EC88-423 Color Expression in the Home

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Color Expressions In The Home
Hue is the name of a color or family of colors (e.g., red, blue-green). White light can be separated into parts to give a number of hues, each differing slightly from its neighbor and flowing into it. An infinite number of hues is possible, but only a few are given names. When light is passed through a prism, six basic bands of color result - red, orange, yellow, green, blue, and violet. These hues can be displayed by joining the ends to form a circle or "color wheel".

Primary hues red, yellow, and blue cannot be mixed from other pigments and are the basis for other pigment colors. When equal amounts of two primary hues are mixed, secondary hues are produced (orange, green, and violet). Intermediate hues are mixed from primary and secondary hues (e.g., yellow and green form yellow-green).

Warm hues include longer wavelengths such as yellow, orange, and red and tend to advance, and seem closer. Cool hues include shorter wavelengths such as blue and violet and are perceived as receding. There is no absolute distinct dividing line for warm and cool colors. Generally, adding red to a color warms it and adding blue cools it. There are "cool" reds and "warm" blues. Neutrals such as grey can also be cool or warm.

Value is the degree of lightness or darkness of a hue, and affects light reflectance. Light colors result from adding white to a hue (tint); dark values by the addition of black (shade). Middle or normal values are those typically seen on a color wheel. Yellow has the lightest normal value and blue-violet the darkest. Dark values of any hue appear warmer, light values cooler.

Intensity (sometimes called chroma or saturation) refers to brightness and dullness of a color. The intensity is reduced (toned) by adding some of the complementary color (color opposite) or a neutral such as grey. Colors on a color wheel are usually the brightest or most saturated that colors can be.

Afterimage occurs after staring at one hue for a time. For example, after staring at red, red-sensitive photoreceptors of the eye become temporarily fatigued. When the eye then looks at a white surface, the photoreceptors sensitive to green will fully function and the complementary color green is seen. The eye itself requires any given color to balance and will generate it if not present. An example is the pink seen after staring at a green computer screen for long periods.
Color Expressions in the Home

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What is Color? How Do We See It?

The sensation of color does not exist without light. Sunlight is composed of colors of the spectrum. White light such as sunlight is a mixture of all colors as seen through a prism.

Light is a "wave motion" or form of energy. Colors have different wavelengths, and are longer for the red end of the color spectrum, shorter at the violet end, and are composed of different energies. When light strikes an object, the particles of energy may be reflected or absorbed. The eye sees the color of an object by the light reflected. If light falls on an object that absorbs cool colors...
(e.g. green) the object will reflect the complement or warm colors (e.g. red). Black absorbs and white reflects nearly all the light waves.

Few people see two colors alike. One person may see more yellow in red even under the same light. We not only may see color differently, but our color vision changes.

**Color, Vision and Age**

Our color vision changes as we age. An increase in accuracy of color discrimination occurs between the ages of two and six. Generally it is not until age fifteen that youth can discriminate colors as accurately as adults. Peak discrimination occurs between about ages 20 to 30 years and then may become less accurate and glare sensitivity may increase, especially around age 65.

Scores on color matching tests show a 70% decline by age 60 and an additional 56% change by age 80. There is a decrease in the ability to distinguish different colors at the blue end of the spectrum where colors are closely related. This is thought to be due to the yellowing of the eye lens. Older persons tend to perceive bright, deep colors as lighter. They are able to see yellow, orange, and red easier than darker colors at the blue end.

A mixture of bright primary colors and pastels may provide stimulus for those with reduced discrimination. Color contrasts can be used to indicate changes in ground levels, for control devices, and other safety purposes. Judging distances between steps may be difficult if the landing, stairs and walls have the same hue, value and intensity.

**Color and Human Response**

**Color and Emotions**

People attach different meanings to colors. The psychological basis for understanding color and its influence on emotions is not well understood. There is no simple explanation for the interaction of color and emotional response.

Some evidence suggests that light of different colors enters the eye and indirectly affects the hypothalamus, which in turn affects the pituitary gland. The pituitary gland controls the endocrine system, and so controls the hormone levels and perhaps thus our moods.

