxiety or create additional sources of stress. Difficult parking, confusing wayfinding, stark color palettes, claustrophobic spaces, lack of daylight, and poor air quality may not only increase stress but even worsen existing conditions (Schweiter et al., 2004). However, well-designed, human-centered spaces can rejuvenate patients, families, and staff. Designing rejuvenating spaces starts with an aim to cause no harm to occupants, then to reduce stress and anxiety, and finally to provide sources of delight and engagement. Rejuvenating environments lead to better patient outcomes and overall satisfaction. Appropriate space planning, acoustic control, air quality, daylighting, and access to nature are all important in reducing stress; however, the introducing of color and positive distraction in certain ways can be pivotal in engaging users, reducing stress, and increasing overall satisfaction.

This paper will focus on forms of positive visual distractions and color applied through finishes, artwork, and graphics. Research on color and positive visual distraction has grown over the past 50 years; however, it is only within the last 30 years that the connection between these environmental factors and the reduction or creation of stress has been monitored. Although it is a newer field with relatively limited studies, a thread can be drawn through existing literature to support a conclusion that color and positive visual distraction can be utilized to create comfortable and even rejuvenating environments that reduce stress and anxiety.

Background on the Emotional and Physiological Effects of Color:

There are some aspects of reviewing research on color that are important to address before examining existing literature. Reviewers must be cautious of the methods by which color research has been conducted (Elliot & Maier, 2013). There are many factors within a study that can cause inconsistencies or inaccuracies in the results. For example, inconsistency in the way a color is presented to the

participants in a study can lead to inaccurate results. For accurate results, researchers must continuously present the same color with no variation in shade, tone, or tint to participants. The lighting of the space, size of the sample, background that the color is presented on, and media (print or screen) that the color is presented on should be identical for each participant or the results will be unpredictable (Elliot & Maier, 2013). Reviewers, researchers, and designers must also realize that while a color may have garnered a certain result in a study, it may not have the same result when applied to the building environment.

Another caution in the analysis of color related studies is that the meanings and categorization of colors are not always consistent between cultures. For example, while Western cultures associate white with purity and light, the Chinese associate white with death; therefore, a study conducted with American participants cannot necessarily be compared with one conducted with Chinese participants (Kaya & Epps, 2004). Different cultures also organize and define colors differently. While red, orange, yellow, green, blue, and purple are all defined separately in the English language, other cultures may group some of these colors together under different terms and definitions. For example, in Robinson, Davidoff, Davies, and Shapiro's study, children of the Himba tribe in Northern Namibia, categorized what English speakers refer to as red, pink, and orange under the term "serandu" and categorized dark blue, dark green, dark brown, dark purple, dark red, and black under the term "zoozu" (Robinson et al., 2004). From this example, research from different countries and cultures should be examined from an objective point of view, with the expectation additional background reading may be necessary to fully understand from where the research comes.

With these cautions in mind, there are many studies which explore the relationship between color and its effect on anxiety and stress in healthcare environments. Theories are often tested using the four primary colors of the Munsell color system (red, green, blue, and yellow) as they are building blocks for all other colors, are routed in nature, and hold the highest contrast (Umamaheshiwari, Asokan, & Kumaran, 2013). For this reason, many studies are conducted using red/green or blue/yellow color combinations as these pairings oppose each other in trichromatic theory and opponent-process theory (Taylor & Franklin, 2012; Elliot & Maier, 2013). Reviewing studies within the context of these four primary colors reveals trends in emotional reaction, major associations, and the physiological effect of color on humans.

Umamaheshwari's study (2013) utilizes these four primary colors as well as pink and black (pink for its relation to the undertones of skin color and black as an achromatic color). In his study, "Child friendly colors in a pediatric dental practice," 300 children were given "6 crayon pencils (blue, green, pink, yellow, red and black)," as well as a printed drawing of a face representing happiness and one representing fear. They were then asked to choose a color each with one of the crayon pencils. For positive emotion, children preferred yellow followed by blue and for fearful emotion, children preferred black, then red. The study found that younger and/or more anxious children tended to prefer yellow, while less anxious and/or older children preferred blue.

