

GUIDELINES FOR THE PROPER APPLICATION OF COLOR AND LIGHT  
IN THE HEALTH AND FITNESS INDUSTRY FOR THE PURPOSE OF  
IMPROVING USER EXPERIENCE AND PERFORMANCE

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Joshua Warren-Louis Logan

Certificate of Approval:

---

Tsai Lu Liu  
Assistant Professor  
Industrial Design

---

Richard E. Britnell, Chair  
Professor  
Industrial Design

---

Christopher Arnold  
Assistant Professor  
Industrial Design

---

Stephen L. McFarland  
Acting Dean  
Graduate School

GUIDELINES FOR THE PROPER APPLICATION OF COLOR AND LIGHT  
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Joshua Warren-Louis Logan

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Signature of Author

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Date

## VITA

Joshua Warren-Louis Logan, son of James Logan and Wanda (Champion) Logan, was born December 29<sup>th</sup>, 1979, in Mobile, Alabama. He graduated from W.P. Davidson High School in Mobile, Alabama in May of 1998 with an Advanced Diploma. He attended Auburn University in Auburn, Alabama where he completed a Bachelor of Industrial Design degree in August 2003. While at Auburn he worked as a Product Designer for Emerson Tool and Exhibit Designer for Weeks Bay National Estuarine Research Reserve. Immediately upon graduation he entered the Graduate School at Auburn University in Auburn, Alabama in pursuit of a Masters of Industrial Design degree.

THESIS ABSTRACT

GUIDELINES FOR THE PROPER APPLICATION OF COLOR AND LIGHT  
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Joshua Warren-Louis Logan

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Guidelines that demonstrate the proper application of color and light for the purpose of improving user experience and performance with consideration given to equipment selection and layout within the realm of a health and fitness facility are presented in this thesis. A conclusion was reached that color and light can positively affect user experience and performance, if properly applied, within a fitness facility. The presented guidelines were developed from existing research and observations of existing facilities. A need for the developed guidelines was realized through the analysis of existing facilities in determining that little consideration, if any, was given to the affect color and light may have on the user of the observed facility.

It was found that by altering the color of a space the user experienced increased energy levels and responded better to stimuli. This principle was then applied to the health and fitness facility. Considering that the application of these guidelines is theoretical, no testing or practical application was completed. Hypothetical application was done in a side-by-side comparison for before and after analysis.

Improving user experience and performance is the goal of the research. This goal is achieved by studying the affects of color and light on the user of a health and fitness facility. The purpose of the research is to develop a set of guidelines that allows for the easy application of the developed theories with consideration for layout and equipment selection.

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## **1.0 INTRODUCTION TO PROBLEM**

### **1.1 Problem Statement -**

So many of today's health and fitness facilities follow a haphazard and otherwise unguided scheme for coloring and lighting their interiors. Granted some facilities have had professional assistance in the design and implementation of color and lighting but few can afford such assistance. Having surveyed almost fifteen different fitness facilities in the Southeastern United States, I am more than certain that color choice and quality of light are an after thought in most cases. What the fitness facility owner doesn't realize is that by applying color and light to their interiors in a guided and effective way, they can directly influence their customers level of satisfaction and comfort within their space. What has not been thought of until recently is how does color and light affect user performance. The right color might make them feel more relaxed or energetic, but how will that color affect them when they are physically active and will it be positive or negative?

According to American Sports Data, Inc. as of July 2002 there were 18,203 health clubs in the United States with a total of 33.8 million members and annual revenues reaching approximately \$12.2 billion. In 2003 there were approximately 20,204 clubs with 36.3 million members and \$13.1 billion in annual revenues. The health and fitness industry is in the middle of an economic boom. Unfortunately, many people open these

facilities and have little experience in design or are so eager to get a piece of the money pie they neglect certain design considerations. The lack of consideration for color and light leads to a lethargic and apathetic membership, which causes fluctuations in membership and revenue, and the user leaves with a bad experience or a general feeling of dissatisfaction.

A set of guidelines are needed that clearly states the best way to properly apply color and light to a fitness facility in order to improve the user experience and performance while maintaining membership and bringing in new members. The guidelines should include effective colors and light levels with reasons why they are effective along with how they are effective and the proper application as to result in improved user experience and performance. The focus will be primarily on commercially owned facilities in either new construction or renovation ranging from basic to expansive. The guidelines will be easy to understand and follow.

## **1.2 Need for Study -**

Due to the rise in obese Americans and the negative effect it has on their health the U.S. Government has implemented over the past years along with other organizations several programs to help Americans get into better shape. The primary motivating factor for the push of such programs is the astonishing rise in the number of adults diagnosed with heart disease. There were approximately 10.9 percent of adults diagnosed with heart disease in 2000 (National Health Interview Survey).

Over the past year the health and fitness industry has grown to remarkable size. In an industry where the yearly growth includes 2,001 new clubs, 2.5 million new

members and \$900 million in revenue, it becomes apparent that there is an ever-widening trend in fitness. As the industry continues to grow, the need for a more unified standard in the way in which customer service is managed becomes more apparent. Most gyms in the U.S. are commercially owned and operate as a single entity, since they make-up 45 percent of the market; these clubs have a lot to lose when it comes to customer service.

A survey of approximately fourteen commercially owned health clubs in the Auburn, AL and Mobile, AL areas indicates a lack of methodology in the consideration of color and light application within their interior spaces. This lack of methodology results in visual noise or visual lethargy. There exists a need for the development of a set of guidelines that will specifically outline the proper use of color and light within the commercially owned health club industry, focusing on improving user experience and performance by positively affecting the users physiological, psychological, and biological systems through the manipulation of color and light within an interior environment.

As society changes and health and fitness become more important to people the need for high quality, affordable fitness opportunities becomes more pronounced. As the market fluctuates and the health industry continues to grow, more people will be joining health and fitness centers. The club owner wants to offer the best services available as long as they turn a profit. Profit comes from new members and member retention; the best way to improve membership is through improved user experience and performance.

### **1.3 Objectives of Study -**

To assemble a set of guidelines, outlining the proper application of color and light in a commercially owned health club, with focus on the beneficial effects of color and

light on human performance and user experience. To include in these guidelines extensive information regarding color theory and the proper application of color and light for the purpose of improving the user experience and performance. To establish a color palette that is most effective in positively affecting the quality of the user experience and that enhance the users performance.

To ultimately improve atmosphere and ambience of a commercially owned health club in order to enhance the users biological and emotional reactions to the environment; member retention and user satisfaction will be of highest importance. The guidelines will be easily applied to both the new construction and renovation phases of a commercially owned health club.

The guidelines will include general improvements with substantial support for the effectiveness of the application. The suggested improvements will be separated into categories based on relevance and each category will contain sections that relate color and light to the proposed area of improvement.

#### **1.4 Definition of Key Terms -**

Achromatic -	possessing no hue: being or involving black, gray, or white
Acoustic monotony -	sameness of tone or sound
Aesthetic -	pleasing in appearance
Afterimage phenomenon -	closely related to successive contrast, a white surface will appear pale green after gazing at a red surface.
Ambience -	a feeling or mood associated with a particular place, person, or thing

Amps -	the practical meter-kilogram-second unit of electric current that is equivalent to a flow of one coulomb per second or to the steady current produced by one volt applied across a resistance of one ohm
Analogous complementary –	a modification of the complementary scheme. Choosing two colors next to each other and combining them with the complementary of one of the two achieve this harmony – for example, yellow-red and yellow combined with blue, the complementary of yellow-red
Analogous harmonies -	Analogous or related harmonies combine usually no more than three colors next to each other on the color wheel. The three hues are unified because of a shared color – for instance, red, yellow-red, and yellow; green, blue-green, and blue. Analogous color schemes offer more variety than monochromatic ones, but neither type will satisfy the problem of the afterimage phenomenon described earlier (Mahnke, Mahnke, 1987).
Anxiety -	an abnormal and overwhelming sense of apprehension and fear often marked by physiological signs (as sweating, tension, and increased pulse), by doubt concerning the reality and nature of the threat, and by self-doubt about one's capacity to cope with it
Apathetic -	having or showing little or no feeling or emotion
Asymmetry -	not symmetrical
Autonomic nervous system -	a part of the vertebrate nervous system that innervates smooth and cardiac muscle and glandular tissues and governs involuntary actions (as secretion and peristalsis) and that consists of the sympathetic nervous system and the parasympathetic nervous system
Bactericidal -	destroying bacteria
Balance -	equality between the totals of the two sides of an account
Capillaries -	any of the smallest blood vessels connecting arterioles with venules and forming networks throughout the body
Central Fovea –	the central small rod less area of the retina that affords acute vision



Centrifugal -	proceeding or acting in a direction away from a center or axis
Chroma -	a quality of color combining hue and saturation
CIE -	The Commission Internationale l'Eclairage (C.I.E.) has devised a color system based on spectrophotometric measurements of color samples and it is the last word in accuracy.
Circuit -	the complete path of an electric current including usually the source of electric energy
Color -	a phenomenon of light (as red, brown, pink, or gray) or visual perception that enables one to differentiate otherwise identical objects
Color system -	color classification and order system. Color systems are an aid to composition, and they bring order into the confusion of the color range. Colors are presented in sequence and in their relationship to each other, and they are listed neatly by hue, saturation, lightness, and interval
Complementary colors -	based on hues directly opposite each other on the color Wheel. Examples are red and blue-green; yellow-red and blue; purple-blue and yellow. These harmonies offer more contrast and introduce both warm and cool colors into the environment.
Cones -	any of the conical photosensitive receptor cells of the vertebrate retina that function in color vision
Contrast -	degree of difference between the lightest and darkest parts of a picture
Cortical activation –	the introduction of activity to the outer layer of gray matter of the cerebrum and cerebellum
Cosmic rays -	a stream of atomic nuclei of extremely penetrating character that enter the earth's atmosphere from outer space at speeds approaching that of light
Diametrically -	completely opposed: being at opposite extremes
Dilates -	to become wide

Double complementary -	the use of two closely related hues and their Complements. One example would be yellow-red and yellow with blue and purple-blue.
Duplicity Theory -	first stated by Max Schultz in 1866, states that low-intensity vision is a function of the rods of the retina, and high-intensity vision is a function of the cones.
Eclectic -	composed of elements drawn from various sources
Electroencephalogram -	the tracing of brain waves made by an electroencephalograph
Electromagnetic energy -	Type of energy distinct from chemical energy, kinetic energy, etc. Visible light and radio waves are both forms of electromagnetic energy.
Environment -	the circumstances, objects, or conditions by which one is surrounded
Erysipelas -	an acute febrile disease associated with intense edematous local inflammation of the skin and subcutaneous tissues caused by a hemolytic streptococcus
Erythematous -	of, pertaining to, or causing redness of the skin by dilatation and congestion of the capillaries, often a sign of inflammation or infection.
Exercise -	bodily exertion for the sake of developing and maintaining physical fitness
Experience -	a: direct observation of or participation in events as a basis of knowledge, b: the act or process of directly perceiving events or reality
Extroversion -	the act, state, or habit of being predominantly concerned with and obtaining gratification from what is outside the self
Fallacious -	tending to deceive or mislead

Fatigue effect -	afterimage is known as a fatigue effect. As the cones in the retina adapt to a particular color, let us say red, the red-sensitive photoreceptors will be temporarily fatigued, and as the red stimulus is replaced by white, they respond less strongly to all the light rays reflected from the white surface
Fear -	to be afraid or apprehensive
Fluorescent -	very bright in color
Foot-candles -	a unit of illuminance on a surface that is everywhere one foot from a uniform point source of light of one candle and equal to one lumen per square foot
Gamma rays -	a photon emitted spontaneously by a radioactive substance
Guidelines -	a line by which one is guided
Habitat -	the typical place of residence of a person or a group
HID lights –	High intensity discharge lights, examples: high-pressure sodium, metal halide, mercury vapor – streetlights, stadium lights, arena lights
Hue -	the attribute of colors that permits them to be classed as red, yellow, green, blue, or an intermediate between any contiguous pair of these colors
Hypotensive -	causing low blood pressure or a lowering of blood pressure
Ideation -	the forming of ideas
Illumination -	the luminous flux per unit area on an intercepting surface at any given point
Incandescent -	white, glowing, or luminous with intense heat
Infrared -	situated outside the visible spectrum at its red end -- used of radiation having a wavelength between about 700 nanometers and 1 millimeter
Insomnia -	prolonged and usually abnormal inability to obtain adequate sleep

Intensity -	the magnitude of a quantity (as force or energy) per unit (as of area, charge, mass, or time)
Introversion -	the state or tendency toward being wholly or predominantly concerned with and interested in one's own mental life
Lethargic -	the quality or state of being lazy, sluggish, or indifferent
Light -	the sensation aroused by stimulation of the visual receptors
Lightness -	the attribute of object colors by which the object appears to reflect or transmit more or less of the incident light
Luminous -	emitting or reflecting usually steady, suffused, or glowing light
Milieu -	the physical or social setting in which something occurs or develops
Monochromatic harmonies -	based on one hue varied in value and saturation – for example, pale green with pure green and dark green.
Mood-tones –	mood associations produced by color along with subjective and objective impressions
Munsell System -	One of the most widely used methods of color notation. Identifies colors based on three attributes: hue, value (lightness), and chroma (saturation). Chosen so that the colors appear equally spaced, the Munsell system is based on five principal and five intermediate hues. Arranged clockwise around the color wheel by name
Munsell Ten-hue Color-wheel –	an alphanumerically organized wheel designed to organize and to quickly reference the color process of the Munsell System.
Neurasthenia -	an emotional and psychic disorder that is characterized especially by easy fatigability and often by lack of motivation, feelings of inadequacy, and psychosomatic symptoms

Neuroses -	a mental and emotional disorder that affects only part of the personality, is accompanied by a less distorted perception of reality than in a psychosis, does not result in disturbance of the use of language, and is accompanied by various physical, physiological, and mental disturbances (as visceral symptoms, anxieties, or phobias)
Obese -	excessively fat
Octaves -	the interval between two frequencies (as in an electromagnetic spectrum) having a ratio of 2 to 1
Palmar conductance –	electrodes in the palm of the hand which indicate arousal of the autonomic nervous system through reaction of the sweat glands
Performance -	the manner of reacting to stimuli
Phasic arousal –	the phase delineated arousal of the optic system by color
Photoreceptors -	a receptor for light stimuli
Physiological -	characteristic of or appropriate to an organism's healthy or normal functioning
Primary colors –	any of a set of colors from which all other colors may be derived specifically, red, yellow, and blue
Psychological -	directed toward the will or toward the mind specifically in its cognitive function
Rickets -	a deficiency disease that affects the young during the period of skeletal growth, is characterized especially by soft and deformed bones, and is caused by failure to assimilate and use calcium and phosphorus normally due to inadequate sunlight or vitamin D
Rods -	any of the long rod-shaped photosensitive receptors in the retina responsive to faint light

Saturation -	a: chromatic purity: freedom from dilution with white b (1): degree of difference from the gray having the same lightness -- used of an object color (2): degree of difference from the achromatic light-source color of the same brightness -- used of a light-source color
Secondary colors –	a color formed by mixing two of the three primary colors in equal or equivalent quantities, specifically, orange, green, and purple
Simultaneous contrast –	The eye will generate the complementary of the hue that it is seeing and projects it toward the color adjacent to or superimposed upon it
Split complementary –	consists of one color and the two colors adjoining its complementary color. For instance, the complementary of red is blue-green, which is bordered by blue and green. The arrangement therefore would comprise red, blue, and green
Strength -	intensity of light, color, sound, or odor
Stress -	a state resulting from a stress; <i>especially</i> : one of bodily or mental tension resulting from factors that tend to alter an existent equilibrium
Successive contrast –	If your eye becomes adapted to a particular hue by staring at it for sometime, and then you shift your gaze to a white (or gray) surface, the complementary color will appear upon that surface
Symbolism -	artistic imitation or invention that is a method of revealing or suggesting immaterial, ideal, or otherwise intangible truth or states
Tension -	either of two balancing forces causing or tending to cause extension
Tertiary colors –	a color produced by mixing two secondary colors or a color produced by an equal mixture of a primary color with a secondary color adjacent to it on the color wheel. They consist of 6 colors, red-orange, red-violet, yellow-green, yellow-orange, blue-green and blue-violet.

Tonus -	a state of partial contraction characteristic of normal muscle
Ultraviolet -	situated beyond the visible spectrum at its violet end -- used of radiation having a wavelength shorter than wavelengths of visible light and longer than those of X rays
Visual monotony –	the appearance of tedious sameness
Visual noise –	collection of visible items that creates disorder and confusion along with distraction.
Vitamin D –	any or all of several fat-soluble vitamins chemically related to steroids, essential for normal bone and tooth structure, and found especially in fish-liver oils, egg yolk, and milk or produced by activation (as by ultraviolet irradiation) of sterols
Voltage -	electric potential or potential difference expressed in volts
Wavelength -	the distance in the line of advance of a wave from any one point to the next point of corresponding phase
X-rays -	any of the electromagnetic radiations of the same nature as visible radiation but having an extremely short wavelength of less than 100 angstroms that is produced by bombarding a metallic target with fast electrons in vacuum or by transition of atoms to lower energy states and that has the properties of ionizing a gas upon passage through it, of penetrating various thickness of all solids, of producing secondary radiations by impinging on material bodies, of acting on photographic films and plates as light does, and of causing fluorescent screens to emit light

### **1.5 Assumptions -**

An assumption has been made that by altering the color and light in the interior space of a commercially owned health club the user experience will be improved and performance will be increased. Further assumptions include the belief that the quality of the experience and the level of performance will somehow affect member retention and new member sales. It has also been assumed that by implementing these guidelines,

either at construction or renovation, the improvements will not have an exorbitant cost to the overall productivity or success of the facility. The assumption is that by improving the user experience, by manipulating color and light, the user will perform better and be more satisfied with their experience, member retention and overall satisfaction would result.

There has been a significant amount of research in the area of color theory and lighting and how it affects humans in different environments. The information obtained from this research has not been applied to the health and fitness industry. By properly applying this information, it can be assumed that there will be a positive effect on the user. By making the experience more satisfying for the user, memberships will be retained and new members added.

Membership is what drives the health/fitness industry. Either by the sale of new memberships or the renewal of existing memberships, the health/fitness industry remains afloat. Improving the selling point of one club will help to initiate the trend that will improve the selling point of many other clubs and eventually the industry. Happy customers often equal happy proprietors.

## **1.6 Scope and Limits -**

This study will involve observations of clubs from the Mobile, AL and Auburn, AL areas and will not include any facility from Auburn University. The guidelines that will be developed are going to include information about the positive and negative effects of different colors on the human organism and the biological, physiological, and psychological advantages to certain colors or combinations of colors within the realm of



health and fitness. The application of those colors, along with light, for the purpose of positive improvement of an environment and the beneficial increase in performance will be of importance. The ergonomic data that will be considered in the development of these guidelines will be specific to the placement of lighting and visibility along with traffic flow.

The guidelines begin with a brief explanation of color and light and how they affect the body and mind. User experience and performance are explained based on their role in the guidelines and what exactly they reference. Suggestions are made based on categories determined by the observation and analysis of existing fitness facilities. From the information gathered, basic requirements were established. Each requirement category contains a set of educated suggestions. Suggestions are organized based on clients, best experience, best performance, renovation vs. new, marketing data and square footage.

The research will consist of a series of charts and matrices that will be limited to basic demographic information, organizational charts and comparative product matrices. Visual observations of existing facilities will be conducted in order to ascertain a level of complexity and a list of design criteria.

Lighting research will be gathered from expert sources that have already conducted the necessary research. That research will be applied to the development of the guidelines along with research involving color theory and the biological, psychological, physiological and emotional effects of color on the human organism, for the purpose of establishing how color and light can improve user performance in the health and fitness environment.

## **1.7 Procedures and Methodology –**

The resulting guidelines are based on the analysis of existing facts regarding recent trends in the health and fitness industry, color theory, the effect of color on the mind and body, the mechanics of vision, the effect of light on the human organism, lighting design principles, the design of experiences and space planning techniques.

The first objective is to study recent trends in the health and fitness industry in order to better understand the direction the industry is moving towards. A brief analysis will be done primarily for illustrating the need for a set of guidelines.

The second objective is to study color theory and how color affects the body. Color has an affect on the body, which has a direct correlation to user experience and performance.

The third objective is to study the biological and psychological effects of light on the human organism.

The fourth objective involves the study if vision mechanics and how the eye sees and how the brain interprets vision.

The fifth objective is to adequately study light in regards to quality, quantity, application principles and general design standards. The study will also focus on new and existing technologies and how proper these technologies are for the fitness industry.

The sixth objective involves a study of user experience in its design and implementation. The study focuses on the tools used for designing experience.

The seventh objective is to study space planning and develop a basic understanding in order to produce primary floor plans for traffic flow and barrier free layout.

The eighth and final objective is to compile all of the research into a set of usable and clearly presented guidelines.

### **1.8 Summary of Section 1.0 -**

The final result will be a set of well-developed and well-researched guidelines that suggest different levels of improvement for new construction and renovation of a commercially owned health club. The sole purpose of the guidelines will be to improve user experience and increase performance through the manipulation of color and light with the hopes of improved member retention and membership sales. The guidelines will also indirectly assist in the development of marketing plans.

A completed and approved thesis dissertation that completes the requirements for the degree of Master of Industrial Design is the ultimate anticipated outcome.

## **2.0 LITERATURE REVIEW**

### **2.1 Need for Study -**

Few people would speculate that there currently exists a growing trend towards fitness. According to the International Health, Racquet & Sportsclub Association, in 2005 there were approximately 26,830 clubs with 39.4 million members and \$14.1 billion in annual revenues. There are new products being introduced daily to satisfy consumer demands. A record increase in the amount of new journals and books on the subject is an indication of the growing trend. A considerable percentage of the adult population is now participating regularly in planned exercise. Many of these fitness enthusiasts are members of clubs or organizations that have facilities and equipment for participating in a wide variety of fitness and sports activities. Many of these clubs and facilities are privately owned and lack the proper understanding of the effect of color and light on health and fitness.

### **2.2 Guidelines and References -**

There are a number of references available to assist professionals in the proper implementation of guidelines for the development of health and fitness facilities. References of this type speak mostly of business plans and the economic impact of

starting a health and fitness facility. Existing guidelines focus primarily on the layout of the facility and how to hire knowledgeable staff. There are checklists for the types of equipment to have, services to offer, and the best way to keep track of financial records. As far as building design, there are few guidelines that focus on aesthetics and visual appeal of the facility. There are even fewer guidelines that are concerned with interior usability and productivity. Guidelines do not currently exist for the improvement of the user experience and performance in relation to color and light within the health and fitness industry and specifically commercially owned health clubs.

### **2.3 Quality Differences -**

Corporate programs, for example, were found to be very program intensive, whereas commercial programs were more marketing intensive (Gerson, Gettman, Grantham, Patton, 1989). Due to improved funding corporate facilities are able to focus on the client and less on marketing, because commercial facilities rely more on new clients for revenue they have to focus more heavily on marketing. However, evidence has shown that programs are becoming more, rather than less, homogeneous in their nature and makeup (Gerson, Gettman, Grantham, Patton, 1989). The substance of the programs is similar while the quality varies due to the fluctuation in funding type. Manipulating interior color and light adds a new venue for commercial marketing agents to pursue.

## 2.4 Facility Lighting -

Lamps are defined as an electric source of light, regardless of the type of lamp. Luminaires are used to control the output of lamps by shielding some of the light in order to reduce glare. Luminaire efficiency is the ratio of the lumen output (light intensity) of the Luminaire to the lumen output of the lamp, expressed as a percentage.

Some basic definitions that will be used later in the thesis and that are specific to understanding light follow. A “Lumen” is the basic unit of measure of light and light arriving on a surface is measured in “Foot-candles.” A “Foot-candle” is the amount of illumination from one standard candle falling on a surface one foot away. The further away the point source (source of light) the fewer foot-candles reach the surface.

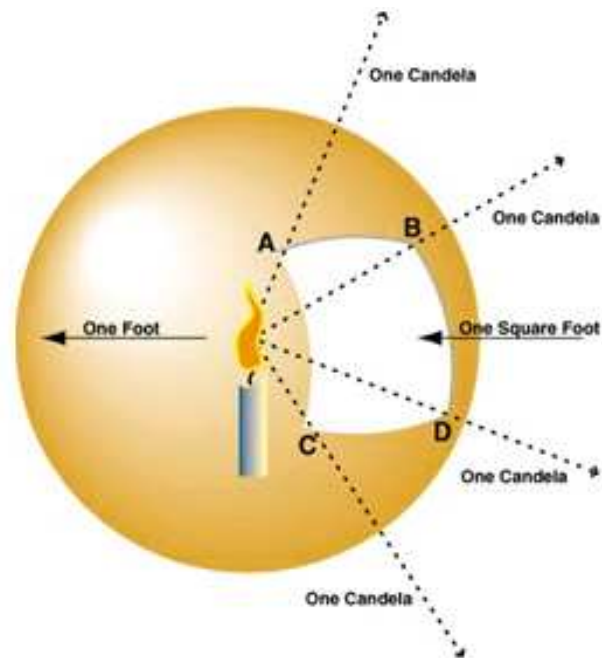


Figure 1: Foot-candle

Providing adequate illumination is difficult because each area has specific lighting requirements (Gerson, Gettman, Grantham, Patton, 1989). High-intensity discharge (HID) lights are adequate for large recreational areas such as gymnasiums or pool areas, while incandescent lights are more appropriate for smaller areas like walkways and hallways. There are major differences in chroma (temperature), hue, and

foot-candles in relation to the different types of lighting. Fluorescent lights, which are cool in color, tend to cast a blue hue, are more suited for general lighting. There are positive and negative aspects to each type of lighting.

### 2.4.1 Quality of Light –

There are several factors that affect the quality of light in a space. Glare is one of the contributing

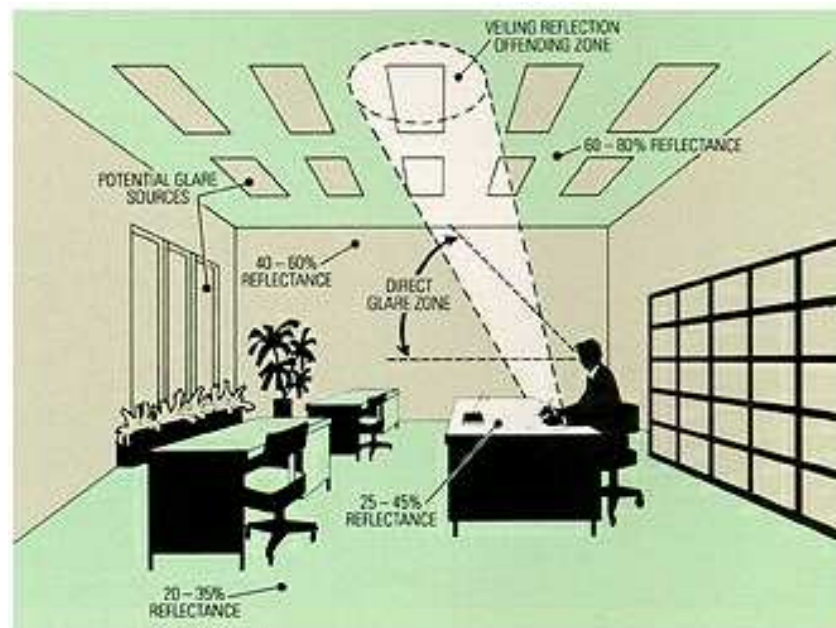
factors in lower quality light. Glare is brightness in the visual field, which is annoying and uncomfortable, causing fatigue and loss of productivity.