Some experiments have suggested that color may affect our emotions. One experiment showed that in a room colored in red light, time was overestimated while in green or blue light, time was underestimated. In another study, workers lifting black boxes complained they were too heavy; but when the boxes were painted green they felt lighter. During the Middle Ages, Blackfriars Bridge in London, a gloomy black structure, was noted for its record number of suicides until the bridge was painted bright green.

However, attempts to establish scientifically the effects of color on the mind have not been conclusive. Reactions to color may be very individual and due to associations. Red walls may reassure some or cause discomfort for others.

**Color and our Physical Reactions**

When we get reactions in an all red room, is it a physical response, emotional response, the result of learning, or a combination?

For example, infant jaundice is treated with the use of blue light. In one study, patients suffering from Parkinson's Disease had a tendency to worsen in presence of red, while green seemed to improve the condition.

One explanation suggests that light may reach the hypothalamus that controls nerve centers and body functions such as heart ac-
tion and respiration. The intensity of color, and the wave length and energy may affect us in different ways.

Color may bring about a reflex action on the vascular system, but this may be brought about through feelings and emotions. Some studies indicate that red tends to raise the blood pressure, pulse rate, perspiration, and excite brain waves. Noticeable muscular reaction or tension and greater frequency of eye blinks result. Blue tends to have a reverse effect - lowering blood pressure and pulse rate, brain waves tend to decline and skin response is less. Reactions to orange and yellow are similar to red, but less pronounced. Reactions to violet are similar to blue.

However, the effects of color appear to be temporary. When exposed to strong areas of any color, there generally is an immediate reaction that can be measured with an instrument, but after a length of time, body response may fail to or below normal. So whether or not red is an "exciting" color may depend on time.

The relationship of color hue, intensity and value is also not understood and may enter into the effects. Warm colors may calm one person and excite another. Cool colors may stimulate one person and calm another. Red or green may elevate blood pressure or quicken the pulse rate, or the reverse. Some color authorities suggest that emotional excitement indicated through the physical changes in blood pressure, pulse frequency and rhythm are the result of association of colors with memories.

**Color Preferences and Associations**

Various cultures develop color preferences, associations or symbolisms.

**Color Preferences**

Children up to age three tend to prefer bright, primary colors over pastels, and favor bright luminous colors such as red, orange, pink and yellow. Color is preferred over black. Red is preferred during early preschool years. Interest in cooler colors increases as children grow older and preferences for high intensity decreases.

A greater liking for the colors of shorter wavelength such as blue and green than for colors of longer wavelength such as red, orange, and yellow comes with maturity. The majority of adults prefer blue and indicate less preference for yellow or yellow-red. Some researchers suggest the order of preference by adults as blue, red, green, violet, orange and yellow.

Later in life, our color preferences may again change. Studies of persons 65 to 90 indicate they prefer bright colors to pale pastels. This may relate to the physical changes in the eye.

Color preferences may affect behavior. One study indicated that work production rate increased eight percent when the men's rooms were painted a ghastly electric green to reduce lingering.

Choosing a color as a preferred color does not mean that one would want a majority of that color in his environment - but that the color has a special meaning in comparison to other colors.

**Color Associations**

Emotions are commonly associated with various colors, but vary among individuals and cultures. Some research indicates red, yellow and orange are associated with excitement, stimulation and aggression. Blue and green are associated with calm, security, and peace. Yellow is associated with cheer and joyful-ness; and purple with dignity, and sadness. Black, gray and brown
are associated with strength, sadness and depression. These color associations may be the result of learned responses.

However, color associations are complex. The value and intensity of a color affects the associations. Studies have shown that in rooms of strong, intense colors perceived excitement is increased. Weak colors give an impression of calmness regardless of hue. For example, calm can be reflected in warm hues. Pale, dull peach may appear calmer than bright, intense green.

Associations may relate to how we view our environment and may affect our other senses. For example, color suggests warmth and coolness. Persons in a blue-green room in one study felt that 59°F was cold, but in the red-orange room, the temperature had to fall to 52 to 54°F before people reported being cold. In another study, people tended to set the thermostat four degrees higher for comfort in a blue room than in a red room.