Similarly, college students were asked to associate certain colors (five primary hues: red, yellow, green, blue, purple; five intermediate hues: yellow-red, green-yellow, blue-green, purple-blue, red-blue; and three achromatic hues: white, gray and black) with a positive or negative emotion and explain why they felt that association (Kaya & Epps, 2004). While some of the answers were unexpected—positive association with black in relation to thoughts of formal occasions and tuxedos, which shows the power of association—the results of the study showed that primary hues had the most positive associations followed by secondary hues and finally achromatic hues. Green, yellow, and blue hues were most commonly associated with positive emotions; reasons for the positive feelings included their association with nature, plants, and sunlight. However; this study also showed how easily a color with positive associations can turn into a color that produces negative associations. While blue was

generally considered positive color, negative associations included sadness and depression. Negative associations were perceived to be highly related to the shade, tone, tint, or context of the color. Meanwhile, while green and yellow were considered positive as primary hues, yellow-green received mostly negative ratings for its association with bile and vomit.

Green has many associations including calm settings, positive feelings, and nature. Studies often conclude that green is preferred because of a predisposed, human instinct to find comfort in nature (Ulrich, 1991). Likewise, blue is also associated with calm and serenity due to its relation to sky and water (Ulrich, 1991). In a study on the impact of color on stroke patients, poster sized paint swatches were shown to participants who were asked to share how each color made them feel. Blue (specifically arctic blue, hue 9.8B, value 7.4, and chroma 5.6) was found to induce the most calming effect, not only on patients but also on staff and family (Gunawan, Kristanto, Elsiana, Yusani, Haryogo, & Budihardja, 2015). The color reminded participants of clear skies in comparison to other blues, which were considered more depressing due to grey undertones.

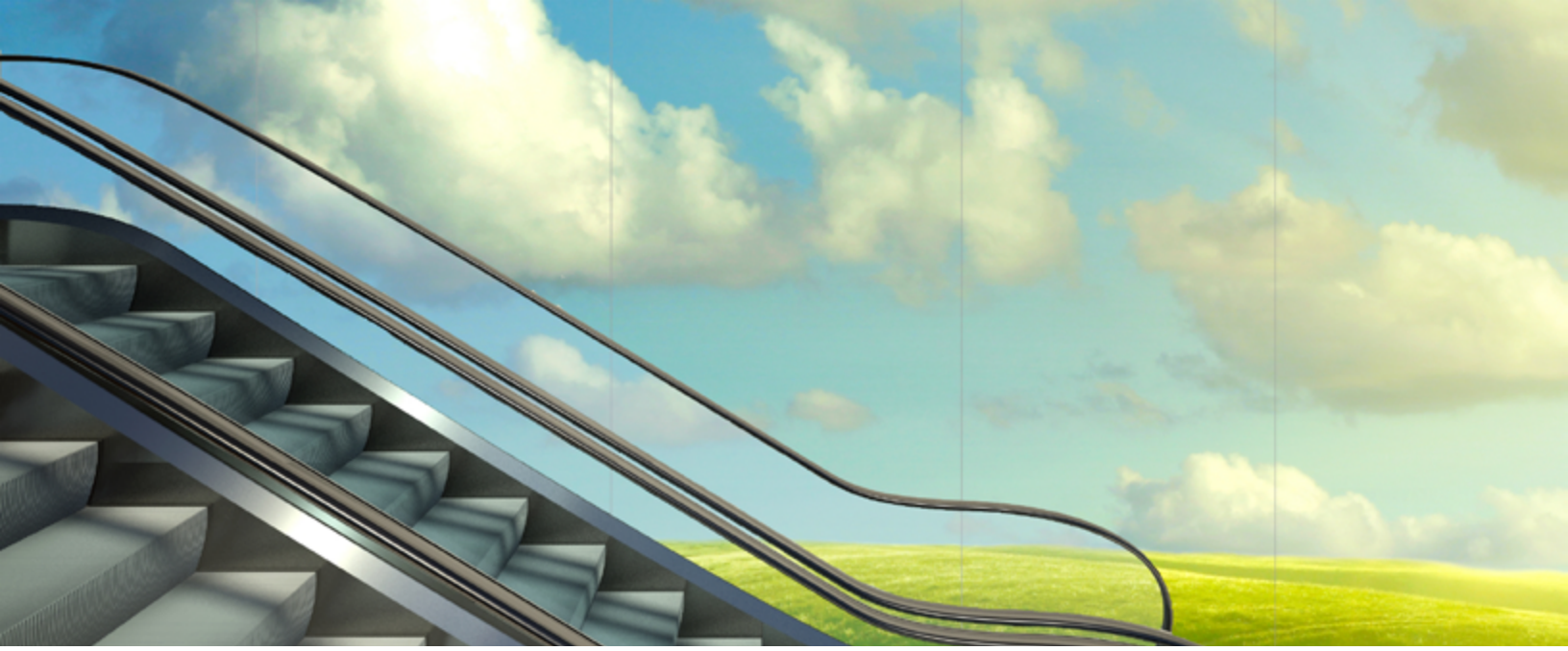
Anecdotally, red is known to elicit strong emotional and physiological reactions from viewers including: aggressive and passionate emotions, as well as increased heart rate and onslaught of adrenaline (Mahnke, 1996). Trends of aggression, dominance, and success have been recorded in sports teams that wear red uniforms in comparison to other colors such as blue or green (Elliot & Maier, 2013). In an experiment testing the effects of red and green on healthy adults vs. those with traumatic brain injury, it was found that both groups had normal brain function in a green environment and healthy adults had normal brain function in the red environment. However, patients with traumatic brain injuries had significantly reduced cognition in the red environment (Kodama, Morita, Doi, Shoji, & Shigemori, 2009). While some literature reveals that these physiological reactions to strong colors, such as red, are temporary (Mahnke, 1996), Kodama's research suggests that it is safer to avoid red in healthcare settings.