Direct glare results from seeing high

Luminaire

brightness in the

normal field of view.



Courtesy of GE Lighting

Figure 2: Quality and Glare

There are current standards to suggest the minimal amount of glare for a space while maintaining comfort and productivity. Visual comfort probability (VCP) is the standard used and it evaluates the probability in a given set of parameters that a person

seated in the worst position for glare in a room (usually at the center rear) will find the degree of glare from the lighting system just acceptable.

The Illuminating Engineering Society suggests a minimum VCP of 70 and a ratio of maximum-to-average Luminaire brightness of five to one, with a ratio of three to one being preferable. The IES also has suggestions for maximum luminance at different angles. Reflected glare is also a problem and causes discomfort and occurs when Luminaire brightness is reflected from shiny (specular) surfaces in the field of view.

Equivalent sphere illumination (ESI) evaluates the way in which lighting systems affect task visibility, rather than just expressing the amount. The proper lighting of a health/fitness facility is dependant not only on the quantity of light, but also the quality of light (Gerson, Gettman, Grantham, Patton, 1989). Sphere illumination refers to both the quantity and quality of light on a task. In the center of an evenly illuminated sphere in which light falls on a task equally from all directions, there is minimal loss in visibility from veiling reflections.

Ample foot-candles of the correct chroma and hue of light combined with wall colors and surrounding objects can add sufficient ambience to a space. By improving the ambience of a space, you have essentially improved the way in which that space is experienced. Improving the experience will insure the return of current clients and the likelihood of acquiring new clients.



### 2.4.2 Lighting Technology –

There are several lighting technologies available to choose from when designing the lighting system for an environment. Some of the technologies are more suited for specific kinds of environments than for others.

Example, High Intensity Discharge (HID) would be poorly suited for lighting a living space while fluorescence would be poorly suited for a cosmetics counter. Through manipulation of different features involved

in the lamp technology, some of these technologies can be adjusted to accommodate different needs.

Artificial light can be produced in a variety of different ways.

Incandescence is the emission of visible radiation by a body at a high temperature (Jones, 1989). Incandescent

filament sources have a

continuous spectrum, which means they emit light at nearly all wavelengths.

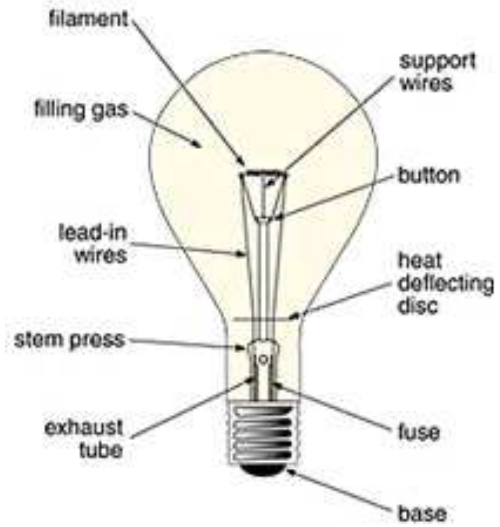


Figure 3: Incandescent Lamp

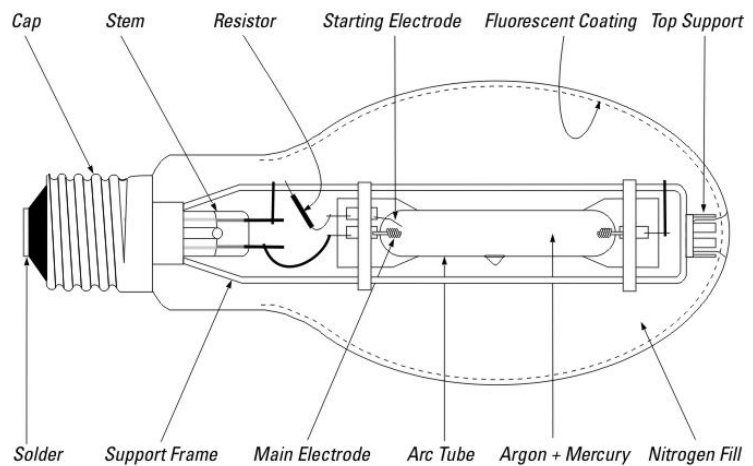


Figure 4: HID Structure

Incandescent lamps are one of the most widely used sources of light available and they come in varying levels of output and focus.

Photoluminescence results from the excitation of neutral gas atoms through collisions with electrons in an arc discharge. The resulting illumination may be visible to the eye (light), or invisible (ultraviolet). Radiation may be produced in a low-pressure discharge (low pressure sodium lamp), or a high-pressure discharge (high-intensity discharge [HID] light source family).

These different technologies come in different sizes, shapes, and with different output levels and colors (temperature). The challenge is knowing which technology or mix of technology is best suited for the environment being illuminated. HID technology is typically used for stadium lighting or outdoor lighting while fluorescent light is more common in offices and large general use spaces. Incandescent lamps are the most commonly used and are considered a general use lamp. In addition to the quantity and quality of light provided, these factors should be considered: maintenance requirements, bulb availability, repair and replacement capabilities, cleaning requirements, and cost (Gerson, Gettman, Grantham, Patton, 1989).

Many types of lights exist, that are virtually maintenance free, except for changing the bulb, and little work is required. The more common types of light fixtures have common bulb types, which can be easily located and purchased at a reasonable cost. The less common fixtures usually require specialized bulbs and can range in price for affordable to cost prohibitive. Operating costs also vary, HID fixtures, when installed properly, can save money. Fixtures of this type often run at a higher voltage and consume fewer amps, which allows more fixtures to exist on the same circuit. The fewer

circuits used, the less space taken up in the circuit panel. A smaller circuit panel is less costly but may hinder any expansion later.

### 2.4.3 Luminaires –

A Luminaire is a complete lighting unit. It consists of housing, lamp holders, lamps, (possibly a ballast or transformer) and the optical system; the reflector, and either a lens, louver or diffuser for controlling brightness. The Luminaire is basically the meat of the lighting system; it is the technical device that encompasses the light-producing element.

There are six basic classifications of luminaires; direct - where all the light is directed down, semi-direct – where the majority of the light is directed down, general – where light is distributed in all directions, direct-indirect – where light is distributed equally up and down, semi-indirect – where the majority of light is directed up and indirect – where all of the light is directed up. These are the six basic ways in which light can be directed or manipulated in order to alter the perception or use of a space.



Figure 5: Recessed Luminaires

### 2.4.4 Design Principles –

“Lighting design is the process of integrating, in a unique way, the art and science of human perception with the art and science of human technology. The result is a very

complex system that varies in time in a way that can be extremely exciting. The complex and temporal nature of lighting is one of the least understood of its many variables. The time of day and year, the age and mood of the observer, the use and location of the architectural space being experienced – all these elements come into play with the intention of the lighting designer and result in a myriad of totally unique experiences of the environment.” (Jones, 1989, p. 43)

According to Frederic H. Jones, Ph.D., Good lighting makes a building look and work the way the architect intended at all hours of the day and night. This statement defines good lighting in regards to architecture but not to the function of the person within the environment the architect has created. Jones, Ph.D., also states that light is invisible until it strikes a surface and molds our environment. The angle, quality and intensity that light strikes a surface all combine to render objects in different ways. The vital relationship between light and color can enhance or destroy the most carefully worked out color scheme. By manipulating these varying attributes, with guidance, the health facility owner can begin to affect his clientele in a positive manor.

The guidelines will define how light is to be applied to surfaces in order to establish the character and mood of the space. Light is often cast onto planes of brightness (wall, ceiling, floor) to change the mood or character of a space and often also affects the usability of that space.

Jones, Ph.D. (1989) states the following;

A ceiling left in shadow creates a secure, intimate, relaxing environment suitable for lunches, leisurely dining and boardrooms. High brightness on the ceiling creates a bright and cheerful or efficient and work-like atmosphere good in

coffee shops, classrooms and kitchens. With the ceiling in shadow, brightness on the vertical planes of a space draws attention to the walls, expanding space visually; good for galleries, merchandising, lobbies. A pattern of varying levels of brightness can indicate direction and lead people through a space.

There are several elements that are readily available for lighting design. The use of lighting principles such as glitter and sparkle are used to create a scintillating effect that heightens awareness by using pinpoints of brightness from small exposed filaments or multiple reflection from crystal, chrome or other shiny surfaces. Care must be taken to not over use this characteristic because there is only a fine line between stimulating points of brightness and discomfort glare.

The best known, and probably the most widely used lighting principle is that of light and shadow. According to Jones Ph.D. (1989), an evenly illuminated space is similar to an overcast day – dull, monotonous and boring. In order to bring a sense of excitement and visual relief to a space, variations in brightness and the interplay of light and shadow should be added. Caution should be taken as not to create a space that is so exciting that it overwhelms or destroys the interior design, nor so placid as to make a room dull and uninteresting. Another thing to consider is, that shadows are essential for perceiving dimensionality and can be used to make freestanding objects, such as sculpture, appear fully three-dimensional.

The process used and the elements that are considered while making and realizing a design should be based on the entire environmental and psycho-physical system that interact with the observer to create a lighting installation. Some factors to be considered

are the situation; is it a working, viewing, circulation or living space? The function; what will people do in the space? The quantity and quality of light needed to perform tasks, the architecture and décor, the atmosphere or psychology of the space, the relationship to adjacent areas.

There are different categories of lighting to assist with meeting the needs of the users of a space. For instance, task lighting is illumination from nearby sources that allows the performance of visual tasks. It is localized light to work by and is considered one of the most important elements of commercial lighting design. The purpose is to provide the necessary amount of illumination for a worker to perform his/her task.

General or ambient lighting is background or fill light in a space that reduces harsh contrast between pools of localized tasks or accent or that supplies a substantially even level of illumination throughout an area (Jones Ph.D., 1989). The ambient light creates a canvas for the designer to use for the purpose of improving the ambience of the space.

#### **2.4.5 Lighting Techniques –**

There are several aspects to consider in designing lighting systems but the most important part is not to rely on technical data alone but to also have a well thought out design. There exist several techniques for developing a lighting design and many of these techniques have been around for many years. Recently, there has been a growth in new lighting technology, LED, fiber optic, compact fluorescence have all become more cost effective and readily available. As the cost is reduced the availability and the scope

with which these tools can be used is broadened. Even though the new technology is what's cool, you have to be sure not to forget the traditional lighting techniques.

The first of these techniques involves lighting the vertical plane or the walls. There are a variety of walls to light in a variety of ways; the most common is using a wall wash. A smooth even distribution of light over a wall is called wall wash. When the texture and make-up of a wall changes, the effectiveness and value of wall wash may be either increased or reduced.



Figure 6: Wall Perimeter

Wall lighting may be from incandescent, HID or fluorescent sources, the selection being based on the size of the space and the evenness of the brightness, the intensity and textural emphasis desired. Accent or display lighting is usually incandescent because of its suitability to directional control.

Texture rendition lighting can emphasize texture and surface irregularities if it is installed close to a wall (“grazing” light) as with light sources concealed behind a baffle or in a trough next to the wall, or it can minimize texture – and faulty seams or plaster work – if it is installed at some distance from the wall as with wall washer luminaires. The farther out from the wall the luminaires are, the “flatter” the wall will appear and the less its surface variations and texture will be noticed.

Continuous fluorescent strip systems are particularly effective when used to make ceilings appear to “float.” Because of the diffuse nature of the light with subsequent lack

of directionality inherent in fluorescent lighting, the wall brightness drops off quickly with distance from the ceiling; hence most fluorescent systems such as the Trough Systems are not primarily wall washers and are generally best suited for 10' ceilings or lower (Jones Ph.D., 1989).



Figure 7: Localized Accent

Accent lighting should be used to bring attention to a specific object or location within the interior environment. An accented element should be at least three times brighter than the background for discernible contrast. For added contrast or for lighting something such as a store manikin or store fixture are lighting ratio of five to one is more acceptable.

Discontinuous wall washing can be used to accent a section of the wall where a wall fixture is located. Localized accent lighting that uses confined beams are good for focusing attention on smaller pictures, signs, graphics or displays. Aiming the localized accent 30 degrees from the vertical will help to reduce reflective glare and to help reduce the possibility of someone walking through the beam of light. A negative to localized beam is the distortion of shadows, which can add a bizarre element to an environment.



Figure 8: Discontinuous Wall Wash

Task visibility is important because it involves seeing the job to be done. There are many areas that are encompassed by task visibility such as office work, food



preparation, handcraft or any activity that requires close visual attention and discrimination among details. The size and contrast of the details of a task, its brightness, and the time required to perceive the visual message are the factors that influence task visibility. Up to a certain point, these factors improve as the quantity of illumination increases. There are published recommended foot-candle levels for a variety of visual tasks.

Visibility is the key to increased production, according to Jones. He continues, more work with fewer errors results when the task can be seen quickly, easily, and accurately. Illumination on a task, as suggested by Jones, may be provided by an overhead system that distributes even general lighting throughout a space or by luminaires located closer to the task (local lighting) that are designed to light primarily the task area.

Glare is not generally considered a design element or technique but rather something to be avoided. There are two principal types of glare to consider, Reflected Glare and Direct Glare. Reflected glare is a result of light being reflected off a surface and interfering with the task. Direct glare is the result of a light source shining directly into the observer's eyes and causing the eye to inappropriately adjust for light levels. In order to avoid reflected glare from veiling reflections, the light source should be slightly behind the user or to the side.

Placing a light source directly in the line of sight of the user causes direct glare. The only way to eliminate direct glare is through careful placement of luminaires and by shielding. Parabolic louvers on fluorescent fixtures are an example of shielding. Direct

glare is one of the most distracting forms of glare and is the most easily eliminated through careful planning.

Local lighting refers to a luminaire located below ceiling level and/or one that is specifically related to a limited area in which visual tasks are performed. Under cabinet lighting in a kitchen, suspended down lights over a work table or a directional source aimed at a sewing machine needle all provide localized lighting. The level of illumination increases the closer a light source is to a task. The location of local task lighting determines the presence or absence of veiling reflections. Local lighting is frequently in the line of sight, so luminaire brightness becomes particularly critical.

## 2.5 Color -

Color is not the property of objects, spaces, or surfaces; it is the sensation caused by certain qualities of light that the eye recognizes and the brain interprets (Mahnke, 1987). It is this approach to

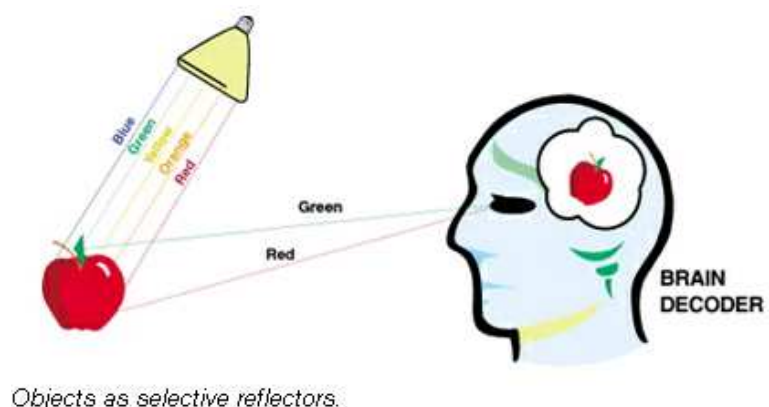


Figure 9: Selective Mirroring

color that has been omitted from the guidelines and references of professional health facility designers. Therefore, light and color are inseparable, and, in the design of the human habitat, equal attention must be devoted to their psychological, physiological, visual, aesthetical, and technical aspects (Mahnke, Mahnke, 1987). There is often very

little attention paid to the psychological affects of color and light and even less attention paid to the physiological affects of color and light within the realm of health and fitness.

### **2.5.1 Color as Energy –**

Color, which is created by light, is therefore a form of energy, and this energy affects body function just as it influences mind and emotion (Mahnke, Mahnke, 1987). Because light is received through the eye and interpreted by the brain, certain chroma and hues of light can effect the way the brain functions. Adjusting the lighting and color of a space, affects the way it is received and interpreted by the brain, thus causing the brain to react. These reactions affect the way a user experiences the space and how well they perform within that space. By manipulating the color and light of a space you can either positively or negatively affect the way in which someone experiences that space and how well they perform within its confines.

### **2.5.2 Color Interest –**

A dull environment tends to prod brain activity, which may induce anxiety, fear, and distress (Mahnke, Mahnke, 1987). Poor choices of lighting and color can negatively affect the user. The last things a user wants to feel, especially while in a health/fitness facility, is anxiety, fear, and distress. These types of emotional and biological reactions to light and color, when experienced in a health/fitness facility, can affect client retention and new client sales.

### **2.5.21 Biological Arousal –**

More complex or incongruous visual patterns evoke an increase in phasic arousal level (Mahnke, Mahnke, 1987). Different colors and patterns can cause a heightened sense of arousal by the user. Variety is visually exciting. According to Mahnke and Mahnke, color is rarely seen in isolation; in the visual field, different colors are usually seen simultaneously. This creates an optical effect closely related to successive contrast (afterimage) (Mahnke, Mahnke, 1987). A white surface will appear pale green after gazing at a red surface. This is known as the afterimage phenomenon.

### **2.5.22 Eye Fatigue -**

The afterimage is known as a fatigue effect. As the cones in the retina adapt to a particular color, let us say red, the red-sensitive photoreceptors will be temporarily fatigued, and as the red stimulus is replaced by white, they respond less strongly to all the light rays reflected from the white surface (Mahnke, Mahnke, 1987). Only the cones sensitive to green will function fully. This effect is not permanent, but the color patch that floats in front of the eyes can be disturbing and even annoying.

Over excitation is distracting and fatiguing (Mahnke, Mahnke, 1987). Too many colors and too many patterns can distract the eye and the user from the task. In an area where concentration is important, a low level of “visual noise,” is ideal for an optimal working environment. This can be applied to the health/fitness industry because of the amount of concentration required to focus on the task at hand. Many people exercise while listening to music, which breaks the acoustic monotony of a space and drowns out background noise. The same can be said for visual monotony. Too much color is

distracting and the user cannot close their eyes to drown it out. Removing the unnecessary distractions and simplifying the space is the easiest way to improve user attention levels.

### **2.5.23 Keeping Interest -**

It is not just that one color is better than another for a specific purpose, that one may be considered psychologically exciting or another calming, but a variety of visual stimulation and change in atmosphere is required in establishing a sound milieu (Mahnke, Mahnke, 1987). By changing colors between different spaces and altering lighting, the spaces occupied by people can be more interesting and conducive for the task at hand. A boring environment reduces the level of perception, consciousness, and thought. The only way to keep these at a higher level is to keep the environment continually changing. Adaptation is the best way to keep someone mentally acute in a physical environment.

In response to environment, people expect all of their senses to be stimulated at all times. This is what happens in nature, and it relates not only to color and changing degrees of brightness, but to variations in temperature and sound. The unnatural condition is one that is static, boring, tedious and unchanging. Variety is indeed the spice – and needed substance – of life (Birren, 1983).

### **2.5.24 Balance -**

Balance is finding unity among variety. Both variety and unity are necessary to sustain interest, and these opposing forces must be balanced (Crewdson, 1953). Variety is needed to attract and excite interest; unity is essential to make a positive impression

and to satisfy the moods and desires. Excessive variety can be confusing and unpleasant; excessive unity is monotonous. The key to good color arrangement is in knowing where to stop between these two extremes.

#### **2.5.25 Visual Noise -**

First of all, as human beings exposed to visual stimuli, we are easily confused. Disorder occasioned by unrestrained diversity can be nothing but emotionally repellent. We have a limited tolerance for diversity (Ellinger, 1967). A lack of order and excessive variety lead to a lack of interest. It is necessary, when considering colors and patterns for interior and exterior spaces, to be aware of the complexity and variation among the elements involved. Too many details are overwhelming, while too few are dull. A balance of complexity and unity are necessary for the successful use of color in any environment.

#### **2.5.26 Differing Reactions –**

All people have pleasant or unpleasant arousal reactions, but they experience them in varying degrees (Mahnke, 1987). Extroversion and introversion are terms that express the degree of excitability, as designated by psychologist H.J. Eysenck. There is a fallacious tradition among designers to prescribe passive environments for the extroverted temperaments in order to calm them down, and active environments for the subdued and introverted personalities to draw them out of their introspection and boost their spirits (Mahnke, 1987). The opposite effect will take place; neither one will be

happy in surroundings that oppose their personality. The introvert's nervous system is more excitable than that of the extrovert.

### **2.5.27 Mood-tones –**

Color not only produces mood associations, subjective and objective impressions, but also influences our estimation of volume, weight, time, temperature, and noise (Mahnke, 1987). Researchers have collected findings that suggest that there are basic reactions to color that are common to most people. Several studies have been done that show affective values of certain hues, thus making with reasonable accuracy, an assessment of mood-tones of colors. Some colors were found to be associated with several mood-tones some mood-tones were associated with more than one color.

Red, for instance, can be interpreted as exciting or stimulating by altering the hue; positive and negative associations include words such as passionate and aggressive, fervid and raging, active and intense. There are certain character associations related to red, it is the most dominant and dynamic of all colors, it grabs the attention and overrules all other hues. Red objects create illusions that make objects appear closer than they actually are. Symbolism related to the color red includes fire, life, and strength, but its aggressive masculine nature is also linked with combat, dominance, war, and rebellion (Mahnke, Mahnke, 1987). There are five other colors; orange, yellow, green, blue, and purple, that has similar types of symbolism and associations.

### **2.5.28 Cultural Differences –**

It has often been questioned whether cultural heritage influences the effect of color, thus rendering meaningless any reasonable conclusions about color's psychological effects (Mahnke, 1987). In the United States, the combination of red, white, and blue, symbolizes patriotism and evokes an image of the American Flag, similar reactions occur in France with a reversal of the order. In Jamaica, the colors on the flag represent different aspects of the culture in Jamaica; yellow – sunshine and natural resources, black – the burdens borne by the people, and green – agriculture and hope for the future. For the Jamaican people, their flag is a symbol of hope in time of hardship. This proves that color evokes certain emotions among people; some of the emotions are similar, while others are distinctively different.

### **2.5.29 Interior Effect –**

According to Mahnke and Mahnke, it must be stressed that the mood or atmosphere of a space can be manipulated to conform to the function of that space. The type of mood created depends on the color used. Warm and luminous colors with high levels of light produce a centrifugal action, directing attention outward and toward the environment (Mahnke, Mahnke, 1987). This type of environment is conducive to cheerfulness, action, and muscular effort.

Softer surroundings, cooler colors, and lower levels of illumination produce centripetal action (Mahnke, Mahnke, 1987). An environment such as this encourages inward focus and improves the ability to concentrate. This can be used in areas where a group of people is required to perform difficult visual and mental tasks, which contrasts



with warm and luminous spaces previously discussed. By differentiating colors and light, the mood or ambience of a space can be altered in such a way as to enhance the function of that space.

### **2.5.291 Volume –**

Lightness is one of the most important factors in the perception of openness in the interior space (Mahnke, Mahnke, 1987). Light, pale, and cooler colors in combination with small patterns can increase apparent room size. Another way to increase or diminish apparent room size is by manipulating illumination levels. High illumination levels will increase apparent room size while low illumination will diminish it. The wall opposite a window generally should be kept fairly light, or it will absorb much of the daylight and cause uneven illumination (Mahnke, Mahnke, 1987). The trim around the window should also be kept light in order to reduce irritating glare.

### **2.5.292 Weight and Size –**

In general, darker colors appear heavier, whereas lighter and less saturated (pastel) ones seem less dense. If the hues are of the same value and intensity, the tendency is to perceive the warmer hues as heavier (Mahnke, Mahnke, 1987). According to Mahnke, bases for machinery and equipment will appear steadier and more solid if they are painted darker than the equipment itself.

Cooler, lighter colors will make larger heavier objects seem lighter; this effect helps reduce the perceived level of effort required to move an object. Cool colors will also make things look smaller and shorter; warm colors make them seem larger and

longer (Mahnke, Mahnke, 1987). Painting a high ceiling with a darker, warmer color will reduce the perceived height of the ceiling, making it appear lower. The opposite is true for low ceilings.

#### **2.5.293 Time Estimation –**

In environments with warm colors, time is overestimated. With cool colors, on the other hand, the opposite appears to be true: Time is underestimated (Mahnke, Mahnke, 1987). An experiment conducted by Goldstein, in Clark 1975, it was noted that under the influence of red light, time is overestimated. Under green and blue light, the judgment of time is in the opposite direction. Other experiments have been conducted that illustrate the opposite effect. Although there is as yet no resolution to the question of which hues affect the over- or underestimation of time, it can be concluded from these experiments that color apparently influences the judgment of time (Mahnke, Mahnke, 1987).

#### **2.5.294 Temperature –**

A long-favored hypothesis maintains that color has the power to suggest warmth or coolness. People are fairly unanimous in their opinions of the colors that visually induce either effect (Mahnke, Mahnke, 1987). In his book *The Elements of Color*, Johannes Itten tells of experiments that demonstrated a difference of five to seven degrees in the subjective feeling of heat or cold between a workroom painted blue-green and one painted red-orange. Occupants of the blue-green room felt that 59°F was cold,

whereas the temperature had to fall to 52° to 54°F in the red-orange room before the subjects felt cold (Mahnke, Mahnke, 1987).

Colors also absorb and retain heat in various degrees, depending on their light-reflection ratio. The lighter the color, the more light (therefore heat) is reflected; the darker the color, the more light is absorbed (Mahnke, Mahnke, 1987). In a practical application, it is better to consider the sensation given off by a color rather than the absorption factor. Cool colors should be applied in locations where people are exposed to high temperatures, and vice versa (Mahnke, Mahnke, 1987).

#### **2.5.295 Noise and Sound –**

Krakov, Allen, and Schwartz (quoted in Birren 1982) found that loud noises and strong odors and tastes make the eye more sensitive to green and less sensitive to red.