A noisy environment may be experienced as noisier if painted glaring yellows and reds due to associations. Experiments have shown that a given sound appears to have different intensities in the same room when wall colors are changed.

The ability of color to affect human response is questioned by some. Individual response to color may be too complex to allow for a simple interpretation. Despite the controversy in research, there remain associations, and preferences and to some extent individual physical and psychological responses to color. Although no absolute relationships have been established, research has shown that certain general reactions are common to many people. These may be learned, the result of past experiences, or physical effects.

What does this mean to us as we plan our environments? In using color, extensive monotony can lead to understimulation and therefore anxiety, and extreme complexity to overstimulation. A balanced approach and a variety of color is suggested. One color does not satisfy all the physical and emotional needs in our environment.

Color Explored

Color Systems

With over 9 million colors that can be distinguished, various color systems are used to help bring order to confusion, provide a method of creating matching colors, and to see relationships.

The Munsell Color Tree and Prang systems are just two examples of systems used by artists and designers. For example, the Prang system is based on mixing colors to give gradations from one color to the next on the wheel. The three primaries are red, blue and yellow placed equidistant apart around the wheel. The secondary colors orange, green, and violet, result from mixing the primary colors and are placed halfway between the primary colors. By further mixing, a range of intermediate colors are produced.

These color systems can be used in planning harmonious color schemes. When a sense for color harmony is lacking, color harmony wheels may be helpful.

Planning Color Harmony

With a basic understanding of color and color systems, color plans for the home can be developed. Color plans may be developed from 1) color wheels or schemes 2) consultations with professional interior designers or consultants or from 3) existing color harmonies found in a favorite painting, textile item, wallpaper or fabric or from nature and nature's seasons. By breaking down and analyzing an existing item, and using the colors in similar or varying proportions, the individual uses the work of a professional artist or designer.
Color Schemes
Traditionally, colors were chosen to reflect definite color schemes. However, designers today may reject rules in favor of more freedom of expression. The use of color schemes in planning provides a starting point, but we can be creative - allowing ourselves to develop a sense of color awareness and harmony. Both a system or guides and freedom of expression can be of benefit in planning.

Awareness of traditional color schemes is useful in understanding why certain colors work together. Many color schemes are suited to a home, but rarely do actual color schemes fit perfectly into one of the traditional scheme patterns. These color schemes can be used as points of departure.

One system of color harmonies has been developed using the Prang color wheel. The most frequently used combinations are related or contrasting schemes.

Related Schemes include monochromatic and analogous. Monochromatic schemes use one hue, but varied in value and intensity. For example, pale, medium, and dark blue. Monotony can be avoided by including a variety of intensities, values, textures and patterns.

Analogous schemes usually are based on no more than three colors next to each other on the color wheel and they share a color. For example, green, blue-green and yellow-green. They offer more variety and interest, and because they share a color, appear unified. Colors may be analogous cool, warm, or a combination. To add contrast, vary the value or intensity or introduce a color that is not a part of the scheme.

Contrasting schemes may be complementary, split-complementary, triad and others. The difference in hues provides contrast and a sense of action or excitement. Schemes may need some similar hues, values and intensities to provide harmony.

Complementary schemes are based on hues directly opposite on the color wheel (e.g. red and green). These colors offer contrast and introduce both warm and cool colors into the environment. Value and intensity needs careful consideration. Generally complementary colors are more harmonious if one of the colors is lowered in value or intensity.

Split-complementary uses one color and the two colors next to its complementary color. These colors provide a softness to the scheme as they contrast less than the direct complement. They add variety and interest.

Triad schemes use three colors equally spaced from each other on the wheel. Almost any color combination can be used in developing color harmonies.

Color Decisions
Attempts to plan color harmonies by rigid formulas and rules may not allow for individual needs, and the diversity of homes. Each home is unique with features that cannot be dealt with through rigid rules. However guidelines can be helpful in planning color use in rooms.

Color portrays personality, influences moods, defines space, and suggests function and temperature. There are many factors to consider in choosing colors - room size, shape, orientation, use, personal preference and lighting.