In their book, *Color and Light in the Man-made Environment,* Mahnke and Mahnke (1987) discuss the implications of using certain colors on ceilings, walls, and floors. They warn of the oppressive nature of black, brown, and other dark colors; the overly delicate or overly stimulating nature of warm tones; and the calming aura of blues and greens. While some of these cautions on color suggest the idea of using neutral colors, Malkin (1992) argues that lack of color can lead to boredom and sensory starvation and boredom. Entirely white spaces can read as sterile and even intimidating (Mahnke & Mahnke, 1987). However, a room with neutral walls, ceiling, and floor will not necessarily be devoid of color. Color can be introduced into a space, as discussed in greater detail below, through accent walls, art, graphics, patterns, textures, fixtures, and furniture.

Background of various forms of positive visual distractions in healthcare settings:

Positive distraction, as relayed above, is any "environmental feature that elicits positive feelings and holds attention without taxing or stressing the individual, thereby blocking worrisome thoughts" (Ulrich, 1991, p. 102). These can include anything from playing with a kitten to listening to music. This paper focuses on positive *visual* distractions, but here too there are many variations. While many types of positive visual distractions can be effective, some forms of visual distraction can also be expensive, time consuming, or irritating to some user groups in healthcare settings. Therefore, it is important to single out options that will serve to mitigate stress in most users instead of causing stress.

Interactive visual distractions, such as looking at a kaleidoscope can be a positive way of distracting a child who is receiving a shot; however, interactive visual distractions often involve additional time and staff to utilize (Vessey, Carlson, & Mcgill, 1994). Kaleidoscopes are also a momentary distraction during the procedure and do not take into consideration the stress and anxiety that the child may have been feeling during the rest of their stay in the



healthcare setting. Aquariums are effective, long term, positive visual distractions in settings like waiting rooms and lobbies and are a good means of bringing nature inside. However, they are also expensive and time consuming to maintain, especially when designing individual patient rooms or exam rooms (Ulrich, 1992). Patients enjoy watching fish tanks and often have positive associations with them (such as *Finding Nemo*); however, they often have equally positive responses to images of fish and water related scenes (Katcher, Segal, & Beck, 1984; Pati & Nanda, 2011).