The designer may profit from the relationship between noise and color that is more of a poetic nature or mental association. Stimulation of the senses, brightness, and loudness are associated with the most active effect of warm colors, the reverse being true for cool colors (Mahnke, Mahnke, 1987). High-pitched and shrill sounds tend to be compared with saturated and light hues. A noisy environment will be experienced subjectively as noisier or more bothersome if painted with glaring yellows or reds (Mahnke, Mahnke, 1987). To offset shrill or high-pitched sounds, olive green may be used. Darker hues tend to increase the perceived level of already muffled sounds; lighter colors can be used to compensate, such as light, clean greens (slightly toward yellow).

### **2.5.296 Odor and Taste –**

Colors that hold pleasant associations with smell are pink, lavender, pale yellow, and green. Tints of coral, peach, soft yellow, light green, turquoise, flamingo, and pumpkin have pleasant associations with taste (Mahnke, Mahnke, 1987).

The psychological power of one color will never satisfy all of the needs of an environment. A psychiatric hospital will not be “relaxing” all in greens just because that is an inherent characteristic of that color. The principle of unity and complexity balance must be satisfied at all times, and various color effects are an aid in achieving that balance (Mahnke, Mahnke, 1987).

### **2.5.297 Ceilings, Walls and Floors –**

The location (top, sides, bottom) of a color stimulus within the interior space can make a great deal of difference in influencing a room’s character, the way it is perceived psychologically, and the 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 (Mahnke, 1987).

A red ceiling is intrusive while a red floor evokes a feeling of consciousness and red walls feel as though they are aggressive or advancing. Blue ceilings feel open like the sky while a blue floor inspires a feeling of effortless movement and a blue wall seems cool and distant (Mahnke, 1987).

### 2.5.3 Color Fundamentals –

This section deals with the varied aspects of color and its application to the design process. Fundamentals include information about hue, saturation, and lightness with regard to the quality and characteristics of each aspect. Color contrast determines how a color is perceived, how a color scheme is developed, and how objects are highlighted or partially concealed (Mahnke, Mahnke, 1987).

Successive and simultaneous contrasts involve how a color is perceived when viewed in the presence of other colors. Successive contrast deals with the color that is seen after gazing at a complimentary color. Simultaneous contrast involves seeing the complimentary color of the primary projected onto an adjacent color. Different contrasts can help to improve the way space is perceived.

The following examples are based on the Munsell ten-hue color-wheel. The color wheel is divided into ten divisions, which are red, yellow-red, yellow, green-yellow, green, blue-green, blue, purple-blue, purple, and red-purple (Mahnke, Mahnke, 1987).

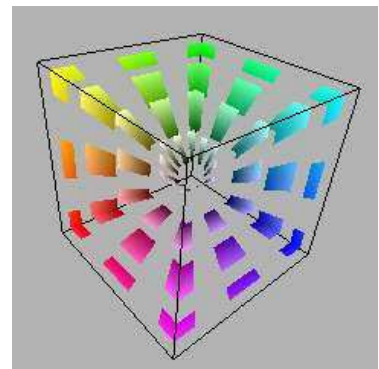


Figure 10: Munsell color separation

### 2.5.31 Hue –

The quality or characteristic by which one color is distinguished from another is referred to as hue. Physically, hue is determined by wavelength. The elementary hues that we differentiate are based on the spectral hues red, orange, yellow, green, blue, and violet. All colors are judged to be similar to one hue or a proportion of two of the

spectral hues. White, gray, and black are perceived as colorless, being neither reddish, yellowish, greenish, nor bluish. This lack of color (chroma) causes them to be termed achromatic (Mahnke, Mahnke, 1987).

### 2.5.32 Saturation –

The second attribute by which a color is distinguished is referred to as saturation. Also referred to as strength, intensity, or chroma, it designates the purity of a given color, the quality that distinguishes it from a grayed color. Two colors may be the same in hue (for instance, two greens), and one no lighter or darker than the other, yet still appear different in color strength (Mahnke, Mahnke, 1987).

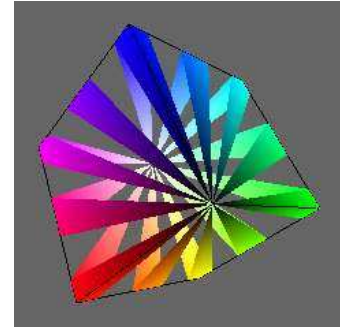


Figure 11: Color Saturation

### 2.5.33 Lightness –

The third dimension in the description of color is lightness, or its synonym value. It is the quality that differentiates a dark color from a light one. The lightness of a pigment is the measure of how much light is reflected from its surface. Sometimes brightness is

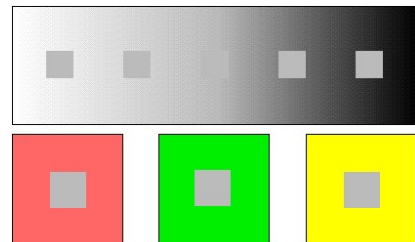


Figure 12: Lightness

used as a synonym for lightness – which may be confusing. Brightness means the intensity of a light source or a luminous sensation when describing the light and it means highly saturated when describing color (Mahnke, Mahnke, 1987).

### **2.5.34 Color Contrast –**

Since the three attributes of color are hue, saturation, and lightness, it is easy to identify the three basic contrasts: hue contrast, saturation contrast, and lightness contrast. Contrast effects may be helpful or harmful, and they are always present in the environment in one form or another (Mahnke, Mahnke, 1987). There are a few hints that Mahnke suggests. One, hues similar in saturation and value can unify a room and make a space seem larger. However, be sure to avoid monotony. Two, contrast between walls and furnishings will make the furnishings more prominent. Three, hue, value, and saturation contrasts emphasize contours. Four, visual spaciousness increases when similar colors are carried from one room to another.

### **2.5.341 Successive Contrast –**

If your eye becomes adapted to a particular hue by staring at it for sometime, and then you shift your gaze to a white (or gray) surface, the complementary color will appear upon that surface (Mahnke, Mahnke, 1987). A white surface will look pale green, for example, after your eye has first adapted to a red stimulus. This is referred to as the afterimage phenomenon (Mahnke, Mahnke, 1987). The afterimages are understood as a fatigue effect.

A good example of successive contrast existed when operating rooms in hospitals were white, as were the cover sheets and surgical gowns. Surgeons working at a strongly illuminated operating table were disturbed by the afterimages of blood and tissue that appeared when they would look temporarily at the white walls or the white gown of their

colleagues. Today, most gowns, cover sheets, and walls are green or blue-green, and the problem has been nearly eliminated (Mahnke, Mahnke, 1987).

The physiological fact is that the eye requires any given color to be balanced by its complementary, and will generate it if it is not present. Complementary colors, besides being psychological pairs in the eyes, provide a psychological balance of warmth and coolness of color (Mahnke, Mahnke, 1987).

The physiological phenomenon of afterimage is often used as proof that the complementary colors are the basis of harmonious design. Also, when complementary colors are placed next to each other, the effect is both stimulating and pleasing because the afterimage of one enhances the other (Mahnke, Mahnke, 1987). The concept of complementary hues is based on the color wheel, on which those colors that are diametrically opposite are considered complementary (Mahnke, Mahnke, 1987).

### **2.5.342 Simultaneous Contrast –**

Rarely is a color seen in isolation; in the visual field, different colors usually are seen simultaneously (Mahnke, Mahnke, 1987). This creates an optical effect closely related to successive contrast (afterimage). The eye will generate the complementary of the hue that it is seeing and project it toward the color adjacent to or superimposed upon it (Mahnke, Mahnke, 1987).

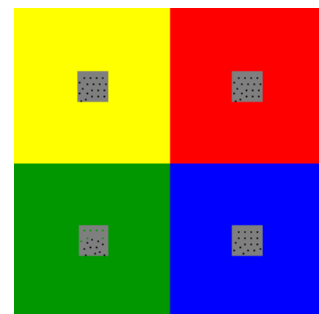


Figure 13: Simultaneous Contrast

Simultaneous contrast occurs not only between gray and a strong colored background, but also between any two hues (as long as they are not complementary).



Each of the two hues tends to shift the other toward its own complement. Achromatic simultaneous contrast will make a gray appear dark against a light background, yet light against a dark background. Another observation shows that closely related hues would lose some of their brightness, while complementary colors adjoining each other become intensified (Mahnke, Mahnke, 1987).

### **2.5.35 Harmonies and Combinations –**

It can never be assumed that beauty is unnecessary for mental well-being. Beauty or pleasantness might be an elusive element, however; what one person may consider beautiful, another may question. People react favorably to harmonious surroundings, and few people are completely oblivious to discord (Mahnke, Mahnke, 1987).

Related harmonies are subdivided into monochromatic and analogous. Contrasting color harmonies unite hues that are separated on the color wheel. The most common of these harmonies is the complementary color scheme (Mahnke, Mahnke, 1987).

### **2.5.351 Monochromatic Harmonies -**

Based on one hue varied in value and saturation – for example, pale green with pure green and dark green. With regard to interior design, there is a real danger of monotony in such an arrangement (Mahnke, Mahnke, 1987).

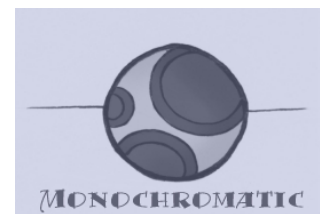


Figure 14:  
Monochromatic  
Harmonies

### 2.5.352 Analogous Harmonies –

Combine usually no more than three colors next to each other on the color wheel. The three hues are unified because of a shared color – for instance, red, yellow-red, and yellow; green, blue-green, and blue. Analogous color schemes offer more variety than monochromatic ones, but neither type will satisfy the problem of the afterimage phenomenon described earlier (Mahnke, Mahnke, 1987).



Figure 15: Analogous Harmonies

### 2.5.36 Complementary Schemes –

Based on hues directly opposite each other on the color wheel. Examples are red and blue-green; yellow-red and blue; purple-blue and yellow. These harmonies offer more contrast and introduce both warm and cool colors into the environment. Careful handling of value and intensity, as with all contrasting schemes, is a prerequisite to ensure the success of these combinations (Mahnke, Mahnke, 1987).

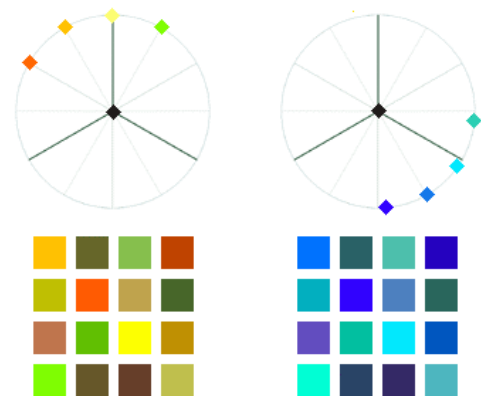


Figure 16: Complementary Schemes

### 2.5.361 Analogous-Complementary -

Analogous complementary is a term that could be used to describe a modification of the complementary scheme. Choosing two colors next to each other and combining

them with the complementary of one of the two achieve this harmony – for example, yellow-red and yellow combined with blue, the complementary of yellow-red (Mahnke, Mahnke, 1987).

### **2.5.362 Split-Complementary Harmony -**

Consists of one color and the two colors adjoining its complementary color. For instance, the complementary of red is blue-green, which is bordered by blue and green. The arrangement therefore would comprise red, blue, and green (Mahnke, Mahnke, 1987).

### **2.5.363 Double-Complementary -**

Schemes recommend the use of two closely related hues and their complements. One example would be yellow-red and yellow with blue and purple-blue.

Other systematic variations of color relationships that are considered harmonious are triads and tetrads. *Triads* use three colors as equally spaced as possible on the color wheel, while *tetrads* are any four hues equidistant from each other (Mahnke, Mahnke, 1987).

The idea that complementary colors produce harmony and balance is a traditional colorist approach. The modern colorist approach states that non-complementary colors produce asymmetry and tension. *Asymmetric harmony* is based on two or more colors from one side of the color wheel without any shared hue. The eclectic approach uses neither of these two orientations (Mahnke, Mahnke, 1987).

#### **2.5.4 Color Systems –**

Anyone working seriously with color will find it necessary to use some kind of color classification and order system. Color systems are an aid to composition, and they bring order into the confusion of the color range. Colors are presented in sequence and in their relationship to each other, and they are listed neatly by hue, saturation, lightness, and interval (Mahnke, Mahnke, 1987).

Unfortunately, there does not currently exist an international system for color organization. Almost every major industrial nation has its own color standard, and most industries in which color is important have developed their own systems – none of which are interchangeable.

#### **2.5.41 C.I.E. –**

The Commission Internationale l’Eclairage (C.I.E.) has devised a color system based on spectrophotometric measurements of color samples and it is the last word in accuracy. But for everyday practical use, it is not as convenient as those systems composed of color chips or patches with which a sample can be matched visually. C.I.E. specifications are presented in mathematical form, so it is necessary to refer to color samples built up from coordinates (Mahnke, Mahnke, 1987).

Most systems classify colors in terms of hue, lightness, and saturation. Some systems describe colors by their color content, referring to the proportion of white, black, or full color contained in a particular hue (Mahnke, Mahnke, 1987).

### 2.5.42 Munsell System –

One of the most widely used methods of color notation is the Munsell system. This system identifies colors based on three attributes: hue, value (lightness), and chroma (saturation). Chosen so that the colors appear equally spaced, the Munsell system is based on five principal and five intermediate hues.

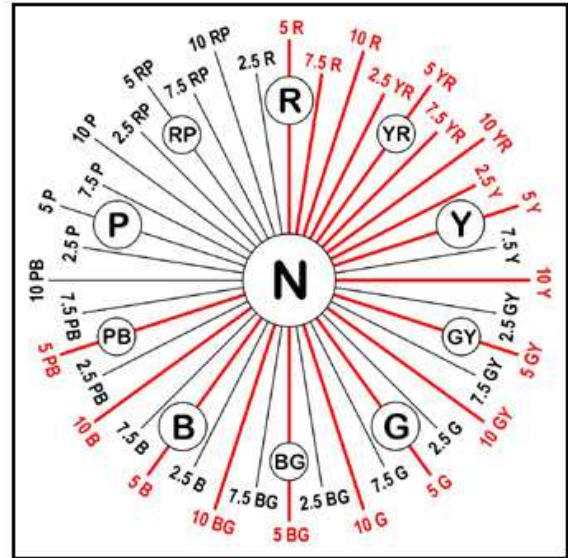


Figure 17: Munsell Color Wheel

Arranged clockwise around the color wheel by name (abbreviated by initials), they are: red (R), yellow-red (YR), yellow (Y), green-yellow (GY), green (G), blue-green (BG), blue (B), purple-blue (PB), purple (P), and red-purple (RP). Each named hue is subdivided further into four sections and designated 2.5, 5, 7.5, and 10, followed by its hue initial (2.5R, 5R, 7.5R, 10R). These are shown in the inner circle of the color wheel and may be used for rough identification of hue. Each named color is also divided into ten sections denoted by the numerals 1 to 100 and shown on the outer circle of the color wheel. These are used primarily for statistical records, cataloging, and computer programming (Mahnke, Mahnke, 1987).

### 2.6 Biological and Psychological Effects of Light -

Further enlightenment has been enacted on the psychological effect of blank walls, boredom, and monotony. The ape can acquire neuroses and ulcers just as man can from the terrors of isolation. Not only is properly balanced light a prerequisite for all

things, but the color of the light, the character of the environment, the stimulation of the senses (or lack there of) are all vital to normal life, as well as to survival itself (Birren, 1969).

Sunlight is balanced light, so to speak, emitting power that has a wide range in wavelength and frequency, each part or “octave” of which has a certain need and purpose. The complete spectrum of electromagnetic energy including sunlight contains sixty or seventy “octaves.” It begins, at one end, with radio waves of exceedingly great wavelength, proceeds through infrared rays, visible light, and ultraviolet – the wavelengths becoming shorter – to reach it’s other extreme in X rays, gamma rays, and cosmic rays (Birren, 1969).

### 2.6.1 Solar Light –

The sun’s spectrum extends from the relatively long waves of infrared light, through the entire gamut of visible light

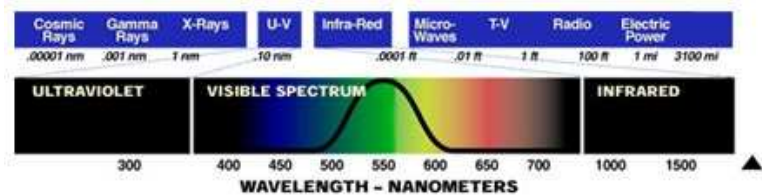


Figure 18: Wavelengths

(red, orange, yellow, green, blue, and violet), into shorter waves of ultraviolet light. The longer waves of ultraviolet produce fluorescence in many substances. Erythral rays produce suntan and are employed for the synthetic production of vitamin D. Still shorter ultraviolet energy has bactericidal properties. It is used to destroy certain microorganisms and for the sterilization of materials, water, and air (Birren, 1969).

It is sunlight, however, real or artificial, that most concerns man's environment. Must it be balanced? Must it emit all energy from infrared through visible light to ultraviolet? What would happen to man if there were gaps (Birren, 1969)?

### **2.6.2 Effect on Humans –**

In an article for *Endocrinology* (72: 962, 1963) W.F. Ganong and others reached the conclusion that “environmental light can penetrate the mammalian skull in sufficient amount to activate photoelectric cells imbedded in the brain tissue.” This means that light is quite essential to a healthful and normal life and that nature has devised ways of having it affect the body through the tissues of the skin, the eyes, and even the skull itself (Birren, 1969).

H.L. Logan, a leading light engineer, has gathered data on the effects of light. Quoting his own experience and the research of others, Logan points out that light dilates the blood vessels, increases circulation, thus ridding the body of toxins and lightening the load on the kidneys (Birren, 1969). It seems clear that light is the most important environmental input, after food, in controlling bodily function (Birren, 1969).

Ultraviolet radiation is essential to human welfare. It prevents rickets, keeps the skin in a healthy condition, and is responsible for the production of vitamin D, destroys germs, and affects certain necessary chemical changes in the body. It is used in the treatment of certain skin diseases, in erysipelas, and in skin tuberculosis.

When the body is exposed to UV light, there is a dilation of the capillaries of the skin. Blood pressure falls slightly. In addition to a feeling of well being, there is a quickening of pulse rate and appetite, plus a stimulation of energy. The brain is caused to

work on a level of higher activity (Birren, 1969). UV radiation tends to increase protein metabolism. It will thus help reduce sugar level in the blood of diabetics – having an effect similar to that of insulin (Birren, 1969).

### **2.6.3 Biological Effects –**

It seems apparent that human beings, like all other living things, have a radiation sense. What is significant is that such sense may be independent of conscious vision itself. Completely blind individuals will note awareness of the existence of light, even where heat and ultraviolet energy are excluded. Some authorities are of the opinion that the visible light of the sun acts directly on the superficial layers of the skin and has definite metabolic effects (Birren, 1969).

#### **2.6.31 Specific Colors -**

No matter, reactions to color through the eye itself are many, varied, and intriguing. In the main, color effects tend to be in two directions – toward red and toward blue – with the yellow or yellow-green region of the spectrum more or less neutral. Further, these two major colors induce different levels of activation both in the autonomic nervous system and in the brain (Birren, 1969).

Red seems to have an exciting influence. Kurt Goldstein writes, “It is probably not a false statement if we say that a specific color stimulation is accompanied by a specific response pattern of the entire organism.” Working with infants, who obviously had no prior experience with color, Josephine M. Smith noted that blue light tended to lessen activity and crying. It may be that man’s reactions to color in later life are not due



solely to cultural training (many psychologists have assumed this), but to deeper lying responses. Differential responses to color have also been observed in blindfolded subjects. This would again suggest that human reactions to color, while influenced by consciousness, are not altogether dependent on it (Birren, 1969).

### **2.6.32 Muscular Reactions -**

There is a general light tonus in the muscular reactions of the human body. Conditions of muscular tensions and relaxation are noticeable and measurable as tonus changes. Mostly they rise from complete inaction and are more active with warm colors than with cool ones. Through optic excitation, A. Metzger observed that when light was directed on one eye of many animals and humans, a tonus condition could be produced in the corresponding half of the body. Accompanying these tonus changes in “the superficial and deep-seated sensations, both showing a regular dependence upon optical stimuli.” He concluded that the influence of light not only acted on the muscles but also was effective in producing changes over the entire organism (Birren, 1969).

### **2.6.33 Sensory Reactions -**

Light and color undoubtedly affect body functions, just as they exert an influence over so-called mind and emotion. In what is known as the unity of the senses, individual experiences are seldom confined to one organ or a sense of the organism. All experiences, color included, have definite interrelationships.

It may thus be generalized that color affects muscular tension, cortical activation (brain waves), heart rate, respiration, and other functions of the autonomic nervous

system – and certainly that it arouses definite emotional and esthetic reactions, likes and dislikes, pleasant and unpleasant associations (Birren, 1969). In experiments, use was made of red, blue, and white lights transmitted on a diffusing screen. Brightness and spectral purity were balanced. Measurements were made of blood pressure, palmar conductance (electrodes in the palm of the hand which indicate arousal of the autonomic nervous system through reaction of the sweat glands), respiration rate, heart rate, muscular activation, frequency of eye blinks, and brain waves by means of an electroencephalogram (Birren, 1969).

Affective responses based on the personal experience, judgment, and feelings of the subjects were also recorded. These responses, incidentally, ran rather true to traditional form. On the subjective side, red was found somewhat disturbing to the more anxious subjects. In fact, the higher their chronic tension, the more they were affected physiologically and psychologically by red. Blue had reverse effects, for anxious subjects were relaxed and calmed by it. From the point of view of clinical psychology, this may be an important finding, for it points to the possibility that blue may be effective as a tranquilizer in cases of tension and anxiety. In brief, there was a greater feeling of well-being, greater calm, more pleasant ideation with blue, and more tension, excitement, and arousal with red. Both reactions may well hold implications for clinical practice (Birren, 1969).

#### **2.6.34 Blood Pressure -**

Blood pressure for the most part increased under the influence of red light and decreased under blue light. In palmer conductance, both colors produced immediate

increases. However, arousal after a period of time was consistently higher for red than for blue. Respiratory movements increased during exposure to red light, and decreased during blue illumination. With heart rate, no appreciable differences were found between the stimulation of red and blue. Frequency of eye blinks increased during exposure of red light and decreased during exposure of blue light (Birren, 1969).

#### **2.6.35 Cortical Activation -**

Regarding cortical activation. The brain was markedly affected upon the introduction of all three lights. With time however (up to 10 minutes), activation remained consistently greater for red than for blue. In its effects blue seems to hold particular merits. It might act as a relaxant and tranquilizer to dampen psycho-physiological arousal in anxious individuals, since this effect was marked in the more anxious subjects (Birren, 1969).

#### **2.6.36 Eye Sensitivity -**

Because blue reduces eye blink frequency and is subjectively experienced as soothing, it might have some advantages in eye irritations. Because of its restful effects, dim blue illumination might be conducive to sleep in cases of insomnia. It might further contribute to the subjective relief of pain due to its sedative action (Birren, 1969).

From this it may be assumed that red and other “warm” colors are more related to excitation in general. Blue and other “cool” colors, however, may be more specific in their particular effects. Yet red might be useful in arousing persons troubled with

reactive depression or neurasthenia. It may have value in increasing muscular tonus or blood pressure in hypertensive individuals (Birren, 1969).

White light may be physiologically stimulating while it may be psychologically boring. In other words, stimulation by itself does not compose the whole reaction. Such boredom (with white) might prove irritating and hence be reflected in physiological arousal. On the other hand, arousal with red seems to accompany feelings of aggression, sex, and fear of injury. The autonomic reactions may be similar, but the subjects feel a great difference (Birren, 1969).

## 2.7 Vision -

Although the exact process of vision is still a mystery, science generally approves of the so-called “duplicity theory,” first stated by Max Schultz in 1866. This theory states that low-intensity vision is a function of the rods of the retina, and high-intensity vision is a function of the cones. The rods, it is believed, react chiefly to brightness and motion but also to colors. Accordingly in the central fovea and in the region next to it, most of the action of seeing takes place; for only here does the eye perceive fine detail and color. Foveal sight is essentially cone vision and day vision; peripheral sight is rod vision, especially useful at night (Birren, 1969).

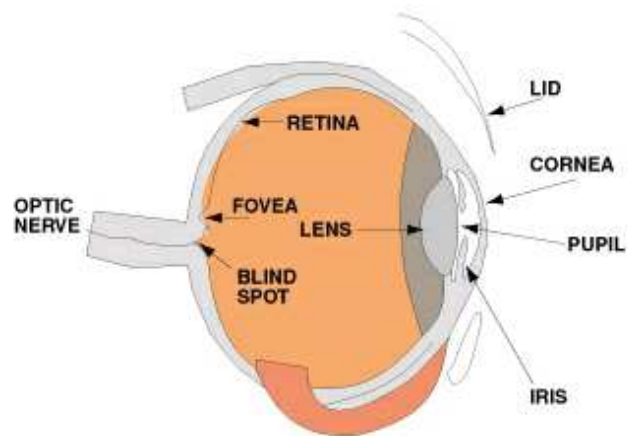


Figure 19: Diagram of the human eye

### **2.7.1 Acuity –**

Human eyes see better than the eyes of lower animals because the humans' brain are superior. Stimuli received by any eye, in fact, have no particular meaning until the brain interprets them. A rudimentary eye bud can be taken from a hen's egg and made to grow in a salt solution. It will actually develop and form a lens. Without a brain connection, however, it does not "see." (Birren, 1969)

Human eyes are not the most complex or highly developed in nature. As R.L. Gregory states, "Complicated eyes often go with simple brains." The visual acuity of a hawk, for example, is four times superior to that of man (Birren, 1969).

### **2.7.2 Color Perception –**

In its sensitivity to color, the human eye responds to a relatively small span of the total electromagnetic spectrum. Human vision may have had its evolution in water, for the visible spectrum is in general the transmission spectrum of water. Rod vision is closely fitted to water and cone vision is more closely fitted to air.

Though perception of color may connote spiritual, emotional, and aesthetic feelings to man, nature is less interested in beauty than in clear vision. Light and color have biological significance. Color sense aids perception. It has a functional basis and was evolved by nature not to make men happy, but to assure their better adaptation to environment. Just as nature imposes herself on man through vision, so man interprets nature as his brain directs. In short, seeing works two ways: physical stimuli from the outside world enters the eye, which then sends impulses to the brain; the brain adds its

experience, judgment, and perception to what it receives, and “looks” wisely back at the world and “sees” it (Birren, 1969).

As for theories of color vision, the duplicity theory still holds weight. The rods of the eye are sensitive to brightness, while the cones react to color. It has further been postulated that the eye responds primarily to red, green, and blue wavelengths, and through combinations of them all other colors are seen (Birren, 1969).