Another common form of positive visual distraction is televisions, which are a staple in healthcare waiting areas and patient rooms. In waiting rooms, televisions can be agitating and nerve-wracking if one is not interested in the program or is bothered by the additional noise. On the other hand, televisions in patient rooms can provide a sense of control by allowing patients to view preferred channels or through educational programs that provide information on upcoming procedures, their team of doctors, etc. Views of nature through windows and access to plants or gardens are a well-documented means of reducing stress (Ulrich, 1984). Unfortunately, views of nature or installation of healing gardens are not always feasible (urban settings, lower level procedure or waiting rooms) and some patients (especially those in isolation) are not always able to go outside. Images of nature, nature related patterns (waves, leaf motifs, etc.), and natural materials (wood, grass mat, stone) are often suitable alternatives to direct access to nature (Ulrich, 1991).

Art, graphics, and finishes can be inexpensive, easily adopted options for positive visual distraction that are shown to have similar results as options addressed above without the need for additional staff, facilities, equipment, or expensive remodeling. Art, graphics, and finishes may even be a better option when it comes to positively impacting users. In a study comparing patient agitation in a waiting room with a mural versus a television versus a blank wall, patients in the waiting area with the mural reported the least amount of anxiety (Ulrich, 1992). The mural shows how easily blank walls in existing facilities can be adapted without renovating or introducing equipment. Another study examined two children's waiting rooms to determine whether showing various television slideshows of images (with and without music) would provide enough positive distraction to calm children and reduce chaos in waiting areas. The study found that the silent slideshow with images of nature were effective at inducing calm behavior and reducing overall noise and chaos (Pati et al. 2011). In a recent review of research on wood, Augustin and Fell found that wood is an extremely beneficial feature in healthcare settings (2015). Even in spaces lacking in natural light, views, and positive distractions, wood can aesthetically, emotionally, and physiologically benefit individuals. Wood incorporated into furniture, millwork, wall features, floors, ceilings, etc. all positively affected viewers. These studies indicate that images and other finishes have calming effects on users without causing addition strain on budgets or schedules of healthcare settings or on other users.

Patterns in preferences of color and positive visual distraction:

Research shows that there are overarching similarities regarding reactions to and preferences for color and positive visual distraction between users from different demographics groups, including: sick and healthy; young and old; male and female; and users from various cultures and countries, but it is also important to recognize the nuanced difference between user groups.

Beginning with the similarities, studies show that blue is one of the most preferred colors (specifically for healthcare settings). Green and yellow follow closely after blue. These three colors have a strong association with nature; therefore, relating to Ulrich's conclusion that humans are instinctively calmed by natural colors (Umamaheshwari et al., 2013; Park & Park, 2013; Gunawan et al., 2015; Coad & Coad, 2008). Although blue, green, and yellow were heavily preferred by all demographics, there are significant preferences and recommendations for men vs. women, children,

adolescents, adults, and the elderly. For example, males tend to prefer cooler colors while females prefer warmer colors (Park & Park, 2013). The caveat being that while people may prefer a color or have a "favorite color" it does not necessarily mean that they want that color to be the primary color in their surroundings (Schatz & Bowers, 2005). Studies also show that use of color in a space has more to do with saturation, shade, tint, percent coverage, and context than just chroma, meaning that although certain colors are shown to be preferred, almost any hue is appropriate if the saturation is reduced (Coad & Coad, 2008; Schatz & Bowers, 2005).

Preferred forms of positive visual distraction—including murals, framed art, and image slideshows—also showed consistent trends across demographics. Beginning with Ulrich's findings in the 1980s, many studies have concluded there is a preference for natural imagery and that natural imagery reduces stress. Images of representational nature were almost always preferred over images including subject matter such as animals, urban settings and abstract or impressionist pieces (Coad & Coad, 2008; Nanda, Chanaud, Brown, Hart, & Hathorn, 2009; Ulrich, 1991). Viewers often preferred familiar, relatable images, such as images of their own communities or surrounding nature (Nanda et al., 2009). Therefore, images of neighborhoods or scenes of nature should relate to the surrounding areas. Several studies show that representational nature images were not only preferred, but also reduced heart rate and blood pressure in patients—in some cases patients who were exposed to scenes of nature even required less pain medication (Ulrich, 1992).

Abstract images were often found to confuse, frustrate, or worry viewers, which in turn increased heartrate and blood pressure, which makes them less appropriate for patient rooms (Eisen et al., 2009). McCuskey Shepley notes that as people become more stressed or anxious they tend to seek less challenging or less stimulating environments (2006). Abstract art and saturated colors are considered stimulating and therefore may be overwhelming to those who are already stressed. Based on work of Ulrich, Schweitzer, Gilpin, and Frampton argue against including art that conveys "ambiguity or uncertainty; emotionally negative or provocative subject matter; surreal qualities; closely spaced repeating edges; forms that are optically unstable or appear to move; restricted depth or claustrophobic qualities; close-up animals staring straight at the view; and outdoor scenes with overcast or foreboding water" (Schweitzer et al., 2004, p. 312). Schweitzer et al. also promotes natural, figurative images. However, abstract art, graphics and finishes may still be appropriate for public spaces (Wiesenberger, 2016). Abstract art, graphics, and patterns, especially those with organic forms, can have a whimsical quality and spark the imagination of the viewer. Therefore, designers must use careful judgement when selecting art and colors. Wiesenberger suggests art should be uplifting and hopeful, no matter what the subject matter (Wiesenberger, 2016; Hentges & Travis, 2007).

Preferences of Different Age Groups:

Although, broadly speaking, people have similarities in their positive reaction toward natural colors and natural positive visual distractions, there are differences between user groups, especially when it comes to age. In 2008, Coad and Coad were some of the first to comprehensively interview children (between the ages of 3 and 18) regarding their preferences on color and thematic design in healthcare settings. Despite expectations that children would prefer bright colors, children's art, and cartoon related themes, Coad and Coad found that children were often drawn to much subtler colors and natural themes. Regarding color, children preferred pastel to medium tone colors including warm blue and green with accents of warm colors such as yellow and orange. While very young children did enjoy children's art and animated character related themes, the study found that most children preferred images and themes with natural content or patterns, including: sea, water, beach, ocean designs, nature, plants, trees and flowers. While younger children vs. older children often preferred different styles of art, they often preferred the same content. In 2009, Nanda et al. completed a study

that observed the preferred art in children between the ages of 5-17. Similar to Coad and Coad, all children had positive reactions to images with warm colors and light hearted, natural themes. Children reacted negatively to scenes that were lonely or "boring".

Adolescents, though addressed in Coad and Coad (2008) and Nanda et al. (2009), are the focus of a growing field of research because of their unique situation of being neither a child nor an adult. Adolescents (age roughly 12-14) are often under represented and at a fragile and stressful time in their lives; this can be exacerbated by healthcare settings. Studies by Blumberg and Devlin (2006) and Ullan, Belver, Fernández, Serrano, Delgado, and Herrero (2012) show that adolescents often relate to the colors of an adult healthcare setting, but prefer the whimsical nature of thematic (baring teddy bears and balloons) design in pediatric settings. Whimsical and natural themes and images can spark the imagination and allow adolescents (and people of all ages) to day dream or feel less anxious and overwhelmed in the healthcare environment. Interestingly, adolescents who had stayed overnight in the hospital and their parents were more likely to prefer more "childlike" settings than adolescents who had not stayed in a hospital overnight (Ullan et al., 2012). This shows that although adolescents may like to identify with adults, they are still very vulnerable and need to feel as though they are being protected and cared for in order to minimize stress in healthcare settings.

The aging population also has distinct needs when it comes to designing healthcare environments. While there is no distinct difference between adults and aging generations when it comes to preferences of visual distraction (representational, natural images are still preferred), there are distinct differences in which colors should be used. The aging population often suffers from yellowing of the eye and diminished overall vision (Bosch, Cama, Edelstein, & Malkin, 2012). For this reason, pale or pastel color are often inadequate to have an effect on older individuals. While green and blue are very effective in soothing younger demographics, aging eyes have trouble differentiating between the two colors, which can lead to confusion and difficulty with depth perception (see more in the next section). Neutral colors can also appear to be muddied or blurred (Ulrich, 1992). For these reasons, it is preferred to use more saturated colors when designing for older populations.