### **2.7.3 Affected by Light –**

It is probably no exaggeration to say that light level is the simplest of all problems to deal with in a man-made environment. In effect, a task is setup and light level increased until the job is visible and easily, as well as efficiently, done. Some things that may effect this are: the surround of the task should not be too dark or too bright; glare and distraction must be eliminated; some brightness should usually encompass the whole field of view; shadows should give form and depth to lighted spaces; total “effect” must be pleasing; the appearance of the worker himself, in his setting, should be acceptable and sometimes flattering. There must be considerations as to the “quality” of the light, the color tint of the surroundings brightness, the beauty, proportion, and balance of the interior itself (Birren, 1969).

### **2.7.31 Monotony and Contrast -**

Although a monotonous task, in high contrast, may require little light, the worker may be kept more alert if he is stimulated by brightness. There is often a naïve assumption that critical seeing tasks merely need adequate light. The operation of the eye

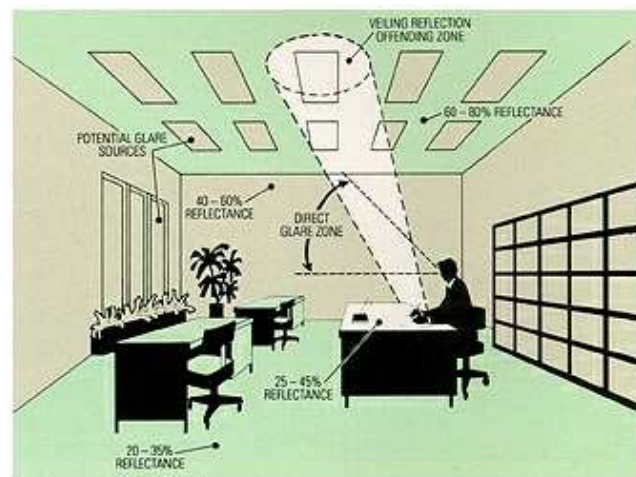
is largely muscular, and being muscular any excessive activity will tire it out – regardless of light levels or surrounding (Birren, 1969).

### 2.7.32 Illumination -

The fact that the eye sees remarkably well over a range from 1-1000 (or more) foot-candles allows for wide tolerances. Proponents of high levels may therefore speak of statistical efficiency, attempting to prove (often correctly) that the more light, the greater the accuracy. After all, vision is slow in dim light and needs good illumination to be fully alert. Visibility increases at a rapid rate from darkness to a 50 foot-candle level. For added “efficiency” beyond this, light levels may have to be doubled and redoubled (Birren, 1969).

### 2.7.33 Light Placement -

High-level light may be an aid to acuity, but it may also be a handicap if the high light level involves glare or gives great brightness to wall areas. The eye cannot help itself from looking at, accommodating to, and focusing upon the brightest area in its field of view. Such response is automatic.



Courtesy of GE Lighting

Figure 20: Light Placement

Therefore, if walls are meaningless in the performance of a visual task, it hardly seems logical to give them the advantage (Birren, 1969).

A lighting system in which 55 percent of light comes from above the horizontal line of vision and 45 percent from below is considered quite well developed. This would mean well-distributed illumination, and light floors and furnishings to reflect light. The eye is quick in adjusting itself to brightness and slows in adjusting itself to dimness. If the task is dark, and if the surrounding is bright, the whole arrangement from the standpoint of visual efficiency and comfort may be in reverse. Some compensation may be achieved through color. Uniformity of stimulus is undesirable (Birren, 1969).

#### **2.7.34 Brightness -**

Areas of steady brightness will appear to fade in and out. The pupil opening of the eye will actually close and dilate slightly. Steady sounds will not be heard consistently. Sensations of taste, heat, cold, and pressure will all vary and will be surprisingly independent of unvarying stimuli in the early stages of exposure. If the monotony is long continued, the ability to respond to the stimulus will deteriorate (Birren, 1969).

People require varying, cycling stimuli to remain sensitive and alert to their environments. Comfort and agreeableness are normally identified with moderate, if not radical, change, and this change concerns brightness as well as all other elements in the environment. If over-stimulation may cause distress, so may severe monotony (Birren, 1969).



## **2.8 User Experience**

While everything, technically, is an experience of some sort, there is something important and special to many experiences that make them worth discussing. In particular, the elements that contribute to superior experiences are knowable and reproducible, which make them designable (Shedroff, 2001). These elements aren't always obvious and, surely, they aren't always foolproof. So it's important to realize that great experiences can be deliberate, and they are based upon principles that have been proven (Shedroff, 2001).

### **2.8.1 History of Experience Design -**

The design of experiences isn't any newer than the recognition of experiences. As a discipline, though, Experience Design is still somewhat in its infancy. Simultaneously having no history (since it is a discipline only recently defined), and the longest history (since it is the culmination of many, ancient disciplines), Experience Design has become newly recognized and named. However, it is really the combination of many previous disciplines; but never before have these disciplines been so interrelated, nor have the possibilities for integrating them into whole solutions been so great (Shedroff, 2001).

Experience Design as a discipline is also so new that its very definition is in flux. Many see it as a field for digital media, while others view it in broad-brush terms that encompass traditional, established, and other such diverse disciplines as theatre, graphic design, storytelling, exhibit design, theme-park design, online design, game design, interior design, architecture, and so forth (Shedroff, 2001).

The most important concept to grasp is that all experiences are important and that we can learn from them whether they are traditional, physical, or offline experiences; or whether they are digital, online, or other technological experiences (Shedroff, 2001).

### **2.8.2 What is an Experience? –**

One of the most important ways to define an experience is to search its boundaries. While many experiences are ongoing, sometimes even indefinitely, most have edges that define their start, middle, and end. Much like a story (a special and important type of experience), these boundaries help us differentiate meaning, pacing, and completion. Whether it is due to attention span, energy, or emotion, most people cannot continue an experience indefinitely, or they will grow tired, confused, or distracted if an experience – however consistent – doesn't conclude (Shedroff, 2001).

At the very least, think of an experience as requiring an attraction, an engagement, and a conclusion (Shedroff, 2001).

#### **2.8.21 Attraction -**

The attraction is necessary to initiate the experience. It can be cognitive, visual, auditory, or a signal to any of our senses. The attraction can be intentional on the part of the experience, not just the experience creator. For example, the attraction for filling-out your taxes is based on a need, and not flashy introduction. However, there still needs to be cues as to where and how to begin the experience (Shedroff, 2001).

### **2.8.22 Engagement -**

The engagement is the experience itself. It needs to be sufficiently different than the surrounding environment of the experience to hold the attention of the experience, as well as cognitively important (or relevant) enough for someone to continue the experience (Shedroff, 2001).

### **2.8.23 Conclusion -**

The conclusion can come in many ways, but it must provide some sort of resolution, whether through meaning – story or context – or activity to make an otherwise enjoyable experience satisfactory. Often, an experience that is engaging has no real end. This leaves participants dissatisfied or even confused about the experience, the ideas, or the emotions they just felt. An experience creator that does not spend enough (or any) attention on the conclusion – whether through inattention to detail, boredom, or speed – has just wasted his or her effort and the audience’s time (Shedroff, 2001).

### **2.8.24 Extension -**

It is possible, and appropriate, for an experience to have an extension, which can merely prolong the experience, revive it, or form a bridge to another experience. In this sense, a larger conclusion with greater meaning can be alluded to so that experiences can be elicited. Each experience still needs a satisfactory conclusion on its own level in order to justify more time for further experiences. Hanging your audience completely out to dry will more likely disappoint them than keep their attention for more experiences. Just

like serial narratives (such as episodes of television or comic books), all experiences must reward attention at their end (Shedroff, 2001).

### **2.8.3 Considerations in Experience Design -**

Experiences are crucial to our lives and our understanding of the world, as well as to our ability to function within it. Indeed, to be creative at all requires a wealth of experience from which to draw. As turn-of-the Century educator John Dewey described in his book *Experience and Education*, there are three natural mental resources: “a store of experiences and facts from which suggestions proceed; promptness, flexibility, and fertility of suggestions; and orderliness, consecutiveness, and appropriateness of what is suggested.” (Shedroff, 2001)

Finally, it is critical to remember that while all experiences aren't created equally, all must compete for the attention of the audience and participants (Shedroff, 2001).

#### **2.8.31 Cognitive Models -**

“It is not enough to insist upon the necessity of experience, nor even of activity in experience. Everything depends on the *quality* of the experience, which is had.... Just as no man lives or dies to himself, so no experience lives or dies to itself. Wholly independent of desire or intent, every experience lives on in further experiences. Hence the central problem of an education based upon experiences that live fruitfully and creatively in subsequent experiences.” (John Dewey, *Experience and Education*)

The most important aspect of any design is how it is understood in the minds of the audience. This concept, whether fully or partially formed, is a cognitive model.

Everyone forms cognitive models for nearly everything they encounter – particularly those things they interact with repeatedly, or those things that we focus on because they are important to us. Some people are more adept at forming cognitive models than others, and these facilities also differ between people in their type of understanding – that is, some people form understandings textually, visually, aurally, temporally, geographically, and so forth. In any case, the form of the experience is what gives it meaning since this is what people experience directly (Shedroff, 2001).

Whether or not you focus on creating a cognitive model for your experience, your participants will nonetheless. They might form a mental map of the sequence or process or location. It might be of their feelings, or merely a randomly strung together list of memories of their experiences. What's important however is whether you want or need them to remember the experience well enough to follow directions, repeat it, recount it, or duplicate it. Much of education is about creating mental models for students to use and follow (Shedroff, 2001).

### **2.8.32 Consistency –**

Consistency is often an end in itself. While it is always a good idea for elements of an experience – especially informational ones – to be consistent, sometimes it can actually get in the way. Because life experiences are often inconsistent, consistency can sometimes be confusing when it is incongruous with our experiences or expectations. Therefore, a good measure of when consistency works is to compare it with the expectations of the users for the intended behavior of the experience or system. Because consistency is a cognitive process, it is something that must work for us mentally, and the

only way for us to check this is to test the experience with real users in situations as close to real as possible (Shedroff, 2001).

This is not a license to create inconsistent experiences – unless confusion or disorientation is the goal or challenge of the experience (as with some games). Like metaphors, it's important to ease off on consistency only if it is actually interfering with users' assumptions, and a strict adherence to consistency shouldn't prevent designers from doing this (Shedroff, 2001).

Consistency is also important among related experiences. Branding is built successfully, for example, when different experiences, often in different media, feel consistent and connected. Again, what is important is the cognitive level of consistency – that is, that the experiences feel similar and related, even if the details are quite different. Because media differ greatly in their strengths, weaknesses, and how people perceive them, transmedia design must deliberately mutate in order to take advantage of the differences and to be successful in each. What is carried away from the different media types is the feeling of connection that comes when the overall experience and some elements are consistent overall. The mistake that many designers make is in trying to design once for all circumstances. While this is always an ideal goal, this is rarely possible and usually results in experiences that aren't quite successful in all media, though very much consistent overall (Shedroff, 2001).

### **2.8.33 Metaphors –**

Metaphors are one way to build a cognitive model, and they can be very powerful in orienting people to help them understand an experience; but they can be equally

disastrous if they aren't applied well. Metaphors use references to already known experiences as clues to new ones. The "desktop" metaphor of most personal computer operating systems is an attempt to help people create and use files, store and arrange them, delete them, and work with them. It has mostly worked well, but only because the metaphor isn't totally consistent with the real experience – the operating system doesn't really work like a person's desk. Too close of an adherence to the theme either limits the functions of the system, or creates confusion when the two don't work together consistently (Shedroff, 2001).

Metaphors are not required and can be crutches for poor idea and design. Used well, however, they can be illuminating for users and quickly orient them to the functions and interactions of an experience (Shedroff, 2001).

#### **2.8.34 User Behavior –**

Users interact with experiences in different ways, and this interaction can be a source of information for customizing the experience so that it responds differently for each user. Experiences should, ultimately, change and modify themselves to be more appropriate for users. It's conceivable, though undoubtedly difficult, for an experience to know a lot about its audience. With real-time experiences, people controlling the experience can usually see how many people are present, if they're engaged sufficiently, how they're interacting, and whether or not they understand the experience, and so forth. Storytellers have been modifying their stories in real time for as long as stories have been told. It's the behavior of their audiences that allows them to adjust their stories to get the effects they're seeking (Shedroff, 2001).

There's no reason why an experience can't be designed to change based on how people react to it, whether the experience is digital, theatrical, or occurs in real space. Even small changes to only a few characteristics can make an experience feel more interactive (Shedroff, 2001).

### **2.8.35 Meaning –**

People find meaning in experiences and things based on a wide variety of personal values. That people find meaning in things is, perhaps, the only constant that can be relied upon. To this end, it's important to design experiences so that audiences or participants can find meaning in them by making connections to their own lives and values – that is, if we want these experiences to have lasting impact (Shedroff, 2001).

Objects and experiences that allow us to grow or experience intense emotions often build meaning. Not every experience should, necessarily, have this as a goal but, often, the distinction of a successful or memorable experience is that it transforms us or makes us feel something. Artifacts of an experience (physical objects from the experience that serve as reminders of what we experienced, such as photographs and souvenirs) become valuable to us because they serve to remind us and help us relive those experiences (Shedroff, 2001).

### **2.8.36 Technology –**

Technology is so seductive that those who work with it too often forgets that the purpose of technology is to serve people's interests and needs. Ultimately, what's important is not the technology but the people served by it. Technological problems, in



fact, are usually easy to solve (although economic viability is usually the limiting factor). Meeting people's needs, however, is much more difficult – whether solved with technology or not. In fact, technology has become so sufficiently sophisticated that the limiting factors are less and less technical, and are now more social, cultural, and often political (Shedroff, 2001).

Technology should not be ignored – whether the technology in question is high-tech and computer-related or more traditional. Indeed, technology both enables and limits the experience that can be implemented, often creating an aesthetic of its own, the way art media are influenced by their technologies (compare, for example, tempera, oil, and watercolor paints). Rather, technologies need to be understood and implemented after the overall experience is designed (Shedroff, 2001).

### **2.8.37 Participants –**

Designers are often afraid of what their audiences or user may do with their designs. If possible, most designers would love to prevent audiences from changing (or “ruining,” in their minds) their designs – whether they are designed products, experiences, books, or websites. Other designers' welcome audience participation in order to understand how well the solution works, and whether it improves with use, like a good wine does with age (Shedroff, 2001).

Experience designers must regard their audiences as active participants – not passive viewers. Many real-space experiences (such as parties and other events versus art displays or theater) require participation in order to be successful. These are often the most satisfying experiences for us (Shedroff, 2001).

While participant is probably the best word to describe your audience for such interactions, any instance where customer, user, actor, or consumer is used, you should regard them in the same way (Shedroff, 2001).

### **2.8.38 Feedback –**

An experience that tells us something about itself tends to feel more interactive than ones that don't. Whether the feedback is a simple explanation about why you are waiting, a reaction to some user action, or a detailed accounting of the system's performance, most people expect experiences to acknowledge their actions in some way. It's important to give just the right amount of feedback because too little may not be helpful or frustrating, and too much may be overbearing and distracting (Shedroff, 2001).

If your participants become confused about what's happening, they probably need some feedback to their actions – unless, of course, confusion is the goal of the experience (Shedroff, 2001).

Different experiences demand different rates of feedback. Games, for example (whether computer-based or not), require a great deal of feedback to keep the action moving. Relaxing experiences, on the other hand, require very little feedback in order to be successful. When designing experiences, it's always best to keep in mind real-world, physical experiences among people and use these as models for new experiences. Generally, people expect to be treated as they treat others, and expect to interact with systems in the same way they interact with people (Shedroff, 2001).

### **2.8.39 Control –**

As with feedback, comparing the amount of control in real-world experiences gives us a good starting point for designing other kinds of experiences. People expect to have some degree of control over their experiences. This control usually makes them feel more comfortable and respected. It might be controlling the rate of interaction, the sequence of steps, the type of action or features, or even how much feedback they desire. The only way to know how much control is important is to question participants about their needs and desires, and then test the experiences to see how well they work (Shedroff, 2001).

### **2.8.40 Adaptivity –**

Experiences that seem to adapt to our interests and behaviors (whether real or merely simulated) always feel more sophisticated and personal. Though these experiences, necessarily, take more energy and planning and are significantly more difficult to accomplish, they are more valuable to the participants (Shedroff, 2001).

Customization is one form of Adaptivity that allows people to overtly choose options to tailor an experience to their needs and desires. Customization is easier to develop than personalization since the options are always finite and controllable (Shedroff, 2001).

Personalization requires a more sophisticated level of interaction and planning, as choices and options cannot always be anticipated. Personalization allows people to create more unique experiences that are adapted even more to their needs and desires (Shedroff, 2001).

It is possible for experiences to adapt to participants in a variety of ways. The experience can change based on the behavior of the user, reader, participant, actor, or to a user's interests, needs, goals or desires (stated or inferred from behavior), experience or skill level, or even to the time or day or year, or even location (or experience or participant). It's important for designers to understand which attributes will make an experience more successful and valuable to users (which attributes are most appropriate), and balance these with those that are possible to create with the system, resources, budget, or schedule (Shedroff, 2001).

#### **2.8.41 Participation –**

Participation is the key to many successful experiences – certainly those that are intentionally designed in such a way that they couldn't exist without the participation of their audience. Participation makes experience more meaningful because it taps into our desires to be creative and communicate. Whether we are merely sharing our ideas and opinions or creating and displaying our works of art, it is gratifying to almost everyone to express him or herself creatively and work with others to build an experience (Shedroff, 2001).

Many experiences couldn't survive – or even exist – without the involvement of their audiences. Most experiences could also be made better by redesigning them to include opportunities for participation on the part of the audience (Shedroff, 2001).

## **2.8.42 Storytelling –**

Some of the most compelling and involving experiences are organized around the telling of stories – whether these are from the experience creators of the audience.

Storytelling is one of the oldest experiences and still one of the most powerful because it organizes information in a way that allows us, usually, to draw personal meaning and create knowledge (Shedroff, 2001).

There are as many different ways to tell a story, as there are storytellers. The two most important characteristics of successful stories are that they are authentic (this does not mean that they cannot be fictional), and that they are relevant to the audience. Additionally, many stories are successful when they can evolve to fit the circumstance and take into account the reaction of the audience. This doesn't mean that the story must be told or created cooperatively (in fact, this form of storytelling can be fun or silly, but usually isn't fulfilling) (Shedroff, 2001).

Storytelling must take into account perspective – whether the story is told from the first person (as something that happened to the storyteller personally), the second person (a difficult perspective to use for most stories), or the third person (a very common perspective) (Shedroff, 2001).

Most stories require at least a beginning (to understand the context), a middle (the story itself), and some form of end (to draw the story to a satisfactory close and, often, to point out the meaning, moral, or lesson if there is one). Settings, characters, styles, dramatic purpose, and themes are all important, but without the basis of purpose and flow, no story can be told well (Shedroff, 2001).

Innovative experiments in storytelling have tried to incorporate multiple points of view in the telling, offer non-linear or branching stories, or provide improvisational story building. Some of these have been successful, but it takes a particularly skilled storyteller to do these well. More often than not, simple, linear story structures allow storytellers to concentrate on the meaning and emotional content as well as the careful development of action and characters in order to arrive at a satisfying conclusion. Storytelling is so difficult for most people that the less variables they need to control, the more successful the stories they create (Shedroff, 2001).

Stories can be used not just as entertainment but also as a way to make difficult concepts, information, or instructions more accessible. Again, because we are so familiar with stories, the structure allows us to concentrate and order the information more easily than many other forms. As long as the story doesn't get in the way of the purpose or use of the information, there's no reason why stories can't be used to make instructions, directions, reports, or guidelines of any kind easier to understand and remember. Politicians have been using stories to illustrate their positions for a long time (Shedroff, 2001).

#### **2.8.43 Point of View –**

The perspective of the activity or content in an experience can affect how it is understood. Certainly, the point of view of the experience itself can have an affect on how people interact and relate to it. Consider how immersive computer and video games can be with their (mostly) first-person and second person perspectives. Stories, movies,

and theater also draw us in at different levels based on the perspective from which we view them (Shedroff, 2001).

Point of view is also relevant to the context and environment of an experience, in terms of the opinion and context that may be embodied in it. For example, an encyclopedia that offers only one opinion or perspective on a subject might not be seen as balanced and authoritative as one that offers several. Experiences that allow the audience to share their experiences can be more satisfying than those that don't, and these viewpoints can deepen understanding (Shedroff, 2001).

### **2.8.5 Experience and the Five Senses –**

We don't always take time to evaluate our own senses and their roles in our lives. Everything we perceive must enter our minds through one of our senses. This becomes so automatic through our growing years that we easily take our senses for granted. However, a deeper understanding (or at least a re-addressing) of our senses can lead us to innovative experiences that allow us and our audiences to experience new reactions to even the most common experiences (Shedroff, 2001).

There's some debate about how many senses we have. Many people regard kinesthetic, electromagnetic, and even psychic senses as viable, important senses; others stick to the traditional five senses: vision, hearing, taste, smell, and touch (Shedroff, 2001).

One way to understand how senses can be used in experiences is to build taxonomy and populate it with your own opinions. Since our senses are such an intimate and immediate part of us, they tend to be difficult to translate to others. This means

conducting a more thorough exploration of not only our own reactions to senses, but the reactions of others as well (Shedroff, 2001).

### **2.8.51 Smell –**

Smell is one of those poorly understood and often ignored senses – yet it can be one of the most memorable and powerful. Many people speak of memories elicited by a smell long forgotten. Experiences, which carefully incorporate smells, can add an extra dimension that is both robust and surprising. Shopping mall planners and store owners have long known that different scents can enhance not only the shopping experience (by enticing customers to come inside, or make them feel more comfortable once they are), but can increase sales as well (Shedroff, 2001).

Smells act upon a primal part of our brain over which we have little control. Our reactions to smells are more instinctive than any other sense. Pheromones, for example, are said to trigger reactions in our body as well as our mind, often with such subtlety that we're hardly even aware of either the stimulus or the reaction – at least at first. Odors can be subtle as well as overt, and they can trigger a variety of reactions that can elicit complex combinations of feelings (Shedroff, 2001).

### **2.8.52 Taste –**

Like smell, taste is often overlooked as an element of designed experiences. There are currently no artificial devices that can recreate taste, but taste is well understood by professional food laboratories. In real-world experiences, food has long been an important consideration, whether for parties, restaurants, theme parks, movies or



even theater. However, aside from nicer restaurants and some parties, food is rarely integrated into the experience – even as an enhancement. Rather, food is viewed as nourishment or an accompaniment. Finding ways to integrate taste into an experience requires more originality than any other sense, but the result can be stronger, more memorable experience for the participants (Shedroff, 2001).

### **2.8.53 Touch –**

The sense of touch is much more prevalent in experience because it is easier to address, as every experience requires us to touch something. Every personal computer uses a mouse to control the cursor on the screen. While most computer programs make little or no use of this fact, the contact is still there. There are plenty of alternative mice and other input devices that create touch displays for users, transferring information via our hands. This haptic research has been in development for a few decades, yet there are few commercial examples that have been even remotely successful (Shedroff, 2001).

More common are physical experiences that make touch a part of the encounter. Petting zoos and touch pools in aquariums, for example, rely mainly on introducing touch to a learning experience that would conventionally use only sight (Shedroff, 2001).

Touch is an awkward sense for most people because we are not accustomed to dealing with only touch, and our other senses, particularly sight, and are so much more dominant in our perceptions. Experiences in which we cannot see or hear and only have our hands to guide us are interesting, but frustrating for all but those people who have already lost their sight and have spent time learning to do without. Touch is also inherently intimate, although not as intimate as taste; therefore touch experiences are

often uncomfortable for us when inappropriate. Comfort and familiarity have a lot to do with creating this sense of appropriate touch, and these feelings can change quickly and dynamically based on the topic, purpose, and parts of the body involved (Shedroff, 2001).

#### **2.8.54 Sound –**

Sound is one of the most sophisticated senses we have since we regularly experiment and create innovative displays specifically for our ears. From the time we are very small, our entire world is filled with sounds targeted at stimulating or affecting our behavior. We grow to expect pleasure or annoyance at surprising new sounds as well as established ones (Shedroff, 2001).

Like vision, sight is a reaction to certain frequencies of electromagnetic energy, which includes light, x-rays, and microwaves, our ears are able to interpret. There are certainly sounds (ultrasonic) most human ears cannot pick up that other animals (like dogs) can hear routinely (Shedroff, 2001).

Sound comes in a variety of forms – whether voice, music, sound effects, or other forms of communication – and they can be incredibly complex, rich, and often subtle. It is the primary way most of us receive data, information, and knowledge. While we encounter much of these through reading, still, and increasingly, the majority of our understanding comes from hearing. Even visual media, such as television and movies, deliver the majority of information through speech and other sounds, and the majority of emotions through music. This isn't to say that there aren't compelling visuals that stimulate our emotions or convey information. However, try turning off the sound on the

television and interpret what is happening. You'll most likely find it's more difficult than simply turning off the picture and keeping the sound (essentially, radio) (Shedroff, 2001).

### **2.8.56 Sight –**

Sight is one of the more precious senses. We use it to guide ourselves and interact with others, to orient ourselves in our world, and to interact with nature. Sight allows nature to convey a great deal of data about itself (weather, time of day, and so on) and we use this data in subtle and often unconscious ways (Shedroff, 2001).

Of course, as we experience it, vision is only a small slice of the electromagnetic spectrum and it doesn't even encompass the entire spectrum that is visible. The slice of light that our eyes can see includes a seemingly endless spectrum of colors moving from red to violet. Outside of this range, however, light still exists and some animals and many machines can see in these ranges. Bees and other insects can see in the ultraviolet and this helps them distinguish among flowers. Infrared light is used in most small wireless devices like remote controls. It is also used in night-vision equipment because it allows us to distinguish heat sources (like bodies) and, thus, "see" in the dark (Shedroff, 2001).

Machines use a variety of vision types to perform their tasks. Some use the visible (to us) spectrum, other make use of infrared – either exclusively or to augment the visible spectrum. It is one of the dreams of robot creators to construct a machine that appears to see and understand the things we do so that it can act on these the way we do (Shedroff, 2001).

Because of how our eyesight works, when we design, it is often more important to make our designs work first in grayscale before color as they then will be clearer and easier for an audience to read (whether human or machine). Black- and –white copiers, for example, see color based on their light values and have a hard time distinguishing light blue from white or dark red from black. Other grayscale sensors will, most likely, have the same problem even though the differences in colors are clear to us (Shedroff, 2001).

Human vision is composed of small rods and cones in our eyes, which are sensitive to the spectrum of visible light. In fact, the rods are sensitive to the amount of light (allowing us to distinguish light from dark), and the cones are sensitive to frequency of light (allowing us to distinguish colors). We have many rods and cones, which means that we actually see the amount of light (white, black, and grays) before we see color. While rods give us more and stronger light information, cones enable us to see detail more sharply. Because cones are more prevalent than rods in the fovea (an area at the center of our field of vision), we don't perceive any difference in our environment even though we aren't seeing in the same way from our center of focus to our peripheral vision (Shedroff, 2001).

Our eyes are also attuned to seeing movement, as are most predatory animals (for example cats and birds). This means that experiences that require us to discern small subtle differences or movements are easier for us than distinguishing detail in large, broad movements (Shedroff, 2001).

Knowing how the eye sees (and how machines perceive light) can lead us to new experiences that exploit or play with these phenomena in novel ways (Shedroff, 2001).

### **2.8.6 Designing for the Senses –**

Sensorial design is merely a catchall phrase for the design disciplines, which create experiences that interact directly with our senses. These include traditional design disciplines (for example, graphic design), writing, and media design disciplines (such as videography and animation). Each of these has a complex history and numerous principles (Shedroff, 2001).

### **2.8.7 Visual Design –**

While visual design traditionally has been concerned with appearance, it can communicate more than mere beauty; it can convey meaning in any decision that builds on visual appearance. In particular, graphic and illustrative styles convey cultural hues that help people identify designs with different values. Though most designers make choices based on what they prefer or what “looks nice” (and, unfortunately, are taught to), the best designers choose each element of visual design, including typography, color, layout, and photography based on how they want to communicate the goals and the message to the intended audience. The overall design must still feel consistent and clear, and it should certainly be handsome, but great designs communicate first and are beautiful second. Likewise, these designs tend to transcend trends more readily since they are built upon a more meaningful and less stylish foundation (Shedroff, 2001).

Style is difficult to categorize or characterize because different elements will communicate different meanings to different people. Few people have a well-educated understanding of design or a high visual literacy. However, this isn't their fault as much as it's merely a missed opportunity in our society. This makes it more challenging for

designers to construct experience. As long as designers focus on their audiences and not themselves, they will communicate more successfully (Shedroff, 2001).

### **2.8.71 Immersion –**

Most designers of digital experiences dream of building an experience so immersive that the participants regard it as all encompassing and forget that the experience may be artificial. This is usually accomplished through virtual reality technologies like goggles displaying computer-generated imagery, and headphones often supplying 3D sound. What most designers of these systems fail to understand is that immersive experiences surround us in the real world, and we have well-developed expectations for such experiences. Indeed, our sense of reality is so sensorially stimulating that it's nearly impossible to design an experience that could even approach the immersiveness of reality (Shedroff, 2001).

This being the case, it's often a better strategy to build experiences that cannot exist in reality and, therefore, sidetrack our senses with novelty and originality rather than simulating reality as we have become accustomed to experiencing it. These are the approaches that often make us forget that we are not in our normal reality (Shedroff, 2001).

Immersion does, however, require more than mere novelty. To be an immersive experience (as opposed to just an engrossing one), it needs to stimulate – if not redirect our attention on – our major senses (usually being vision and hearing). Films do this regularly without using any unfamiliar technology. When the story is interesting and the sound and visions capturing, we fall into the experience with rapt attention for that time.

Most people can remember instances where they fall out of such experiences (suddenly remembering they're in a theater, or noticing the people or environment around them). This might be due to the noises of those around us or a disruption in the environment. However, it could result just as easily from a disruption in the narrative, such as anachronistic development or a lapse in consistency or believability (Shedroff, 2001).

Thus, immersion is as much a result of the narrative's ability to capture and hold our attention, as it is the visuals, audio, or other sensory displays that divert our attention toward the experience. In fact, a good story (whether told aloud or read in a book) can more often immerse us in another world than the most advanced technological systems (Shedroff, 2001).

Immersive experiments tend to favor the technological – that is, more often than not, more attention is paid to the technological tricks of diverting our attention – than in building a cognitively interesting and consistent experience. These technological tricks usually aim at stimulating our senses in novel ways or building elaborate environments that enclose us (Shedroff, 2001).

Theater has always experimented with ways to immerse the audience. The theater tends to create more cognitively cohesive experiences and to experiment with non-digital ways to immerse people. Theater often mixes elements like live actors, sets, recorded and live music, lighting, interaction, sets, and rehearsal more than its digital counterparts. It tends to focus less on interactivity and meaning and more on elaborate, expensive, and digitally-prejudiced solutions to problems – often solving problems much easier and more elegantly – and less disruptively – than with computers (Shedroff, 2001).

### **2.8.72 Symbolism –**

Symbols can be used as a way of collapsing information into a smaller form. They also can be used as a mnemonic for the original information. Symbols can demonstrate or illustrate a process or identify something. What makes symbols powerful is their ability to transmit meaning under difficult circumstances – especially across linguistic and language barriers. However, just because something is a symbol, doesn't mean it automatically possesses the ability to communicate to everyone. Cultural differences make symbol, icon, and logo design even more risky and dangerous since they rely on much more shared context than other forms of communication. Not understanding the full range of meaning within a culture often causes designer to design symbols that not only fail to communicate what is intended, but also often communicate false or defamatory information (Shedroff, 2001).

Where symbolism excels is when it is paired with other forms of communication (like diagram or text label). This allows symbols to be more easily recognized and remembered (and used as a true mnemonic device). This is especially important for complex or critical information. Expecting a symbol or icon to function clearly on its own when representing new information or communicating to novices is probably asking too much of a symbol (Shedroff, 2001).

Abstraction is also a difficult concept to communicate because abstract concepts, inherently, are more open to judgment, experience, and interpretation. Conceptual information relies heavily on personal context. However, when done well, this is precisely why abstraction can be so powerful; it can pull into an experience otherwise difficult or unconnected meaning that lead to a richer, more complex experience. This is



what great art does. These wider connections can lead to a more emotional, personal, and surprising experiences that leave us more satisfied than representational experiences that simply “stick to the facts” (Shedroff, 2001).

## **2.9 Space Planning -**

The space planning process usually starts with the designer completing basic tasks such as charting organizational structure; identifying personnel, their tasks, and necessary equipment; analyzing the operational process; and gaining an understanding of the human and cultural qualities of the organization. In effect, the planning professional must take on the full responsibility for organizing, analyzing, and interpreting the problem at hand (Karlen, 1993).

### **2.9.1 The Synthesis Gap –**

Among professionals working in the field, a generally accepted process or sequence of tasks occurs from the point at which the planner begins to work on a project, to the point at which project analysis is complete and the physical planning process begins. Despite many variations in technique or terminology that planners may apply, that basic process consists of the following steps (Karlen, 1993).

#### **2.9.11 Interviews -**

Interviews at three different levels; executive (organizational), managerial (departmental function), and operational (process and equipment detail) is the first step. Observation (of existing or similar facilities); assisted observation, unobtrusive

observation and inventory of existing furniture and equipment (when it is to be reused) is the second step in the process. The third step is to establish architectural parameters. This is done by acquiring complete base plan data (including mechanical and electrical services), compiling contextual data (architectural, historic, social) and researching code constraints.

### **2.9.12 Organizing -**

Organizing the collected data is the first phase of the program. Data is placed in sequential format, which is most useful for planning. Summarizing the confirmed quantitative factors such as square footage, FF+E count, equipment sizes, etc is the second part of the organizational step in the first phase. The last part is to record first thoughts on conceptual planning approaches (Karlen, 1993).

### **2.9.13 Researching -**

Researching the unknowns is the fifth step in the process. Gathering detailed process and equipment information is the first part of this step followed by gathering “case study” information on similar facilities. The final part to this step is integrating researched data with the first phase program (Karlen, 1993).

Step six involves analyzing the data by discovering planning affinities such as working interrelationships, public/private zoning, special acoustic needs, etc. Discovering scheduling affinities enable you to maximize the use of space. Identify planning and architectural relationships such as site, structural, mechanical, and electrical conditions are the final part to this step (Karlen, 1993).

The complete program is the interpretation and diagramming of the data. The functional problems must first be defined in planning terms. The second part involves establishing a basic conceptual approach in terms of human/social and image/aesthetics objectives. Diagrams for relationship or adjacency are prepared for client and designer visualization (Karlen, 1993).

The finished document involves summarizing the data. Finalizing project concepts by stating the problem is the first part. The second part requires outlining and tallying basic budget issues and finally preparing a package for client approval and to serve as the designer's manual for space planning (Karlen, 1993).

### 2.9.2 Criteria Matrix –

The most effective way of visualizing all of the necessary criteria for a space-planning project is by organizing the data in an understandable and visually simple way. Criteria matrices are organized in a rectangular orientation and present all of the requirements of the space being planned. Areas of interest are listed vertically and requirements are listed horizontally. The necessary data is listed in the appropriate square in order to form a visual map of what is required of the space.

BLANK CRITERIA MATRIX

CRITERIA MATRIX FOR: UNIVERSITY CAREER COUNSELING CENTER	SP FOOTAGE NEEDS	ADJACENCIES	PUBLIC ACCESS	DAY LIGHT AND/OR VIEW	PRIVACY	PLUMBING	SPECIAL EQUIPMENT	SPECIAL CONSIDERATIONS
① RECEPTION								
② INTERVIEW STA. (4)								
③ DIRECTOR								
④ STAFF								
⑤ SEMINAR RM								
⑥ REST ROOM (2)								
⑦ WORK AREA								
⑧ COFFEE STATION								
⑨ GUEST APARTMENT								

Figure 21: Criteria Matrix

### 2.9.3 Prototype Sketches –

Prototypes for a space planner are plan sketches. They assist the space planner in fully understanding the level of utilization of a facility. If the total square footage is less than that of the facility then there is the potential for under utilization of interior space and if the total is greater then there exists a risk of crowding.

Generally any kind of paper or drawing too is suitable for creating prototype plan sketches. The key is to make it clear and easily understood and to illustrate the proposed use of space and egress. A basic knowledge of furniture sizes, arrangement, and dimensional relationships between pieces of furniture is necessary.

These sketches are also used to analyze the planned use of the space based on the size of the equipment to occupy that space. It is important to understand the function of the space during this process as drawing a prototype of the plan will assist in visualizing the actual usage and size.

### 2.9.4 Relationship Diagrams –

Often used to bridge the gap between the empirical data and the purely visual design side of a space-planning project. These diagrams help to visualize the overlap of critical spaces creating a better understanding of how occupants will actively use a space. Data is pulled from the criteria matrix and plugged into the diagram visually using different methods. After the criteria matrix is

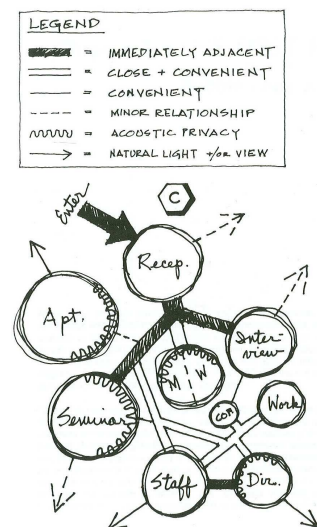


Figure 22: Relationship Diagram

completed an adjacency matrix is added to establish similarities and neighboring usages. A relationship diagram is usually the first diagram to be developed and is based on the data gathered in the adjacency matrix. The relationship diagram shows how people move from one space to another and with what frequency.

### 2.9.41 Bubble -

The bubble diagram is essentially the first rough floor plan. Called the bubble diagram because of the bubbles drawn to represent rooms and square-footage, the bubble diagram is the first real representation of the proposed space.

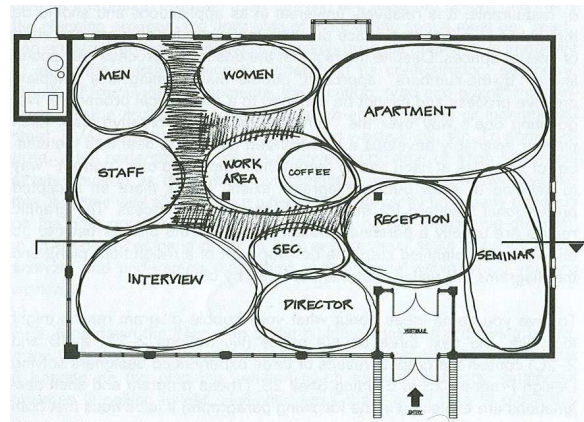


Figure 23: Bubble Diagram

Hallways are shaded in to illustrate non-usable square-footage. In a way, the bubble diagram is a type of Venn diagram. As the bubble diagram evolves it begins to look more like a block diagram, taking the shape of a formal floor plan.

### 2.9.42 Block -

The block diagram most closely resembles a formal floor plan out of the different type of diagramming. The block refers to the rigidity of the shape of the spaces and formality of the size of the

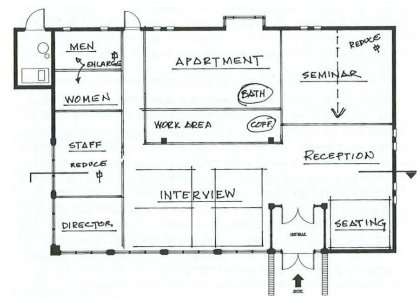


Figure 24: Floor Plan

spaces. A block diagram also includes wall thicknesses and primary entrance and exit sites. The focus is more on the proposed formal size of the spaces and on the flow of traffic. The next level of sketches involves 3 dimensional planning based on range of motion and necessity of access involving related equipment. An example is the work triangle involved in the planning of kitchens.

### **2.9.5 3D Sketches –**

Exactly how it sounds, 3 dimensional sketches are perspective-based representations of the proposed spaces.

Often illustrating corners of rooms or problem areas, the 3D sketch helps to

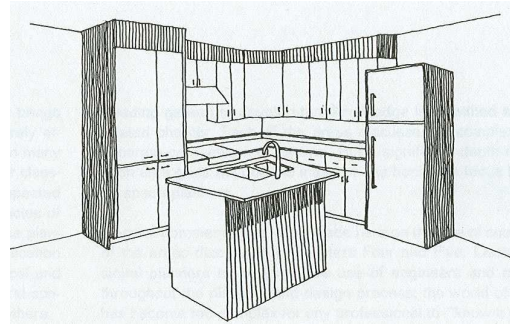


Figure 25: 3 Dimensional Sketch

illustrate the plan and layout of a room and how one might expect it to appear once completed. Color is often added to help sell the design to clients but is often left out to keep from clouding the issue at hand; is the layout appropriate for the clients needs?

### **2.9.6 Codes and Standards –**

There currently exists several volumes of building, lighting, electrical, plumbing, and American's with Disabilities codes and standards. It would be impossible to fully understand and be able to implement all of these codes on your own or even with the help of another person. Electricians and plumbers are expected to be familiar with these codes as are all members of the construction industry. Following certain phases of completion

inspections are required prior to undertaking the next phase or even at the end prior to granting a certificate of occupancy.

## **3.0 GUIDELINE DEVELOPMENT**

### **3.1 Introduction -**

The guidelines were developed through a thorough analysis of the data in chapter two and applied to the fitness industry in the following sections of chapter three. The guidelines will be presented in chapter five as a set of suggestions based on different criteria presented in this section.

### **3.2 Color Associations -**

Many peoples personal and cultural associations affect how they experience color. Through these associations, which are universal and long-held, colors are seen as warm or cool. Some colors are associated with heat and the sun, such as yellow, orange and red; blue, green and violet are often associated with the coolness of leaves, sea and the sky. The strength of a color can attribute to how it is perceived. Warm colors seem closer while colors that are too vivid tend to overwhelm the lighter and subtler warm colors. In order to enhance the perception of depth, cool colors are preferred for the background while warm colors should be in the foreground. These and many other associations attribute to how we perceive the environment around us and how well we function within that environment (Hegde, 2005).



### **3.2.1 Standard Color Meanings –**

Standard color meanings refers to the normal understood meaning of the listed color in the United States of America and any emotional association it may have.

#### **3.2.11 Red -**

The color red is often associated with fire, heat, warmth, the sun and aggression or being aggressive. Red is used to color stop signs, stoplights, brake lights, and fire equipment because of its high visibility. Red, when it is the color of a bow, is believed to bring good luck when tied around a new car. Superstitious people believe red frightens the devil and when someone says they “see red” it means they feel angry. Red is also used in slang, “red herring” is a distraction, something that takes attention away from the real issue, and “red eye” is an overnight airplane flight (Cowart, 2002).

#### **3.2.12 Orange -**

Orange, which is a combination of red and yellow, is considered vibrant and warm. Orange has the physical force of red but is considered to be less intense. Orange is often used as a precautionary color or a warning color because it is seen after both yellow and red (Mahnke, 1987).

#### **3.2.13 Yellow -**

Yellow is often used for warning signs because it has good visibility. The color of deceit and cowardice is yellow. For holistic healers, yellow is the color of peace. As

you can see yellow has many associations even though they are not all positive there are many positives to using yellow or hues of yellow (Mahnke, 1987).

### **3.2.14 Green –**

A relaxing color, green is the color of choice for the “green room” in theatre houses and concert halls because it is believed to help relieve anxiety. Green is considered a youthful color and a healing color. Some negative connotations associated with green include being “green with envy,” “green around the gills,” which is referring to looking pale or sickly, “green eyed monster” refers to jealousy (Mahnke, 1987).

### **3.2.15 Blue –**

The color of peace and tranquility, blue also tend to be the most universally preferred color. In all aspects, blue is the antithesis of red. In its appearance, blue is transparent and wet; red is opaque and dry. Blue tends to have a cool and relaxing nature while exhibiting a sense of nobility. Positive effects of blue tend towards calm, secure, comfortable, sober and contemplative, while the negative effects tend towards frightening, depressing, melancholy and cold (Mahnke, 1987).

### **3.2.16 Purple –**

A subduing color, purple is often associated with dignity and exclusiveness while negatively it is associated with being lonely, mournful, pompous and conceited. Purple is a blend of red and blue, the two colors most opposite each other physically and

psychologically. In its various tones, purple may evoke delicacy and richness or appear unsettling and degenerate (Mahnke, 1987).

### **3.2.17 White –**

A clean and vibrant color, white is often associated with virginity and marriage. White heat is the highest level of heat intensity. When someone refers to whitewashing, they are referring to the act of glossing over defects or making something seem presentable when the opposite is true. A white room is a clean room as well as a temperature controlled, dust free room for precision instruments. White, when applied to an interior environment, can make the space seem large and empty because it helps diffuse light and reduce shadows. White walls appear to be sterile and lack energy (Mahnke, 1987).

### **3.2.18 Black –**

If all colors were mixed together, black would result. Black presents a feeling of hollowness or oppression and often has an ominous feeling. Black is often associated with death and evil which could explain why it also portrays a sense of mystery (Mahnke, 1987).

### **3.2.19 Conclusion –**

Society and science have summarized the effectiveness of certain colors over the past few decades. It can be safely assumed that red is an exciting color. Based on scientific research conducted by Birren (noted in section 2.6.3), the color red has an

exciting influence while blue has a very calming influence. Which signifies that a person seeing one or the other of these colors may experience the effects of the color beyond their emotional response.

In section 2.6.3, Birren cites that warm light colors increase muscular reactions more than cooler light colors. Thus indicating that light combined with color in the right combination can have an arousing biological effect on someone viewing colors at a certain color temperature.

While the physical impact of lighting is obvious, its physiological and psychological impact can be just as strong. Light sends a visual message that can affect mood and motivation levels. Light also affects our biological clocks in the following manner. It is well known that *circadian rhythms*, such as sleeping or waking cycles, are influenced by light. Many business travelers use melatonin in tablet form to help them maintain their work efficiency and performance when they travel to locations in different time zones. What many people do not realize is that simply increasing their exposure to light could also help them naturally alter their melatonin levels.

### **3.2.2 Cultural Meanings –**

In different parts of the world colors have different meanings. These different meanings are a result of cultural and social relativism. Each society and culture developed their own meanings to these colors; some are similar to other cultures.

### **3.2.21 Red –**

In ancient Rome, red was used to signal battle while in Russia red means beautiful. The Bolsheviks used a red flag as their symbol when they overthrew the tsar in 1917, making red the color of communism. In Greece, eggs are dyed red at Easter for good luck, in South Africa; red is the symbol of mourning (Coward, 2002).

### **3.2.22 Yellow –**

In Egypt and Burma, yellow signifies mourning; in Spain, executioners once wore yellow. Yellow is also the symbol for a merchant or farmer in India; Hindus in India wear yellow to celebrate the festival of spring. During the War of Dynasty in 1357 Japan, each warrior wore a yellow chrysanthemum as a pledge of courage. In the U.S.A., a yellow ribbon is a sign of support for soldiers stationed at the front line (Coward, 2002).

### **3.2.23 Green –**

In ancient Greece, green symbolized victory, in the highlands of Scotland, people wore green as a mark of honor. Green is the national color of Ireland and the only national flag that is a solid color is that of Libya. In the U.S.A., green means “go,” “all systems green” means everything is in order and the “greenback” is slang for paper currency (Coward, 2002).

### **3.2.24 Violet –**

In Thailand, a widow mourning her husband’s death, while most cultures consider purple a royal color, wears purple. Leonardo da Vinci believed that the power of

meditation increases 10 times when done in a purple light, as in the purple light of stained glass (Cowart, 2002).

### **3.2.25 White –**

In China and Japan, white means mourning, ancient Greeks swore white to bed to ensure pleasant dreams. The Egyptian pharaohs wore white crowns and ancient Persians believed all gods wore white. A “white elephant” is a rare, pale elephant considered sacred to the people of India, Thailand, Burma, and Sri Lanka; in this country, it is either a possession that costs more than it is worth to keep or an item that the owner does not want but cannot get rid of (Cowart, 2002).

### **3.2.3 Physiological Reactions to Colors –**

#### **3.2.31 Red –**

When a person is exposed to red the pituitary gland, which is an endocrine gland, comes into play. In just a fraction of a second a chemical signal goes from the pituitary gland to the adrenal glands and adrenaline is released. The adrenaline courses through the blood stream and produces certain physiological alterations with metabolic effects. The following reactions begin immediately but may not be noticed for a few minutes or even several hours depending on the health of the individual’s Homeostasis (the physiological process by which the internal systems of the body are maintained at equilibrium despite variations in external conditions) (Birren, 1969).

Blood pressure elevates increasing the speed at which blood flows as indicated by increased heart rate. As a result, breathing becomes rapid and the autonomic nervous system takes over and reactions become automatic. Taste buds become more sensitive, appetite improves and the sense of smell heightens. Males become more attracted to yellow based on reds while females become more attracted to blue. The lenses of the eye have to adjust to focus the red light wavelengths; their natural focal point lies behind the retina causing the illusion of advancing in objects colored red. Red light also causes increased eye blinks (Birren, 1969).

### **3.2.32 Orange –**

Being half red and half yellow, orange tends to lend itself to the characteristics of both colors. Orange will cause increased and elevated appetite while inducing relaxation and increasing the potential for sleepiness. The rate of blood flow slows and a sense of placidness, colorfulness and security develops when orange is combined with blue (Birren, 1969).

### **3.2.33 Yellow –**

The electrochemical transference from eye to brain called vision takes place the quickest in the presence of yellow. Yellow is the first color a person distinguishes when they look on any object and it is also the most complex color for the brain to process. Humans have an inherent precautionary reaction to yellow in nature, especially when it is combined with black (Birren, 1969).

For a subject under stress, yellow causes a quick and temporary response by preparing them for a psychological reaction called flight or fight. Flight or fight refers to the psychological reaction in which someone would either avoid or resist the cause of the stress. Yellow surroundings have been known to cause children to cry more often and allergies to flare more frequently (Birren, 1969).

### **3.2.34 Green and Blue -**

Green and blue have similar effect on the physiological reactions of humans. Both colors are relaxing and cause a calming effect by secreting eleven neurotransmitters in the brain that tranquillize. Blue light is a direct opposite to red, causing the exact opposite reactions stated for red. Blue causes the brain to emit hormones, which cause a calmness to be felt through the whole body (Birren, 1969).

Some physiological reactions include reduced heart rate, deepened breathing, reduced perspiration and lowered body temperature. Blue also reduces appetite and eliminates the flight or fight response to stress. Blue light can also reduce muscle spasms and tremors while decreasing the amount of eye blink, can also reduce eye irritation (Birren, 1969).

### **3.3 Lighting Requirements –**

There are different suggested levels of illumination for different tasks that occur in a given space or environment. Each level of illumination can be achieved in a different way. There are generally accepted ways of achieving standard illumination for a given set of tasks. Considering that task visibility is the primary concern, these



standards will be followed and the suggested illumination levels will be observed. However, there are some areas where adjustment can be made.

### **3.3.1 Ambient Lighting -**

Ambient lighting provides the overall illumination in the work environment. There are two types of ambient lighting: Direct and Indirect (Steelcase, 1999).

#### **3.3.11 Direct –**

Direct ambient lighting distributes light directly downward. Lights with parabolic louvers help reduce some glare, but their effectiveness depends on where you happen to be positioned relative to the light source. These lights often create shadows and computer screen glare, and can contribute to an overall sense of dimness in a space (Steelcase, 1999).

#### **3.3.12 Indirect –**

Indirect ambient lighting distributes light upward and reflects off the ceiling. When applied, it can reduce direct and reflected glare to an absolute minimum. Its soft, diffused illumination has proven to be more comfortable for computer users than direct lighting sources like deep cell parabolics. Indirect lighting can create an overall sense of brightness (Steelcase, 1999).

### **3.3.2 Task Lighting –**

Task lighting supplements ambient lighting by filling in shadows and provides additional light needs for focused work that requires higher light levels. Task lighting is playing an increasingly important role as ambient light levels are reduced due to the prominence of computer usage and the ecological importance of saving energy. Task light levels are generally higher than other areas, over 50 footcandles (Steelcase, 1999).

### **3.3.3 Accent Lighting –**

Accent lighting completes the lighting environment and is a powerful element of a lighting system. It can be used very practically to provide fill light to finish and balance the ambient light. It can be used artfully to highlight unique objects or reinforce an aesthetic tone. It can draw people through a space or provide visual relief in areas without daylight. Skillfully applied, accent lighting can transform the perception of space. Accent lighting is generally the highest level of light in a room, well over 100 footcandles, in retail environments upwards of 400 footcandles (Steelcase, 1999).

### **3.3.4 Performance Criteria –**

Lighting criteria are a universal set of lighting performance objectives established by the Illuminating Engineering Society of North America (IESNA). These criteria provide quantitative lighting standards based on the needs of specific tasks. Lighting designers use these criteria, along with qualitative criteria, as the basis for creating comfortably lit work environments without glare or extreme contrast. The following are three key criterions for quality lighting (Steelcase, 1999).

### **3.3.41 Horizontal luminance –**

Horizontal luminance is the amount of light on horizontal surfaces, such as work surfaces. Light must be sufficient and uniform enough to allow you to read printed text, review drawings, and perform other tasks. Combining ambient and task light effectively achieves horizontal luminance (Steelcase, 1999).