Functional use of color and visual distraction and stress reduction:

While some colors and visual distractions reduce stress on emotional and physiological levels, color and visual distractions can also be applied in a functional way to reduce stress regardless of the actual hue or image used. As discussed in the introduction, wayfinding can induce stress from the minute an individual arrives at a healthcare setting. From parking, to locating the entrance of the building to finding the correct facility, stress can build very quickly (Read, 2003; Gulwadi, Joseph, & Keller, 2009). Color can be used in wayfinding to reduce stress. Although vibrant colors like orange and purple may not be good choices for a small exam room, they are attention grabbing and can be utilized in signage to alert users as to where they should go (Read, 2003; Ulrich, 1992). Accent colors in a space or contrasting color palettes can also add visual interest to a space, which can prevent boredom and feelings of claustrophobia (Coad & Coad, 2008).

As mentioned above the aging population often has difficulty differentiating subtle color changes; which is why subtle colors should not be used in wayfinding (i.e. pale green vs. pale blue). Using high contrast color or materials (for example on flooring vs. walls) can make navigating without tripping or bumping into things easier. However, designers should note that high contrast patterns on a single plane can read as multiple planes (a flooring pattern may read as a step) (Bosch et al., 2012; Ulrich, 1992). Color can also be used to highlight or otherwise camouflage doors to help individuals return to their rooms or in some cases prevent them from finding a door to the exterior of the building or service areas where them may get lost or hurt (Marquardt, Bueter, & Motzek, 2014).

Wayfinding should be accessible to all user groups including

children. While clear signage and color coded hallways may make sense to adults, children need wayfinding that relates to them in scale and imagination. Using colored footprints walking down a hallway or theme related murals to designate hospitals are both good techniques to engage children. Images can also be used as landmarks or symbols of location. For example, a parking garage may have a different animal and color associated with each level with the idea that an individual is more likely to remember that they are on the pink flamingo themed floor than that they are on level 3 (Read, 2003).

Giving patients a sense of control:

Giving patients control in their environment and their experience is proven to reduce stress and increase satisfaction; however, when considering color and positive visual distraction it is difficult to provide individualized control. Providing different color schemes in different patient room for adults, children, adolescents, and aging populations is one way of appealing to individuals where it is possible. Another option is the implementation of art carts, which allow patients to choose art for their room from a variety of styles and subject matters; this can give patients a sense of place and ownership (McCuskey Shepley, 2006). Research suggests that choices should be generally associated with nature and steer clear of challenging abstract images (Eisen et al., 2008). Allowing for personalization of rooms, such as patients own posters and art is another way to bring home to a hospital environment, especially for long-term patients. This may indicate that providing patients with a tack-able or magnetic surface would facilitate this without cluttering the space. Some studies, especially those interviewing children on their preferences (Coad & Coad, 2008; Ullan et al., 2012; Blumberg & Devlin, 2006), brought up the idea of changing the paint color of patient rooms to suit the current user's preference. While this is not feasible with current technology, to some extent, this affect can be achieved with color changing LED lights (Phillips Lighting). Color changing LEDs give patients control of their environment by allowing them to choose what color their space is. These colors can also be calming.

Recommendations

Further research may be necessary to understand the difference between images and colors that users like and images and colors that improve rejuvenating environments. They may be the same thing in some or all cases, but it is important to note the difference between liking a color or image and whether it improves medical outcomes.

Further research on interactive positive distraction: digital, virtual reality, tactile, audio, etc.

Conclusion

Through the review of the studies above, there is a close connection between the application of color and positive visual distraction in a healthcare setting, the reduction of stress and anxiety, and the increased sense of delight and wellbeing. Colors, art, graphics, and finishes found in nature provide a soothing effect on users in hospitals; however, patients need to be more than passively soothed. Engagement is also key to creating rejuvenating environments. Fanciful images and colors provoke imagination, prevent boredom and create a sense of delight in users creating an escape from their current situation.

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