### **3.3.42 Vertical luminance –**

Vertical luminance is the amount of light on vertical surfaces, such as office walls, computer screens, paper placed on document holders. Lower and more uniform levels within the immediate work area are generally recommended because high vertical luminance can cause veiling reflections on computer screens. Higher levels at strategic locations within the architectural environment are often recommended to contribute to a brighter, more pleasant workplace (Steelcase, 1999).

### **3.3.43 Ceiling luminance uniformity –**

Ceiling luminance uniformity is the degree to which the light across the ceiling appears even. The more even it appears, the less chance you'll see it as reflected glare on your computer screen (Steelcase, 1999).

### **3.3.5 Data Use in Guidelines –**

Due to the expansive and otherwise overwhelming amount of data involved in planning a lighting scenario, the guidelines will make suggestions based on this data

instead of laying it all out for interpretation. The suggestions will be concise and easy to understand.

### **3.4 Space Planning -**

In a health and fitness facility, space planning is key to the happiness of the members. How difficult it is to move from machine to machine or from cardiovascular to aerobic exercise will partially determine the level of success the business experiences. An excessive amount of attention to this section is not critical; a brief understanding of space planning is all that is necessary to successfully layout a facility, although during construction phases a professional should be consulted.

Some basics to understand include but are not limited to: traffic flow, A.D.A. requirements, the best way to layout equipment, barrier free design, ceiling heights and clearances, general infrastructure requirements (electrical, plumbing), and general space requirements.

#### **3.4.1 Traffic Flow –**

A series of bubble and block diagrams should be used to better understand how spaces and areas interact. Since gyms usually involve large open spaces with equipment sectioned off or separated by type or category of exercise, attention should be paid to layouts not utilizing walls but rather walkways. Based on observation, fitness members tend to favor a more open layout as opposed to being separated into rooms, unless using specialized equipment.

### **3.4.2 ADA Requirements –**

The Americans with Disabilities Act is the result of many years of discrimination based on physical disability. The ADA is responsible for mandating minimum hallway widths and door openings among many other requirements. An outcome of the ADA is a very involved manual of standards and requirements that help to ensure that all Americans have equal access to public spaces. Due to the nature of the requirements, only the most critical standards will be discussed in the guidelines.

The ADA has basic guidelines for color and light, which are limited to signage for the visually impaired. The suggested level of illumination for the signage is between 10 and 30 footcandles with a minimum contrast level of seventy percent (ADA, 1994).

### **3.4.3 Equipment Layout –**

The most important thing to consider during the planning phases of a health and fitness facility is the equipment list. Not having the right equipment or not having enough would be like trying to open a grocery store and not putting any groceries on the shelves. It isn't that difficult to get people to come in but they won't stay for long when there is nothing to do.

#### **3.4.31 Weight Lifting –**

Weight lifting is categorized into three main categories; each category has a separate style of equipment. Lifting for muscles gain (weight gain), muscle maintenance (weight control), muscle conditioning (weight loss). Each uses similar equipment but with varying loads of weight and different ranges of motion.

### **3.4.311 Equipment List –**

Weight lifting consists of items such as bench press, incline and decline, preacher curl, adjustable benches, bars, weights, and varied machines. The layout is usually by muscle group since muscle group categorizes most weight lifting. Some weight lifters prefer opposing muscles, such as chest and back, while others prefer complimentary muscles, such as chest and arms. Weight lifting is also separated by type of weight; free weights are dumbbells and loaded and unloaded bars, machines involve weight that is guided by a rail and bearing system and often moved through a series of pulleys and belts.

### **3.4.32 Circuit Training –**

Circuit training involves quickly moving from one piece of equipment to another in a way that maintains an elevated heart rate. People who favor weights over cardiovascular workouts are more likely to follow a series of circuit training. Avid weight lifters often forget or ignore cardiovascular workouts in favor of more intense weight lifting.

In order to have a successful circuit training area, all major equipment must be in relatively close proximity to one another. The idea is to move from set to set with as much as one minute between sets and if a member has to walk the length of the facility to continue their circuit they will have a less than successful workout.

### **3.4.321 Equipment List –**

The list of equipment for circuit training is much like that of weightlifting with one exception, extreme variety. A facility that is geared primarily for circuit training will have several areas of similar equipment in order to accommodate a higher occupancy. The equipment often includes a variety of machines with a mixture of free weights.

### **3.4.33 Cardiovascular –**

Cardiovascular exercise has been named the primary method for weight loss by most media and physicians. Twenty minutes a day, three days a week, maintaining an elevated heart rate is enough to lose weight and keep in off. If a person was to maintain a slightly elevated heart rate even at a state of rest, they would burn more calories than if they had a lower resting heart rate. Based on existing research, red elevates heart rate and respiration levels almost immediately when the subject is exposed (Birren, 1969). By having members of a health and fitness facility exposed to red or hues of red while exercising will cause continually heightened heart rates, thus burning more calories.

If a person's fitness goal is to lose weight, they will be more pleased with their workout if they get better results. Someone pleased with their results are more often pleased with what got them their results, which mean an overall better perceived user experience.

### **3.4.331 Equipment List –**

The equipment list for cardio equipment is rather standard. Treadmill, elliptical, stair-climber and bicycles are the most common and widely used. The best thing a

facility owner could do is to listen to their members' wants and desires. If you are missing key pieces of equipment, you could be missing key members, those members who bring potential new members.

### **3.5 Creating the Experience –**

In order to create a successful experience certain things must be present or have been considered in the interior environment. Color and lighting play an important role in creating a positive user experience while simultaneously being able to create an equally negative one. According to Birren, color affects muscular tension, cortical activation (brain waves), heart rate, respiration, and other functions of the autonomic nervous system. Birren also notes that color arouses definite emotional and esthetic reactions, likes and dislikes, pleasant and unpleasant associations.

#### **3.5.1 Market/Client Composition –**

The type of people that frequent a health and fitness facility can be described as broad and unique. Through observation and discussion, it appears that no matter where you are you will find similar mentalities in regard to fitness. There are always going to be weight lifters, who want to beat personal bests and improve physical strengths, cardio junkies, those that come in and spend an hour on the treadmill and then leave, circuit trainers, the people who jump from machine to machine trying to get as much from their time as possible.

The make-up of the clientele is rather standard, attention has to be paid to age range, gender composition, cultural differences, and career focuses. If the facility is



located in a metropolitan area, then the members are going to be rather standard with an even mix of all type, unless the facility is geared more towards one type or the other.

Considering that most proprietors want to profit as much as possible, there is likelihood for an even mix of stereotypes.

In a college town, such as Auburn, AL and Mobile, AL, there is an abundance of twenty-something fitness enthusiasts and those looking too simple improve their appearance. In a market such as this, what's hip and cool is important to the success of a fitness facility. This is even more important in a market saturated with a variety of facilities. Hip and cool is not as important when there are only a few facilities.

### **3.5.2 Budget Restrictions –**

Investors looking for financial gain fund most fitness clubs. Investors must be sold on the profit making potential of the project. With the interest in today's fitness market, many development companies are finding that fitness facilities can be profitable in a number of ways (Patton, Grantham, Gerson, Gettman, 1989). An example, development companies will build fitness facilities into their developments as an incentive to sell lease space.

An alternative to building new is to lease a new or established facility. Leasing frees up more capital to apply to operating costs. The scope of the landlord's responsibilities adds another advantage to leasing, by being responsible for tax liability, repair costs, heating and cooling spaces. Either way, capital is needed to start a fitness facility. According to Patton, Grantham, Gerson and Gettman, anything from \$100,000

to \$10,000,000 is sufficient to get into the fitness business and operate profitably in either mode.

### **3.5.3 Choosing the Look –**

The look or style of the facility is in part decided by the market composition. The members of the surrounding society will help in determining what look is appropriate to the area, unless the goal is to be unique and stand out from the rest of the surroundings. Detailed market information will help in deciding what the market is and what would be profitable for the area.

From observing different facilities in the Auburn, AL and Mobile, AL areas, the different styles became obvious. Some facilities looked as though they were barely hanging on and had trouble paying bills and maintaining equipment while others looked to be on top of the game. The most successful and stylish facilities were well funded, which proves that money has a lot to do with success as long as it is managed properly.

The facilities observed fit into several different categories; weight lifting with some cardio and aerobics, circuit training with machines and cardio, general fitness with an even mix of everything and women's fitness with a focus on machines and cardio. There were large commercial facilities and smaller private clubs and both were equally successful, the only difference was scale and intimacy. The smaller facilities tended to be pricier, especially if they were considered high-end fitness, while some larger facilities were expensive due to the wide variety of accommodations provided. Either way, there seemed to be something for everyone in both markets.

### **3.5.4 Color Choices –**

The palette of color used in a facility is extremely important. You have to be careful not to pick colors that irritate, are too calming, too exciting, or too plain. Most of the time altering the hue or saturation of the color can prevent these from happening. There is also some importance in linking the color scheme to the identity of the facility. Some members make their choice of facilities based on how it looks and not so much on what it offers. Color suggestions will be made in the guidelines based on the research in the literature review section.

### **3.5.5 Mood-Effect –**

The mood or ambience the facility presents can dictate how people behave when they are there. If the color scheme dictates hyperactivity there will be an influx in hyper behavior. A calming color scheme will cause a lethargic atmosphere, which is the opposite of what's desirable for a fitness facility. Not having one extreme or the other is important as long as a sense of excitement is maintained.

Energy and lethargy are equally contagious. If the predominant mood of the facility is energetic and exciting, the member response will be one of energy. There is nothing worse than getting up the energy to go to the gym to only feel bored when you get there. The atmosphere of the facility should be one that promotes energy and order. There are several ways to achieve a sense of energy. Many facilities believe loud music and vibrant colors or super happy employees are best way to achieve this, however subtlety is most effective.

### **3.5.6 Appealing to the 5 Senses –**

Everything we perceive must enter our minds through one of our senses. This becomes so automatic that we often take our senses for granted. One way to improve the user experience is to incorporate things that appeal to the five senses in the design of the interior environment.

#### **3.5.61 Sound –**

Most fitness facilities incorporate music into the ambience of their interior environments. If the music is played at a reasonable level and is not boring or distracting then it would be appropriate, if the purpose were to prevent silence. Many facilities broadcast loud music, which is not always agreeable to every member of the facility.

Quite often the purpose of the music is to drown out the clanking of gym equipment. When facilities are their busiest the music is loudest. Some facilities will broadcast quiet non-intrusive sounds while the members wear headphones that are tuned to a special in-house station, which has a selection of generally agreeable music.

According to an article published in the Green Bay Press-Gazette, training to music can improve performance and make exercisers feel better while working out. Based on an interview conducted by Green Bay Press-Gazette with Mark Anshel, a professor of physical education and sports psychology at Middle Tennessee State University, music can act as a natural stimulant or depressant. Some studies have found that listening to upbeat music can measurably raise your heart rate.

Another benefit to listening to music while working out is its ability to take your attention away from the not-so-fun parts of exercising – the sweat, the exertion and

thoughts that you would rather be at the park eating ice cream. Relaxing music can have a calming effect that can help exercises, such as yoga, and can steady jittery nerves before a big game.

### **3.5.62 Sight –**

Besides the health benefits of working out, most people go to fitness facilities for the sole purpose of improving their appearance. They often wear clothes that enhance their physique while working out. Especially in younger generations of fitness enthusiasts, showing off and being able to see yourself work out is half the fun of going to the gym. Mirrors are on nearly every wall, someone could stand in one spot and see the entire contents of the gym without having to turn their heads. Vanity, one of the causes of the boom of the health and fitness industry, is based only on sight.

The proliferation of the “women’s only” fitness facility is the result of a generation of women who prefer to workout in the company of women. This is partially due to the abundance of testosterone-crazed men who cannot keep their eyes to themselves. Some facilities will separate the women’s section, which has specialized equipment with weight stacks appropriate to their preferred level of workout, under the pretense that it gives them more privacy.

### **3.5.63 Scent –**

Scent implies a pleasant fragrance while odor implies a foul stench. Foul stench is predominant in the fitness industry due to the amount of sweating. Some facilities will place dehumidifiers throughout the workout area to remove some of the excess moisture

and odor. Strong fragrances can be dangerous and very distracting to someone in the middle of a vigorous workout. Imagine breathing hard, inhaling deeply trying to get enough air, when someone fresh from the locker room walks by who happened to put on too much cologne or perfume. The result can take your breath away and it often does. Subtle air fresheners and deodorizers are often used to prevent the infamous “gym bag” smell but no matter how hard they try, most facilities are going to smell like sweat.

#### **3.5.64 Touch –**

The extent to which touch is addressed in the health and fitness industry goes only as far as the equipment you use and occasionally having to spot someone or be spotted yourself. It is generally understood that you do not touch someone unless it is for the purpose of spotting and only at his or her request. The only way to appeal to this sense is to make the machines less obtrusive and more comfortable. The scope of this thesis does not encompass equipment design therefore it will not be discussed.

#### **3.5.65 Taste –**

Through observation, it was noted the number of people who brought a sports drink into the gym with them or purchased one while they were there. Water tends to be the most prevalent substance while the power lifters typically drink protein shakes or energy drinks. As far as experiencing taste in a fitness facility, most people would say they do not, however, beverage consumption and the occasional drop of sweat are as far as it goes.

### **3.6 Performance Criteria –**

This section focuses on observations of existing facilities in the Auburn, AL and Mobile, AL areas. The purpose of these observations is to establish a list of requirements for a model facility. The guidelines will be applied to the model in order to demonstrate the proper application of the suggestions. The facilities will remain anonymous with the area they came from noted by an “A” for Auburn, AL and an “M” for Mobile, AL. The names of the facilities will follow with a letter designation starting with “A.” For example, hypothetical facility “Jim’s Gym” in Mobile, AL will be denoted by “M-A,” the letter M notes that it is in Mobile, AL and the letter A replaces the name of the facility.

#### **3.6.1 Auburn, AL Fitness Facilities -**

Observations were made of six facilities in Auburn, AL. Each facility was photographed and notes were taken on lighting, color, equipment, layout, ambience and style of fitness. Employees and members identities will be concealed along with facility names and distinguishing marks. Each facility will have a criteria grade based on a 5 point per category scale. There are eight categories, weights, machines, cardio, aerobics, lighting, color, layout and ambience. A maximum of five points are available per category with a total of forty for the facility. The score will be presented in a comma-delineated format with the total at the end (ex. 4,3,5,4,4,5,3,2=30C). The letter represents the grade average, which is obtained when the score is divided by the total available points and then multiplied by one hundred. There are no pluses or minuses. After the analysis for each facility in both locations is complete, all data will be presented in a criteria matrix.

### 3.6.11 A-A –

The first facility that was observed utilized a combination of track lighting and industrial down lighting (HID). The space seemed adequately lit for the tasks to be performed and had an overall pleasant ambience. The color palette seemed too relaxing with the exception of the orange reception desk and the light yellow band around the room. The carpet and floor coloring also seemed to add to the relaxing nature of the space.

There was an abundance of equipment, however, the focus seemed to be on machines and circuit training. The cardio equipment was located next to the door, which is good for those members that want to come in, work out and leave.



Image 1: Facility A-A

The layout of the facility seemed conducive to circuit training and was easily accessible from different vantage points. The space lacked certain ADA considerations. The criteria grade for this facility is 3,4,4,3,4,2,3,3=26D.



### 3.6.12 A-B –

The second facility was for women only and was one of the more colorful facilities observed. Lighting, being mostly fluorescent, was less than flattering although adequate. The work out area was separate from the reception area and contained no windows.



Image 2: Facility A-B

There was a small childcare area near the main entrance. The overall layout was small and quaint but adequate for the membership. The equipment consisted mostly of cardio machines and a variety of circuit machines and very few free weights, ideal equipment list for most women. There was a large aerobics area, which could accommodate large classes, and a varied schedule of classes was offered. Ambience was relatively good, the space felt light and airy with a slight feeling of energy. The criteria grade for this facility is 1,4,4,5,2,4,4,4=28C

### 3.6.13 A-C -

Facility A-C was one of the worst facilities observed. The reception area was separate from the workout area. In order to get to the gym portion you had to walk down a long hallway. The walls were white and the carpet was a dark blue color. All lighting was standard 4 bulbs fluorescent. The building looked as though a dentist or doctor's office was the previous occupant.



Image 3: Facility A-C

The equipment was predominantly free weights or plate loaded machines with very few selector machines. There was a nice variety of cardio equipment. The general ambience was very muddy and unclean. There was a mild odor present. The facility supplied tanning and had a small aerobics room. The layout was very poor, ceilings were too low for some of the larger equipment and there were too many obstacles. The criteria grade for this facility is 4,1,2,2,2,1,1,1=14F

### 3.6.14 A-D –

Facility A-D was very open and crowded. The space was open with the exception of columns every fifteen feet square and the excessive machines. This facility was multi-level and multi-room with one room full of machines, another full of free weights and plate-loaded machines and the



Image 4: Facility A-D

third being the aerobics room. The layout of this facility lent itself more to weight lifting or to circuit training.

The spaces had relatively high ceilings with tiles floors. The colors were white and blue with black floors. The space seemed drab and not exciting. There was also inadequate parking and a mild odor present. Lighting was all fluorescent and dark in places. The space had a warehouse feel and was rather busy, being that it was downtown. Overall the space lacked style and was rather overwhelming. The criteria grade for this facility is 5,4,4,3,2,1,2,1=22F

### 3.6.15 A-E –

Of all of the facilities observed in Auburn, AL, this was one of the more spacious and most daring. Upon entering the first thing noticed is a large red wall. In the back of the space is another large painted wall with the facility logo, except this wall is painted blue. The work out area is encircled by a red stripe that borders the ceiling on the exterior walls, which were painted white. The carpet and equipment pads were a dark green. A large graphic hangs from one of the columns advertising a professional trainer.



Image 5: Facility A-E

The facility had high ceilings and was lit entirely by 4 foot 4 bulb fluorescent lights in long rows. The lighting was adequate to the task but was not flattering. The cardio equipment was located near the entrance for those members who wanted to complete cardio and then leave. The cardio area featured a large bank of televisions and there was audible music playing over the speaker system in the entire facility. A large aerobic room was located in the back with a large mixture of equipment between the front and back of the space. The free weights were in a different section of the facility. Tanning and a full locker room were available. The criteria grade for this facility is 5,4,4,4,2,3,4,4=30C

### 3.6.16 A-F –

The sixth and final facility for Auburn, AL was a corporate fitness facility. The focus of the facility was rehabilitation and general family fitness. The fact the facility was well funded was apparent. The workout area was separate from the doctor's offices



Image 6: Facility A-F

and featured a wide variety of equipment and free weights. There was a small break area and childcare was also available.

Each machine was linked to a computer that monitored repetitions and sets and even kept up with the data from the last time it was used. There were individual music receivers at each piece of equipment that the member could plug headphones into and listen to a predetermined style of music while working out. The facility was well lit with a series of direct and indirect lighting fixtures affixed to the high ceiling. The walls were off-white, grey, and tope. The reception area was trimmed in wood, which gave the space warmth.

The ambience was very professional and mature. The facility members were mostly older residents off the area. The facility was the nicest and best equipped for general and family fitness. The criteria grade for this facility is 4,4,5,4,4,3,4,4=32B

### 3.6.2 Mobile, AL Fitness Facilities –

Observations were made of eight facilities in Mobile, AL. Each facility was photographed and notes were taken on lighting, color, equipment, layout, ambience and style of fitness. Employees and members identities will be concealed along with facility names and distinguishing marks. Each facility will have a criteria grade based on a 5 point per category scale. There are eight categories, weights, machines, cardio, aerobics, lighting, color, layout and ambience. A maximum of five points are available per category with a total of forty for the facility. The score will be presented in a comma-delineated format with the total at the end (ex. 4,3,5,4,4,5,3,2=30C). The letter represents the grade average, which is obtained when the score is divided by the total available points and then multiplied by one hundred. There are no pluses or minuses. After the analysis for each facility in both locations is complete, all data will be presented in a criteria matrix.

#### 3.6.21 M-A –



Image 7: Facility M-A

The first facility observed in Mobile, AL was ideal for a body builder. There was a good mix of free weights but an almost void of machines. The space had rather low

ceilings and a very drab color scheme. There was an excess of visual noise cluttering the walls and signs were hand-painted. The carpet was a dull grey as were the walls. The only color came from the wide maroon band that went around the room either at the top of the wall or at waist level.

The facility was comprised of two retail spaces with an existing wall dividing the main space. The only clever application of color was a mural painted on the wall in the tanning room, which consisted of a jungle theme. The ambience was very drab and sleepy and did not lend itself to much excitement. The lighting was entirely comprised of four-foot fluorescent fixtures, which there were too few of, the space appeared dark. The criteria grade for this facility is 4,2,1,1,1,1,1,1=12F

### 3.6.22 M-B –



Image 8: Facility M-B

The second facility observed from the Mobile, AL area was a commercial chain facility. This particular chain lacked insufficient color to create an exciting environment. The color palette was dark grey carpet, white walls and purple hued stripes around the upper portion of the large fitness room. The only visually interesting thing in the space was the checked floor when you entered the space. The facility was clean and the music was not overwhelming.

There was adequate lighting even though it consisted entirely of two bulb eight foot fixtures. The aerobics rooms were located in the back of the facility with a large workout area that consisted of an even mix of machines and free weights in the middle. The cardio equipment was immediately to the right when first entering the facility. The overall ambience of the facility was pleasant but lacked excitement. The criteria grade for this facility is 4,4,4,4,3,2,4,3=28C

### 3.6.23 M-C –

The third facility observed was a family fitness/community center. The weight room portion of the facility was large and square with a small square office in the middle, which belonged to the trainers and managers of the weight room. The carpet was a dark grey, as were the

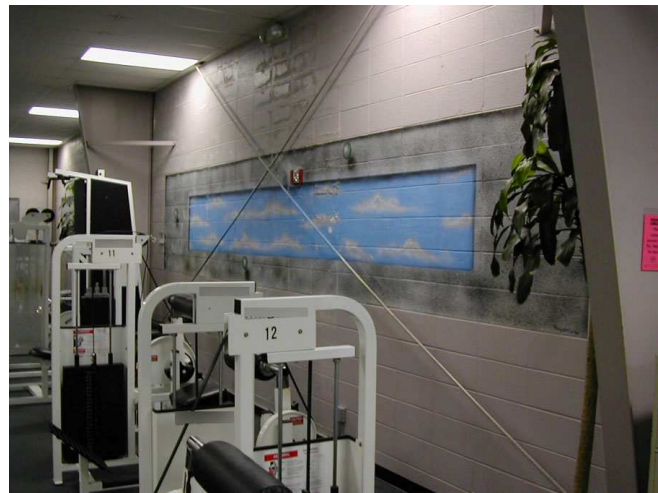


Image 9: Facility M-C

walls. The lighting consisted of four-foot fluorescent fixtures spaced in a grid with fixtures along the walls. The walls were a light grey with a mural of the sky painted on sections of the walls in between large steel support girders. Cabling cross members crisscrossed the walls in-between the steel girders.

There was a large mixture of equipment with one side of the space dedicated to cardio equipment; the other spaces were filled with different types of machines. The free weight section was located at the end farthest from the entrance. The space was lit



enough for the task of the space but it was not adequate enough for optimal performance. The overall ambience of the facility was mild, not exciting but not completely dull either. The criteria grade for this facility is 4,4,5,4,3,3,4,3=30C

### 3.6.24 M-D –



Image 10: Facility M-D

This was the best use of color that was observed. All of the walls were painted solid colors, red, yellow and orange. The longest walls were red with the front wall being orange and the back wall being yellow. The facility was located in a large retail space with a rectangular shape. There was a large front desk area with a graphic logo painted on the wall beside the smoothie bar. Half the length of one of the longest sides was entirely cardio equipment, which faced a large area peppered with weight machines. The back half of the space was free weights with a large back room dedicated to aerobics.

Eight-foot fluorescent fixtures lit the space in rows running the length of the facility, although the lighting was adequate it was not flattering. Trimming the large mirrors on the walls and the offices across the space from them were long neon tubes of green light, which seemed to clash with the overall color scheme. The color scheme appeared to be a hodgepodge of bright colors with no plan or thought given to how they would be best applied. The criteria grade for this facility is 4,4,4,5,3,4,4,4=32B

### 3.6.25 M-E –

The fifth observation was a large commercial fitness chain. The layout and composition of the facility was adequate but confusing. The weights and machines were on different levels. If someone were working-out between a machine and a free weight setup, they would have to go back and forth between levels.



Image 11: Facility M-E

The ceilings in general were high with the exception of the second level. The lighting was direct HID industrial lighting combined with fluorescent.

The color scheme consisted of a yellow stripe that was repeated in different rooms and dark green accents and carpet. Yellow was not part of the corporate identity. The interior architecture was interesting lending itself to improve the overall ambience of the facility. Wood accents could be found in various places throughout the facility. The overall level of excitement was good. The facility featured an open design foyer with weight and workout rooms adjacent to the foyer. The criteria grade of this facility is 4,3,3,4,3,3,4,5=29C

### 3.6.26 M-F –

This facility is a women's only facility and attempted to use color but failed. The worst display of color was a faux finish of bright green. A sponge technique was used to try and lighten up an already annoying shade of green.



Image 12: Facility M-F

There was not a lot of weight equipment and only a small room of machines. The room pictured is one of three. The first is all cardio equipment; the other is the combination of a spinning room and childcare. The childcare portion is separated from the spinning room by a wall. The spinning room walls were painted dark blue and black and then a mural of street life was painted on to create a sense of bicycling down a busy street.

The facility was well lit with the exception being entirely fluorescent and having a green tint. It was quite difficult to see past the green, it was very distracting. The overall ambience of the facility was less than stimulating; it became rather annoying after the short time the observation took place. The spinning area seemed to be the only form of aerobics offered. The criteria grade for this facility is 2,3,4,2,3,1,3,2=20F

### 3.6.27 M-G –

This facility was a weight lifters paradise. Well-lit, creative colors with soothing hues and very industrial looking, this facility was the most visually interesting and exciting observation. There was an abundance of free weights and plate loaded machines and very few



Image 13: Facility M-G

selector machines. There were two rows of cardio equipment on the second level that spanned the length of the storefront. The isles were carpeted dark green and the workout floors were black mats, this combined with all black equipment and purple and yellow (complementary colors) walls and the teal industrial ceiling created a very exciting environment.

The negative was the low ceiling in the workout area and how crowded it felt. Overall the ambience was nice. The facility included a nutrition store and smoothie bar. The locker rooms were on the second level along with the aerobics area and other specialty equipment not often seen in fitness facilities. The criteria grade for this facility is 5,3,4,4,4,5,3,5=33B

### 3.6.28 M-H –

The last observation was of a small private facility, which was considered high-end. The space felt very intimate and not crowded. There was a mirrored wall covered with angled wood decking and an adjacent wall painted red also covered with mirrors.



Image 14: Facility M-H

The weights were on a raised wooden floor with the wood exposed and the equipment sitting on mats. Most of the equipment was white with a few older pieces that were silver and pneumatic. The other half the space was carpeted and contained a small selection of a variety of cardio equipment. There was an adjacent room that was designated as a multipurpose/aerobic room. The facility also featured a Venice Beach inspired outdoor workout area, similar to the famed muscle beach in California. The space lacked sufficient equipment and of course...no beach.

The overall ambience of the space was nice with mostly fluorescent lighting and a blinking stop signal in the corner of the larger room. The foyer of the facility included a smoothie bar and merchandise area. One selling point of the facility was the fact it could be accessed 24 hours a day. The facility is very elite and only select members are granted access. The criteria grade for this facility is 4,4,3,4,4,3,2,4=28C

### 3.6.3 Graphing the Auburn, AL Data –

The preceding Auburn, AL data will be analyzed and placed into a matrix. The matrix will be easy to read and will illustrate the basic need of a health and fitness facility based on the graded categories. The resulting data will then be applied to the development of the guidelines.

#### 3.6.31 Equipment Selection –

The following chart illustrates the quality of the equipment selection available at the facilities observed in the Auburn, AL area. The chart contains data for weights (free weights), machines (selector machines), and cardio (cardiovascular). The selection was graded on a five-point scale, with one being a poor selection and five being a good selection. The data presented in the chart will help to establish the importance of equipment selection.



Graph 1: Equipment Selection Analysis of the Auburn, AL Facilities

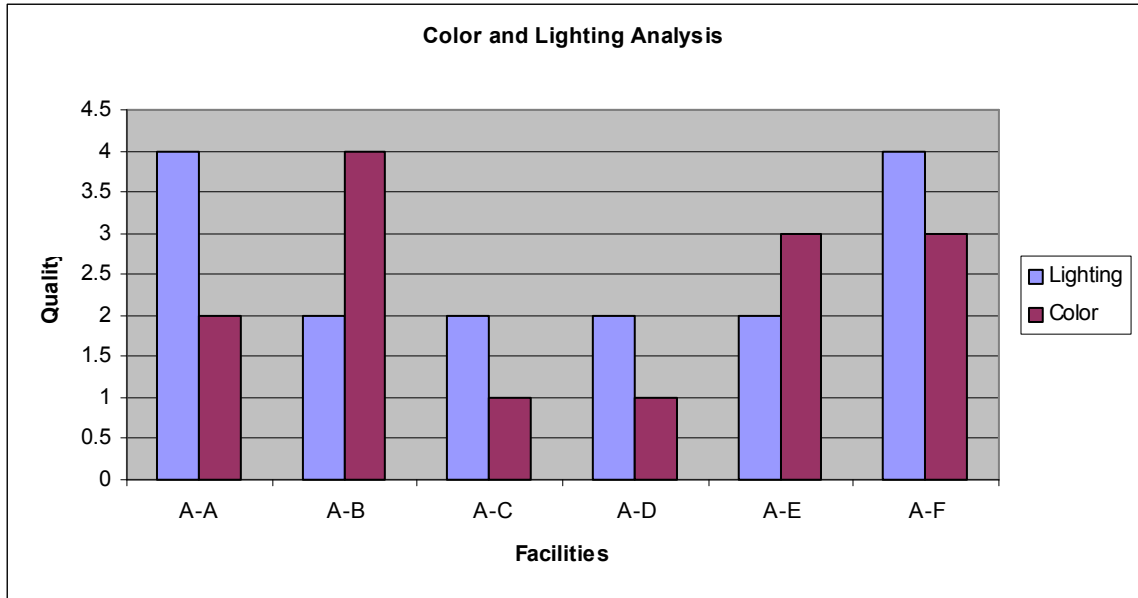
The chart illustrates the varying importance of free weight selection in the different facilities. Some facilities emphasized a broad selection of free weights while others focused more evenly on machines and cardio. This could be due to the fact that most people are not avid weight lifters and prefer circuit training to weight lifting and power lifting.

The facilities that paid close attention to their membership geared their selection more towards what the members requested and less toward what they thought the general public might want. This is good because it saves money and allows a facility to be categorized as either a weight lifters or circuit trainers' type of facility. The result could also affect the facility negatively by limiting the potential member market they previously had available.

### **3.6.32 Color and Lighting Quality –**

An analysis of each facility was completed in order to better understand what their concept of proper color and light application consisted of. The observed facilities were graded on a scale of one to five, one was a poor understanding and five was a good understanding. The analysis was completed with the full understanding that the quality of lighting and color application could have been guided or accidental.

Lighting was graded based on type of fixture, direct or indirect, quality and quantity of light. A single grade was assigned for lighting and a separate grade for color; this was because each was applied to the facility independently and without consideration of the other.



Graph 2: Color and Lighting Analysis of the Auburn, AL Facilities

The resulting data illustrated that color and light were thought of as separate entities within the facilities and were not considered as interdependent of each other. Only two facilities had adequate light with one having a poor understanding of color. The remaining facilities were lit enough for the tasks to be completed but were not adequate enough for optimum performance.

Some facilities had a good understanding of color in the fact they actually had something besides white walls. Colors were, however, limited on variety. Facility color choices were mostly red and yellow with some green and orange mixed in. The one that used green did a very poor job of softening the shade they chose. The colors that were used were often primary and very vibrant and bold.

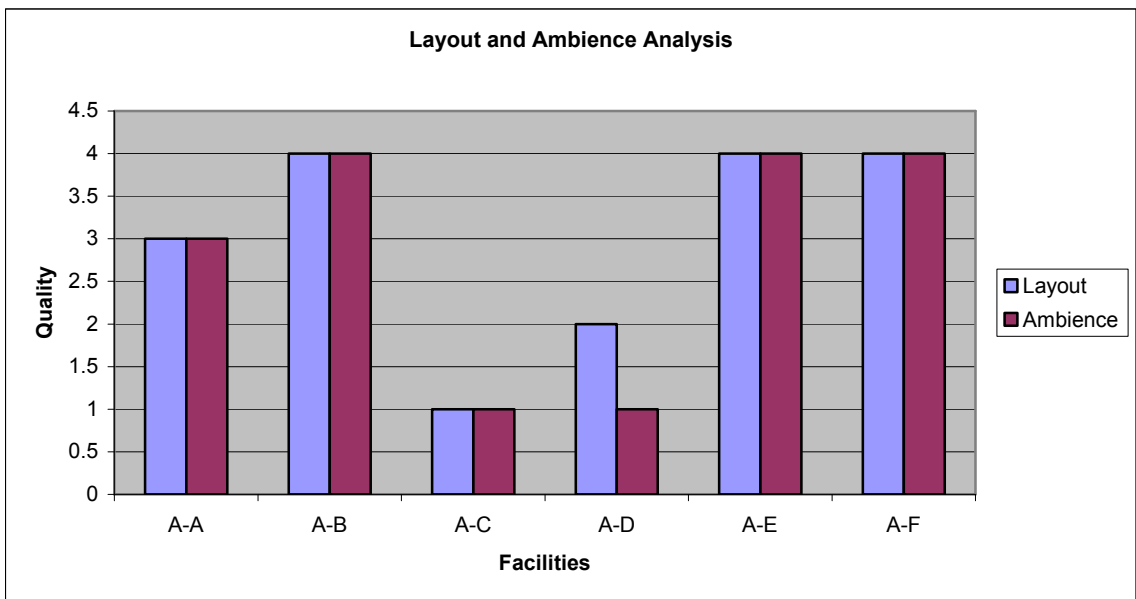
Lighting was mostly fluorescent, consisting of four-foot long four bulb fixtures that dropped into the ceiling grid. One facility used commercial HID fixtures and another



had some track lighting that was incandescent. Overall, there was a poor understanding of the effect of color and light on human performance.

### 3.6.33 Layout and Ambience –

Facility layout was analyzed separate from ambience because the two could be improved without affecting the other. For most facilities layout and ambience were proportional to each other in quality. One facility had a moderately effective layout but a poor ambience; the facility seemed too crowded and spread out. The ambience was poor because the layout was so spread out and the lighting was only moderate.



Graph 3: Layout and Ambience Analysis of the Auburn, AL Facilities

Overall, most facilities had a good understanding of layout which positively affected the ambience. In one case the layout was better than the ambience. Layout and ambience are both important aspects to consider when designing a fitness facility. If one is less than adequate the other will suffer.

**3.6.34 Data Chart –**

The chart shown below is the actual data recorded from the observations. This information was analyzed and applied to the previous tables.

	weight	machine	cardio	aerobics	light	color	layout	ambience	sum	out of 100
Auburn, AL										
A-A	3	4	4	3	4	2	3	3	26	65
A-B	1	4	4	5	2	4	4	4	28	70
A-C	4	1	2	2	2	1	1	1	14	35
A-D	5	4	4	3	2	1	2	1	22	55
A-E	5	4	4	4	2	3	4	4	30	75
A-F	4	4	5	4	4	3	4	4	32	80
average/5	3.67	3.50	3.83	3.50	2.67	2.33	3.00	2.83		
	C	C	C	C	F	F	D	F		

Chart 1: Auburn, AL Facility Observation Recorded Data

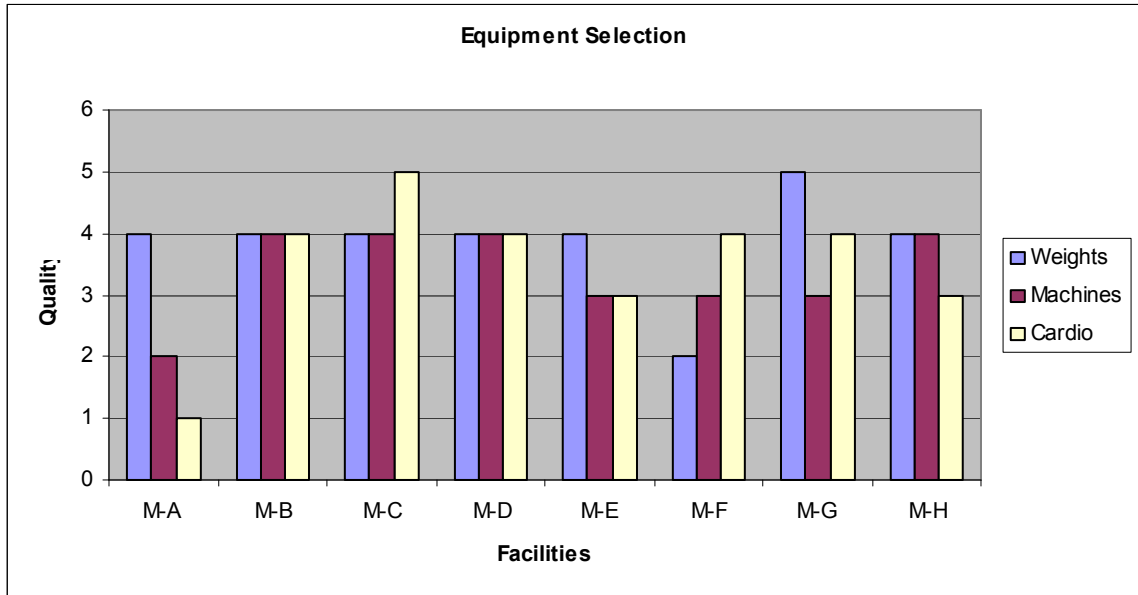
**3.6.4 Charting the Mobile, AL Data –**

The preceding Mobile, AL data will be analyzed and placed into a matrix. The matrix will be easy to read and will illustrate the basic need of a health and fitness facility based on the graded categories. The resulting data will then be applied to the development of the guidelines.

**3.6.41 Equipment Selection –**

The following chart illustrates the quality of the equipment selection available at the facilities observed in the Mobile, AL area. The chart contains data for weights (free weights), machines (selector machines), and cardio (cardiovascular). The selection was graded on a five-point scale, with one being a poor selection and five being a good

selection. The data presented in the chart will help to establish the importance of equipment selection.



Graph 4: Equipment Selection Analysis of the Mobile, AL Facilities

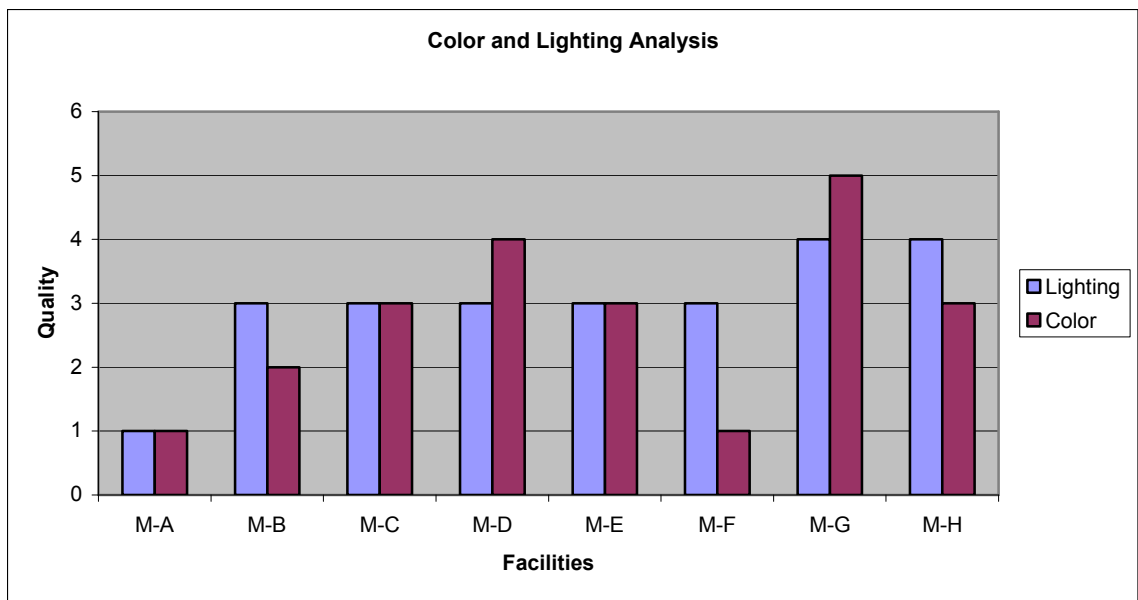
Similar to the Auburn, AL facilities, there was a significant amount of fluctuation in the selection of equipment. Some facilities emphasized weights while others focused more on cardiovascular equipment. The Mobile, AL area was a larger market and a better sample of facility types. There was a range from high-end private to commercial clubs and franchises to small private facilities.

Overall, weights were important but the most consistent selection was with cardio equipment. Circuit training equipment seemed to be moderately supplied. Based on the market and the style of each facility, the assumption could be made that each facility had a good understanding of selection needs.

### 3.6.42 Color and Lighting Quality –

An analysis of each facility was completed in order to better understand what their concept of proper color and light application consisted of. The observed facilities were graded on a scale of one to five, one was a poor understanding and five was a good understanding. The analysis was completed with the full understanding that the quality of lighting and color application could have been guided or accidental.

Lighting was graded based on type of fixture, direct or indirect, quality and quantity of light. A single grade was assigned for lighting and a separate grade for color; this was because each was applied to the facility independently and without consideration of the other.



Graph 5: color and Lighting Analysis of the Mobile, AL Facilities

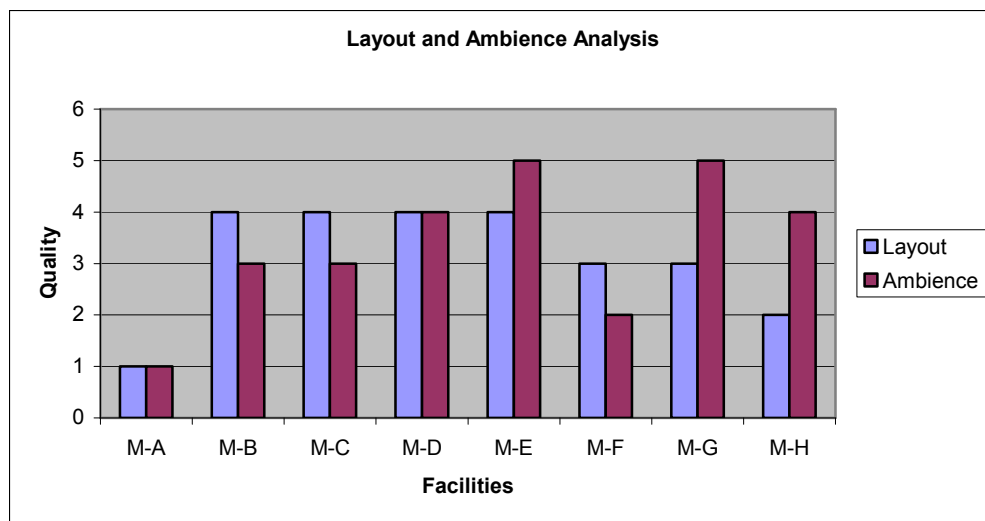
The resulting data illustrated that color and light were thought of as separate entities within the facilities and were not considered as interdependent of each other. Some facilities had a better grasp on lighting than they did on color, which is

understandable considering light is necessary while color is not. Other facilities had a good understanding of color but based on their application it could be assumed that it was accidental. Consideration was not given to the effect it might have on the performance of the members.

Lighting was mostly fluorescent, consisting of four-foot long four bulb fixtures that dropped into the ceiling grid. One facility used commercial HID fixtures and another had some track lighting that was incandescent. Overall, there was a poor understanding of the effect of color and light on human performance.

### 3.6.43 Layout and Ambience –

Facility layout was analyzed separate from ambience because the two could be improved without affecting the other. For most facilities layout and ambience were proportional to each other in quality. One facility had a moderately effective layout but a poor ambience; the facility seemed too crowded and spread out. The ambience was poor because the layout was so spread out and the lighting was only moderate.



Graph 6: Layout and Ambience Analysis of the Mobile, AL Facilities

Overall, most facilities had a good understanding of layout which positively affected the ambience. There were three instances of the ambience being better than the layout. An equal number of instances where layout was better than ambience also existed. Layout and ambience are both important aspects to consider when designing a fitness facility. If one is less than adequate the other will suffer.

### 3.6.44 Data Chart –

The chart shown below is the actual data recorded from the observations. This information was analyzed and applied to the previous tables.

	weight	machine	cardio	aerobics	light	color	layout	ambience	sum	out of 100
Mobile, AL										
M-A	4	2	1	1	1	1	1	1	12	30
M-B	4	4	4	4	3	2	4	3	28	70
M-C	4	4	5	4	3	3	4	3	30	75
M-D	4	4	4	5	3	4	4	4	32	80
M-E	4	3	3	4	3	3	4	5	29	72.5
M-F	2	3	4	2	3	1	3	2	20	50
M-G	5	3	4	4	4	5	3	5	33	82.5
M-H	4	4	3	4	4	3	2	4	28	70
average/5	3.88	3.38	3.50	3.50	3.00	2.75	3.13	3.38		

Chart 2: Mobile, AL Facility Observation Recorded Data

### 3.6.5 Results –

All the data gathered was used to develop a list of criteria that was ranked by importance in order to establish categories for development into the guidelines. The areas of importance are based on the style of fitness the facility is geared towards. The guidelines will base the suggestions off the style of fitness and how beneficial they would be for user experience and performance.

All areas observed were significantly important and needed to be improved in some regards. There appears to be a complete disregard for how color affects the members. The assumption is that whoever is charged with painting or decorating does whatever they believe will work, with no professional or educated assistance. The other misconception is that color and light are separate. In fact, we would not see color if it was not present in light, therefore, light that contains a majority of the color spectrum must be used to render colors correctly. Fluorescent lighting tends to be bluer, which can render interior colors poorly and can negatively affect skin tones.

Equipment is necessary in the fitness industry; however, the type of equipment is specific to the style of fitness, granted all facilities will have some of everything. How much of each type of equipment is determined by whether the facility is designed with weight lifters in mind or circuit trainers. This consideration must also be taken when designing color schemes and lighting arrangements.

Layout is important to the ambience of the facilities. An early form of this concept is the Asian art of Feng Shui, which follows the idea that energy flows through a space and how easily it presents that determines the mood of the space and the ambience.

Observation also showed facilities with a better understanding of color and light had a higher level of member retention. The facilities with adequate light and pleasing colors experienced better member return while facilities with lower lighting and poor color choices experienced poor member return. The amount of differentiation was not extreme but enough to demand attention.

Adequate light combined with appropriate color choices conveyed a higher sense of quality in facilities that contained these characteristics. An unfamiliar person would

expect to pay more in membership dues to belong to the facilities with adequate lighting and appropriate color. The facilities with poor lighting and inadequate color had fewer members and charged less for membership.

Therefore, a facility with adequate lighting and pleasing colors could charge more in membership dues and receive a higher class of members. By applying the following guidelines, this could be achieved in an affordable manner. Minimal cash would be necessary to make the proper improvements to a facility.



## **4.0 PURPOSE OF GUIDELINES**

### **4.1 Introduction –**

The guidelines in chapter five are intended as a supplement to professional advice and are not intended to replace the guidance of a qualified professional. The suggestions that are made come from existing research and are based on the theory that color and light can positively influence user experience and performance. Best effort has been made to prove the validity of the aforementioned theory in its relevance to the field of health and fitness. However, additional testing is required to further prove the effectiveness of the developed guidelines.

### **4.2 Content of Guidelines –**

The guidelines begin with a brief explanation of color and light and how they affect the body and mind. User experience and performance are explained based on their role in the guidelines and what exactly they reference. Suggestions are made based on categories determined by the observation and analysis of existing fitness facilities. From the information gathered, basic requirements were established. Each requirement category contains a set of educated suggestions. Suggestions are organized based on clients, best experience, best performance, renovation vs. new, marketing data and square footage.

### **4.3 Application of Guidelines –**

The guidelines can be applied at any phase of construction or renovation. The ideal circumstance would be to apply them during new construction. During that time utility planning is most ideal. Considering that the lighting scheme may be more than standard, implementing the guidelines at this phase ensures that adequate wiring and electricity will be supplied to the lighting system and fitness equipment.

If the guidelines were to be applied during renovation, less consideration can be made for lighting and wiring schemes without necessitating the installation of additional circuits and lighting. Color and light quality can be easily adjusted in the cosmetic sense, meaning that walls are easily painted and bulbs changed to a more suitable color. Equipment is slightly more difficult to move a second time than to place it in the proper place when installing. Either way, the guidelines can be applied whether the situation involves new construction or renovation.

### **4.4 Contributing Research –**

Color and light information referenced within the guidelines was gathered from credible and scientifically valuable sources. Lighting data was gathered from both published texts and a seminar on interior lighting and environments, which is part of a certification course for architects and interior designers. The principal that color and light will positively affect user experience and performance if applied properly was deduced from the combining of research gathered from various sources, all of which can be found in the bibliography section.

## **5.0 GUIDELINES**

The following guidelines are a series of suggestions based on academic research and the extensive study of color and light and their effect on the human body. The guidelines will explain the basic premise of color and light and how they affect the body and mind. There will also be an explanation of how the human reactions to color and light can be controlled in such a way that will produce positive results in regards to the users experience and performance.

### **5.1 Understanding Color and Light –**

Color is the result of certain qualities of light that the eye recognizes and the brain interprets. If a color is not present in light then it will not be seen. Example, a red apple reflects the red wavelengths of light that are emitted by the light. Therefore, light and color are inseparable, and, in the design of health and fitness facilities, equal attention must be devoted to their psychological, physiological, visual, aesthetical and technical aspects.

#### **5.1.1 Affect on the Body –**

Certain wavelengths of color affect the human body in different ways. Quite often, we notice the temperature of light, warm incandescent or cool fluorescent. We can

even sense the wavelength of some light, the warmth of ultra-violet. What we do not realize is the internal affect light has on our bodies and our minds.

According to H.L. Logan, natural light (sunlight) can dilate the blood vessels, increasing circulation, thus ridding the body of toxins and lightening the load on the kidneys. When the body is exposed to sunlight, the capillaries in the skin dilate, blood pressure falls slightly, the pulse quickens and there is a stimulation of energy, according to Birren.

By simulating the qualities of day light within a health and fitness facility, there exists the ability to improve performance and general well being (experience). Not suggesting that UV lamps be placed throughout a facility, but simply improving the quality of light within a facility will have positive repercussions. This combined with the placement of the lights and the colors applied to the space; the overall effect of the environment will positively affect user experience and performance.

Light also has an affect on muscular reactions in the body. Slight muscle contractions occur as a result of exposure to warm colors, the contractions are more noticeable with warm colors than with cool ones.

### **5.1.2 Affect on the Mind –**

Color and light also affect the mind in different ways. Certain colors will cause excitement, such as reds, yellows and oranges; while other colors provoke a sense of calm and relaxation, greens and blues. With the proper guidance on how to apply these colors to the interior of a health and fitness facility, significant improvement to user experience and performance can be achieved.

Red has caused measurable levels of stimulation in people exposed to the color under test conditions, according to studies done by Birren and others. A similar but opposite reaction resulted from exposure to blue light, which is on the opposite end of the color spectrum from red.

## **5.2 User Experience –**

The ways a person interprets a space and interact with that space are characteristics of their user experience. Experience has taught us that there are certain things you can do to make a space more pleasant or more agreeable for completing a certain task. Bringing pictures of loved ones from home to decorate your office with or playing some music while you clean the house can create an enjoyable experience.

Improving the look and feel of a space is improving the way that space is experienced. By painting a space stimulating colors and lighting it so that it conveys a sense of energy and stimulation can positively affect user experience. The same goes for improving performance. Research shows that people perform better at certain tasks under specific lighting and specific colors. By specifying colors that are stimulating for the mind and pleasant to the eyes, the way that space is experienced along with how well users perform in that space can be improved.

## **5.3 User Performance –**

User performance can be directly linked to color and light. The human body reacts to light in a way that prepares it to perform. By combining the appropriate light

with the correct combination of colors, the body can perform at a heightened level even while at rest. This results in increased caloric burn off, result – weight loss.

By altering the light and color of the interior environment of a health and fitness facility, performance can be improved which will result in improved ability to lose weight. Exposure to proper lighting will also enhance mood and improve the ability to maintain weight loss or current weight.

#### **5.4 Suggestions –**

The following guidelines are separated into five categories and are based on a combination of existing research and new ideas. Each category is divided into sections relevant to the specific category. The forthcoming suggestions have been simplified for content and clarity.

##### **5.4.1 Floor Plans -**

The following category contains sections that suggest ways to improve user experience and performance based on improvements to existing facility floor plans. The suggestions are based on ADA requirements, square footage, marketing data, experience, performance, and renovation vs. new.

##### **5.4.11 ADA Requirements -**

Due to the extent of the requirements of the American's with Disabilities Act, a copy of the Code of Federal Regulations can be found on the Internet at [www.ada.gov](http://www.ada.gov) by

simply clicking on the “Design Standards” link. However, the architect of the renovation or new construction should be educated in the standards and requirements of the ADA.

#### **5.4.12 Based on Square Footage –**

Certain spaces are more conducive to specific functions based on square footage.

The industry standards for facility design measurements are listed below.

- Square footage per member for the building (excluding tennis courts):
  - 10 - 15 square feet – average
  - 6 - 8 square feet – high density (8 – 10 square feet preferred)
  - 8 – 10 square feet – medium density (10 – 12 square feet preferred)
  - 10 – 12 square feet – low density (12 – 14 square feet preferred)
- Square footage per participant:
  - 36 – 40 square feet – for aerobics
  - 40 – 50 square feet – for floor work or weight training
- Space allocations as percentage of total space:
  - 40% for exercise and activity areas
  - 35% for locker room and shower facilities
  - 25% for administrative and service areas
- Furniture and fixture clearances and heights
  - Tabletop – 30 inches high
  - Sink – 36 inches high
  - Vanity counter – 32 inches high
  - Seating clearance – 60 inches minimum for smooth flow

Desk – 34 inches for chair and 26 – 34 inches to pass by

*Developing and Managing Health/Fitness Facilities* by Patton, Grantham, Gerson and Gettman (1989) was the primary source for the above information, which can be located on page 170 appendixes C of that book.

#### **5.4.13 Based on Marketing Data –**

There are some basic questions that must be answered prior to defining a target population. Questions like; what type of population would be serviced, what would the average member income be, what are the average age ranges and sex ratios that are preferred? After answering these questions, some basic suggestions can be made.

If the target population is between the ages of 16 and 60 with a 3 to 1 male to female ratio in a college town, a large facility with only basic amenities and services but a large selection of equipment and activities is suggested. A population that is mostly (70%) college students is going to have a high turnover rate, which means that members will be constantly changing. The focus is on maintaining and updating for the 30% that the facility will actual retain.

If the target population is between the ages of 18 and 60 with a 2 to 1 male to female ratio, the needs change. Size will still be an issue, however, amenities and services will become more of a focus. As the sex ratios get closer to 1 to 1 the need for a better-rounded facility with considerations for both sexes becomes critical to success.



#### **5.4.14 For Best Experience –**

To ensure a positive experience, all aspects of the facility must be considered. The primary areas to consider, however, are the reception/entry area because of its affect on first impressions, the general fitness area, because of the lasting affect it has on current members and their willingness to refer the facility to friends.

The other spaces within the facility should not be neglected, but the primary focus should be on the two aforementioned areas. The primary goal is to wow potential new members as they enter the facility. How to do this can be determined by the style of fitness the facility is geared towards. If the facility is geared more towards weight lifting or weights in general and the target population is mostly male, an industrial theme with exposed metal and beams could prove successful. If the target population is mostly female, softer shapes are more desirable with a fewer hard edges and rough textures. The idea is to mimic the qualities of the target population in the entry area of the facility by including aspects of those qualities in the interior architecture.

In the general fitness area, it is important to continue the theme from the entry area but on a more subdued level. The reason for the shock and awe when a member first enters, is to help remind them of what drew them to this facility the first time and to continue to remind them of that as they proceed through the facility. Subtle accents can be used throughout the remaining space to unify the theme of the facility.

If the theme is industry and geared towards weight lifters, metal objects and surfaces combined with high ceilings and warehouse style lighting, will create the feeling of working-out in a warehouse. To continue a subdued theme, softer shapes and colors throughout the space are more appropriate, but applied in a similar manner.

#### **5.4.15 For Best Performance –**

The layout of the equipment and the proximity certain types have to others will determine how successful the facility is in regards to the performance of the members. If the facility targets weight lifters more than circuit trainers, then emphasis should be given to the free weights and plate loaded equipment. The principle behind organizing equipment for performance is based on two aspects; muscle group and quick access. If the member is looking for an aerobic weight based workout (circuit training), they will want to access a larger variety of equipment more quickly and with less focus on weight than a weight lifter.

Weight lifters tend to work out one of two ways; by focusing on opposing muscle groups or by focusing on supportive muscle groups. Opposing muscle groups refers to the muscle on the anterior and posterior of the body part to be worked, i.e. biceps and triceps, pectorals and lat muscles. By focusing on the muscles on both sides, an even build is achieved. Focusing on supportive muscles refers to working the muscles in a specific group function, i.e. chest and arms or legs and back. The principle behind this style of work out is to achieve a “burn out.” Burn out is when a muscle is worked to the brink of failure. Generally the last repetition of a set of this style requires effort on the part of a spotter and helps to build full muscles.

#### **5.4.16 Renovation versus New –**

Whether the facility is new or being renovated, the same considerations mentioned in the section on square footage must be followed. Care must be taken to

ensure that there is enough square footage to accommodate enough people to make the facility practical, profitable, and enjoyable to use, not to mention safe.

There is less room for error in a renovation. By focusing on existing square footage and areas where more can be gained, a substantial improvement can be made to an existing space. Care must be taken prior to the removal or addition of any walls to ensure that local building codes and ADA requirements have been followed.

#### **5.4.2 Color Palette –**

The importance of color in the health and fitness industry has never been fully realized. The proper manipulation of color can affect the physical reactions of the human user in a way that positively influences the quality of their experience and performance. Certain colors cause the body to react and be more open to certain stimuli, in this case physical activity.

Research shows that when a person is exposed to red the pituitary gland, which is an endocrine gland, sends signals to the adrenal glands. Within seconds adrenaline is released, causing certain physiological alterations with metabolic effects. The following reactions begin immediately but may not be noticed for a few minutes or several hours, depending on the hue and saturation of the color.

Blood pressure elevates as a result of increased heart rate, increasing the rate blood flows through the body. Breathing becomes more rapid, the autonomic nervous system takes over and reactions become more automatic. Taste buds become more sensitive, appetite improves and the sense of smell heightens.

Males become more attracted to yellow when exposed to red while females become more attracted to blue. The lenses of the eye have to adjust to focus the red wavelengths; their natural focal point lies behind the retina causing the illusion of advancing in objects colored red. Red light also causes increased eye blink rates. Further discussion regarding the physiological effects of colors can be found on page 100.

#### **5.4.21 Based on Clients –**

By altering the hue and saturation of a color, the severity of its effect can be controlled. Some colors, not matter the hue or saturation, will have little or no effect. The effectiveness of a color is also determined by the pattern and surface area that it is applied to. Small amounts of red in a stimulating pattern are equally exciting but less invasive and more soothing to view.

The idea is to cater the color selection to the target population of the facility. Due to the rate at which the eye ages and the fact that the retina begins yellowing, affecting how colors are perceived, care must be taken when using vibrant colors in the presence of older users. Brighter colors loose their vibrant qualities and begin to appear more mute and muddled. Softer hues and less saturated colors are more effective for viewing by the elderly.

Younger generations prefer bright, vibrant, rich colors ordered in interesting patterns. The trick is not to create over stimulation of the senses where too much color and too many patterns can cause a feeling of over excitation of the eyes, resulting in eye fatigue. As with all things, bright and vibrant colors are to be used in moderation. A large room that is almost entirely red is too exciting and can be overwhelming. The

proper way to apply red to a space is to use it strategically. Do not rely on red as the primary color but more as an accent to a space.

#### **5.4.22 Based on Marketing Data –**

Choosing a color palette based on marketing data can be just as tricky. The same rules apply, be careful not to rely too heavily on any one color, especially if that color is heavily saturated. The proper way to use the color is more as an accent and less as a focus. Try to pull the filler colors for the space from characteristics of the style of fitness the facility occupies. Try to use colors found in industry for an industrial theme and colors found in the outdoors for a nature theme. In a sea of forest green and yellows, bright red or neon green are not appropriate.

Color choices can also be decided based on the social and cultural make-up of the target population. Try to pull in colors that have specific cultural meaning to the inhabitants of the area. This will help to create a sense of community in the facility, making people feel more comfortable. As in all things, this too must be done in moderation. Over coloring a space can make it seem, if the color is orange, like a 1980's Burger King, if the color is red, like a Russian tearoom.

#### **5.4.23 For Best Experience –**

For the best experience, the colors of a space should send a message, one that relates to the users of that space. If the area is intended for cardiovascular activity, adding colors that cause excitement but feel natural, colors that are common yet vibrant

can create an enhanced experience. Try to avoid over saturated and neon colors, unless the theme is the Las Vegas Strip.

Other enhancements come from multimedia additions. Music and television are common in the cardio room at most fitness facilities. Placing the appliances for these forms of media have to be strategic. The best way to enhance the cardio room experience is keep it clean and uncluttered. Most facilities have cords or cord covers exposed on the floor along with large bulky fixtures for suspending televisions for the ceiling or walls. By setting these appliances into the wall and hiding speakers, users of a space become less aware of their existence and they simply enjoy their result.

#### **5.4.24 For Best Performance –**

Enhancing user performance in a space such as a cardio room can be quite simple. Vibrant reds and orange hues are ideal for an area of heightened physical activity such as a cardio room. If the equipment in the room faces a wall and the users of the equipment also face that wall, paint it red. Paint the other walls a secondary color to red at a lower level of saturation or leave them white. The contrast between the white emptiness and the vibrant red will cause the previously noted physical reactions to occur thus resulting in a heightened level of performance.

By creating a space that even when a person is at rest, causes physiological levels of excitement, will enhance the metabolic function off the body resulting in higher levels of caloric burn off. If the members using the space follow a normal diet of eating healthy and exercising daily, they will begin to notice an increased rate of weight loss.

### **5.4.3 Lighting –**

Notice is almost always given to inadequate lighting. Few people notice the effects of adequate lighting, because the idea behind having adequate lighting is that only the result of the lighting is noticed and not the lighting itself. Few people have focused on this critical area of the fitness industry because it is so often unnoticed. The following suggestions are based on existing research and new ideas.

Special attention must be given to the quality and quantity of the light provided. Lighting engineering and the science of lighting design is beyond the scope of this thesis and the following guidelines. These guidelines serve to inform the user of the importance of adequate light and some standard to follow as a reference.

#### **5.4.31 Based on Need –**

The first thing that must be understood is how much light is required for specific tasks. The following information presents a basic understanding of basic lighting levels based on specific tasks. The suggestions are for minimum foot-candles.

- Industrial Assembly – 100fc
- Corridors – 20fc
- Warehouses – 50fc
- Office spaces – 70fc
- Libraries – 70fc
- Leisure – 30fc

The foot-candle rating for lamps can often be found on the package of the lamp or through the lamp manufacturer.

#### **5.4.32 Based on Clients –**

Lighting requirements change as the user ages. The younger a user the less light is required to a minimum level. With age comes the need for additional light. Special consideration must be given when the elderly are part of the target population. Some basic suggestions for general room lighting for the based on age are listed below in fc.

- Under 40 – 20fc
- 40 to 55 – 30fc
- Over 55 – 50fc

Lighting is not affected by the gender of the user, only the age and task to be done affect lighting requirements. Consideration must also be taken not to place lighting where it creates uncomfortable glare or is a hazard.

#### **5.4.33 Based on Marketing Data –**

Marketing data can only affect the application of lighting if it affects the style of the facility as well. Lighting is otherwise unaffected by the composition and desires of the population using a space. All nationalities and all ages and genders require adequate lighting for the timely completion of tasks.

If the marketing data affected the style, only then would adjustment be needed. Style, in some senses, dictates the color quality, placement, and purpose of lighting within a space. This is because style dictates how a space is used or how the space is intended to be used.



#### **5.4.34 For Best Experience –**

When lighting a space for the optimal experience it should be catered to the specific experience for which it is to be used. Recessed lighting does not work for all experiences nor does fluorescent. At some point in the design process of the facility, a decision has to be made about the style of lighting that is appropriate to the intended experience. If the facility were industrial themed, HID commercial lighting with a mild yellow tone, such as mercury vapor, would be appropriate. The fixture style for that particular application is a high ceiling bay light. The kind of fixture you might see in a Sam's Club store or in a large warehouse.

If the facility were themed for the outdoors, more natural light would be appropriate. The natural light would bring the color choices for the space out and make them more vibrant. Lamps currently exist that replicate the full spectrum of day light and come in both fluorescent and incandescent. Care must be taken to match the color temperature (in Kelvin) and color-rendering index (CRI) of the lamps in order to mix them evenly in a space. Color temperature and CRI are too often neglected when purchasing or replacing lamps. Mixing the two inappropriately can cause an undesired effect of clashing light colors within a space.

#### **5.4.35 For Best Performance –**

Bright and clean, these are the only two suggestions for light for performance. The lighting does not need to be over 100fc nor does it need to have a CRI lower than 70. The best color temperature is going to be higher than 3000K. The purpose of performance lighting is to provide adequate light without negatively affecting the users performance.

#### **5.4.4 Equipment –**

The task of deciding what equipment to purchase for a new facility is the responsibility of the facility owner or planner. The suggestions that follow are not for quantity or type of equipment. The purchaser should be aware of the needs of the facility and should be aware of square footage requirements for the intended equipment.

##### **5.4.41 Based on Need –**

Equipment should be decided based on the style of fitness, weight/power lifting, circuit training, and cardio intensive. No matter what the style, a basic selection of equipment is essential to the success of a facility. Specialized equipment and the abundance of specific pieces of equipment determine the style of fitness. Be certain to consider equipment and padding color when purchasing. Try to choose colors that are complementary to the color scheme previously chosen for the facility. Also avoid equipment that physically clashes with the style of the facility. White is standard for circuit training machines while black is more appropriate for weight/power lifting equipment. The only difficult decision is what color to get the padding and compared to other decisions it is not that difficult either.

##### **5.4.42 Based on Clients –**

The clients or target population of the facility are the biggest determining factors in what kinds of equipment to purchase. The target population determines what styles of fitness are available to choose from. In a market that is primarily thirty-something, care

must be taken not to over emphasize weight/power lifting equipment, the risk of being stereotyped as a “muscle man” facility increases whether that was the intention or not.

#### **5.4.43 Based on Marketing Data –**

Suggestions for marketing data and client needs are the same. The market or potential members of the area within which the facility is to be located is a direct indicator of the type and style of equipment to be purchased. This of course is based on whether the facility desires to make a profit or simply throw money away.

#### **5.4.44 For Best Experience –**

Purchasing quality equipment is the first step to ensure the best experience. There is nothing worse than going to a fitness facility to find the equipment you prefer to use disabled or more plainly, broken. Buying quality equipment is the only thing necessary to ensure a quality experience.

#### **5.4.45 For Best Performance –**

Different styles and types of machines perform different and cost more or less than others. The key to the best performance is having the equipment that compliments the exercise to be performed. Typically, quality is reflected in performance, therefore, by purchasing quality equipment performance is more likely to be positively affected.

## 6.0 PRACTICAL APPLICATION

### Note –

The following steps are to act as a practical guide for the application of color and light within a health and fitness facility. Their purpose is to simplify the preceding research, development and guidelines into usable information. These steps are to be applied during either the renovation or construction of a fitness facility. Future studies are needed to prove the effectiveness of these steps within the research guidelines.

### Step 1 – Establish a Budget

- Determine exactly what can be afforded, how much cash is available for facility improvements.
- Try to minimize how much of the available cash is used for the improvement.

Determining exactly what is available and then keeping costs to a minimum will help assure that profit margins are maintained or improved.

### Step 2 – Determine the Market

- Complete a market analysis to ensure that you meet the needs of your target market.

- Research your target population to ensure that a maximum effort is given to meet the program need of the membership, now and in the future.

Determining the market helps the facility owner better meet the needs of the members. Improving the facility is only possible when an understanding of how positive and negative change affects the members.

### Step 3 – Determine the Style of Fitness

- Decide which area of fitness the facility is focused.
  - Heavy Users – weight lifting (lifting for weight gain)
  - Weight Losers – weight lifting for muscle maintenance and cardiovascular exercise
  - Circuit Training – athletic events training
- Determine what equipment is necessary to meet the style of fitness
  - Heavy Users - plate loaded machines and free weights
  - Weight Losers – plate loaded, free weights, selectorized, cardio
  - Circuit Training – plate loaded, free weights, selectorized, cardio and specialty equipment that is sport specific.

When choosing equipment, consider the gender and age of the intended user.

Also consider equipment color, pad color and whether these colors fit your ideal situation.

#### Step 4 – Pick a Floor Plan

- Analyze the existing floor plan to determine the need for areas of improvement. Consider the following:
  - High traffic areas
  - Locker rooms
  - Aerobics areas
- Decide whether the current floor plan meets the needs of the members.
  - Can the members use the space as it is intended in an effective manner?
- Examples –

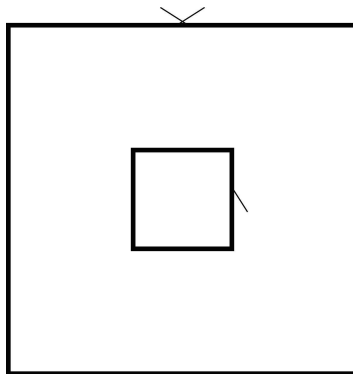


Figure 26: Floor Plan 1

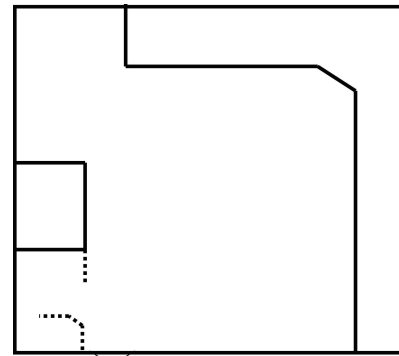


Figure 27: Floor Plan 2

#### Step 5 – Equipment Layout

- Equipment should be laid out in a manner that is conducive to the style of fitness the facility is marketed toward.
- Equipment should be grouped by one of the following:
  - Style – heavy user, weight loser, circuit training
  - Function – free weight, plate loaded, selectorized, cardio

- Examples –

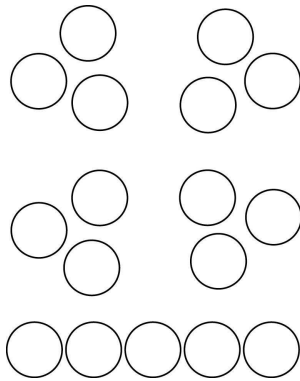


Figure 28: Layout 1

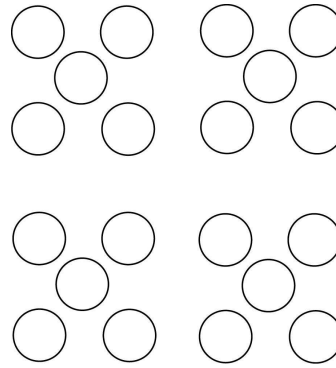


Figure 29: Layout 2

Ample space should be allowed for moving between machines and equipment while also keeping to the style or function of the layout.

### Step 6 – Lighting Design

When considering improvements in lighting, pay attention to cost. Different lighting technologies incur different costs; some are far more expensive to operate. Different fixtures have different efficiencies and render colors better than others. It is also important to remember color temperature when choosing light fixtures. Do not choose a fixture that is designed as outdoor lighting to light indoors.

- High Intensity Discharge lighting is best for large spaces with high ceilings.
- Recessed Incandescent lighting is best for lower ceilings and where a diversity of lighting situations is necessary
- Fluorescent lighting is best for medium ceiling heights in spaces of general use.

- Warm color light is preferred over cooler light because of its ability to render warmer colors correctly and render pleasant skin tones.
- Consider ceiling height and the area to be illuminated when deciding on a lighting scheme.
- The following chart demonstrates proper light placement.

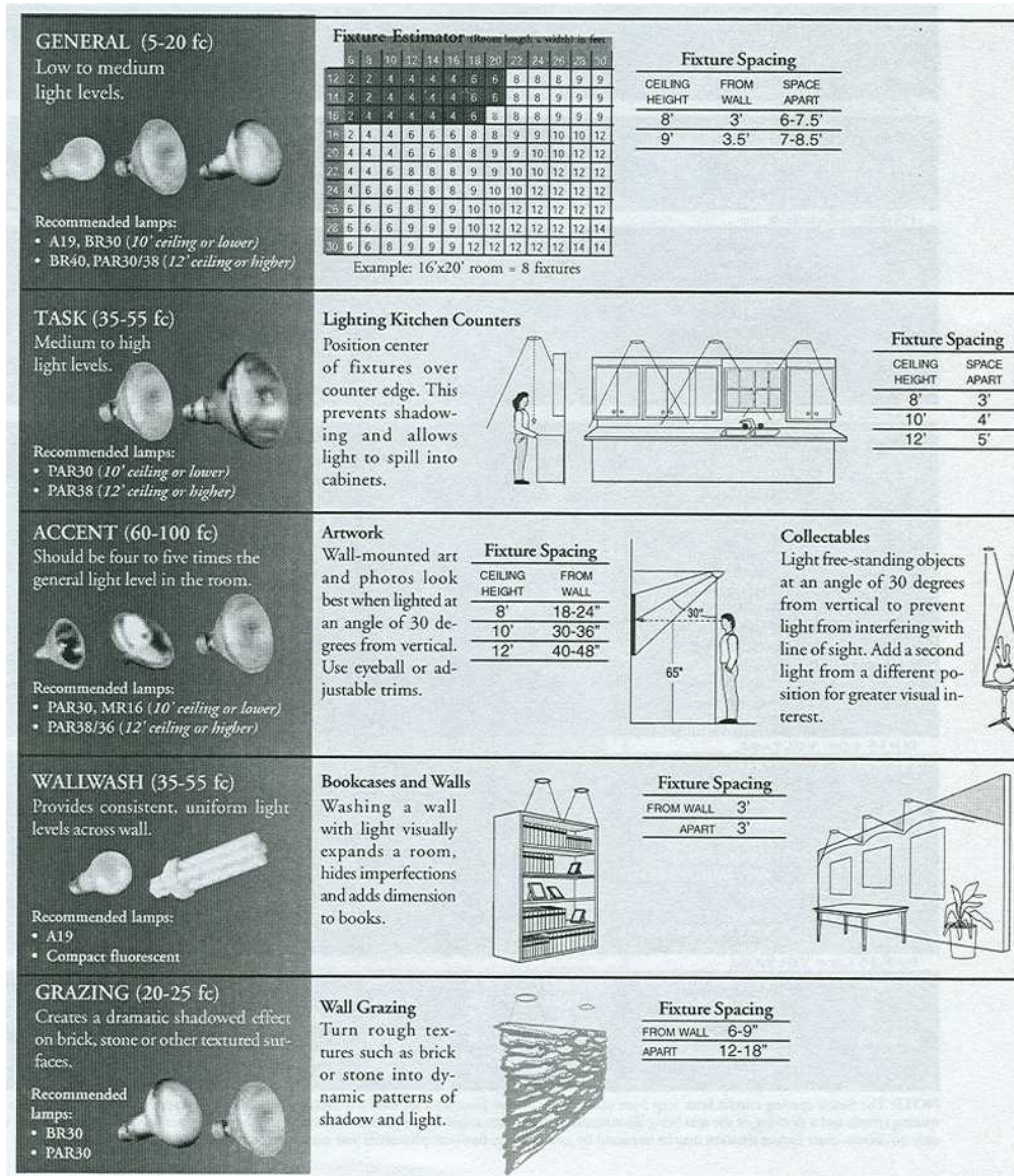


Figure 30: Lighting Layout Guide



## Step 7 – Color Choices

It is important to choose colors that match the identity of the facility. If the facility is designed for heavy users, a more industrial feel is appropriate; weight losers require a subtler environment that utilizes earth tones with energetic accent colors.

- Modifying color intensity is a good way to alter the energy of a space. Too much energy is exhausting and overwhelming while not enough is boring and non-motivating. The key to member retention is keeping the members motivated. Modifying interior color is a good way to help keep members motivated.



Figure 31: Color Intensity

- Variations of the color red are suggested for areas of high energy
- Variations of the color blue or green are suggested for relaxing areas.

- Avoid neon and over saturated colors.
- Avoid faux finishes

### Step 8 – Scheme Examples

Below are images of two different spaces. The first space is a facility prior to having the guidelines applied and the second space is the hypothetical outcome of the proper application of the developed guidelines.



Image 15: Before Guidelines

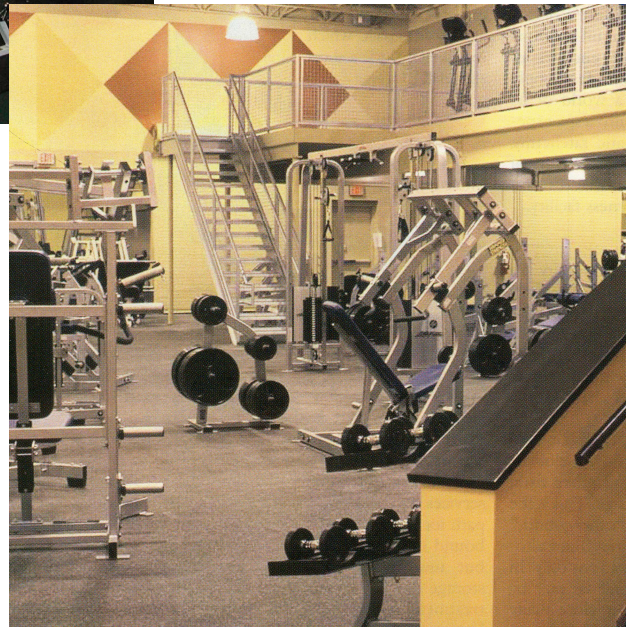


Image 16: After Guidelines

## **7.0 CONCLUSION**

Chapter One identified the problem of the lack of well-developed guidelines for the proper application of color and light in a health and fitness facility that also considered user experience and performance. The need for this study was derived from industry statistics, which illustrated the growth of the industry and the current trend in fitness.

Chapter Two provided the scholastic research necessary to support the claims made in the thesis statement while identifying the interrelated elements that required further study. The focus was primarily on color and light with some emphasis on space planning, experience design, equipment selection and fitness facility management.

Chapter Three outlines the development and formulation of the research presented in the literature review for application to guideline form.

Chapter Four explains the purpose of the guidelines in order to avoid any confusion as to their purpose. The exact intent and limitations of the guidelines were expressed.

Chapter Five presented a series of suggestions based on the research, which were followed in chapter six by the practical application of the guidelines. The suggestions given in chapter five act as a reference for the practical application of the guidelines.

The final summation is presented in chapter six as a set of easily followed and practically applied guidelines. There are eight steps involved in the proper application of the guidelines. A budget must be established, marketing data must be analyzed and a style for the facility must be chosen. Examples of floor plans are presented along with examples of equipment layouts. Finally, suggestions are given for lighting, color and design schemes.

The research presented is theoretical and has not been tested. Future studies are required to determine the effectiveness and validity of the proposed guidelines.

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