To make color planning easier:
1) Consider the people who use the home and the furnishings. Identify color preferences.
2) Decide on the effect to be created - formal or casual, warm or cool, exciting, cheery or relaxing. Use color to establish a theme or mood.
3) **Evaluate existing furnishings** - one rarely starts from scratch. A major furniture item, favorite accessory or existing carpet may need to be considered in the color plan.

4) **Break the areas into categories** of large and small rooms and color areas, fixed or easily changed, orientation - north or south, greater or lesser use, and higher or lower lighting levels.

5) **Subdivide the room and furnishings** into main areas (floor, walls, ceiling), secondary areas (window treatments and large furnishings) and accent areas. The room scheme is primarily determined by the treatment of the main and secondary areas. Accent areas are important to the general effect. Greater harmony is achieved when the same colored accent is repeated in various parts of the room.

6) **Plan for purchases in the future.** A one-, five- or ten-year plan can help to obtain the color and design plan desired. Plans with color samples, and swatches of existing colors kept in a file or container should be available for quick reference when shopping.

Changing fashion and greater mobility has resulted in more color changes. However, furnishings, flooring and window coverings mean a major investment and may be left in place for several years. Paints are available in thousands of colors and generally are the most easily changed color device.

Understanding color interactions can help in achieving a color plan. Harmony occurs when there is enough similarity between colors in a room that the eye wanders rhythmically about the room. A feeling of oneness between furnishings and the space they occupy exists. There is enough contrast between colors to stop the eye and hold attention on items of interest.

Consider the whole area or home in planning color. One or more colors carried from one room to the others provide transition. A "thread of color" can be woven throughout, but not necessarily in the same way. When rooms adjoin, there should be a pleasant relationship of color and pattern. When viewing one room from another, an easy transition of color gives a feeling of unity. Using a color from the wallcovering or fabric in the living room in an adjoining family or dining area is an example. The same or similar colored floor coverings through rooms creates unity and color transition.

Dissatisfaction with colors may come from too much contrast or similarity between color. Monotonous rooms may come from not enough difference in hue, value, or intensity contrast. Disorganized, confused rooms may result from colors with nothing in common. Unify a room by repeating colors and patterns, throughout the room, and by using hues in similar values and intensities. Repetition helps unify varying furniture styles and brings the room together. Color can organize space, add emphasis to a grouping, or camouflage problem features. Various styles of furniture, covered with the same or similar colored fabric may be tied together as a group. Or, similar prints in different harmonious colors can be used.

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**Furnishing With Color - Creating Harmony**

**Color Harmony**

Color harmony implies pleasing relationships among hues, values and intensities. Principles of color harmony can be seen in nature and used in color plans. When placed next to each other, hues produce effects ranging from harmony to competition or conflict.
**Volume, Size and Weight**

Colors can be used to create illusions and change the apparent shape and size of rooms, features and furnishings. Smaller rooms look more spacious when decorated in a single light color, with stronger color for accents. Larger rooms can be broken up with color.

Light and pale colors recede and increase the size of rooms, as do cooler colors. Dark or saturated or intense hues advance or protrude and decrease apparent size of rooms. Generally warm colors also have this effect.

Colors close to us in a small room appear darker and more intense than when seen at a greater distance. Intense darker colors in larger rooms appear less demanding than in smaller rooms.

Generally, darker colored objects appear heavier and smaller; lighter colors and less saturated or pastel colors seem less dense and larger. When using colors of the same values and intensity, the warmer hues appear heavier. Cool colors appear to recede and make objects appear shorter and smaller; warmer colors make items seem longer and larger as they appear to advance.

Applying these concepts, a high ceiling can be painted a darker and warmer color to make it appear lower due to apparent heaviness and advancing color. Low ceilings painted with lighter or cooler colors will look higher.

The volume of the area also influences color. Colors appear stronger in intensity and darker in value when covering larger areas. A paint chip will not show the color behavior in large areas. The walls and ceilings will darken and the hue brighten its effect by about 50 percent. Select a lighter, duller color to give the effect you are trying to achieve. Experiment with a small area of the wall or sample of wallboard to view the color under changes in volume and light.
**Color - Day or Night**

Color decisions made in bright daylight may not appear the same in dim lighting. Examine colors in the environment in which they will be used to judge the effects of natural and artificial light. Although the hues match visually, they may not match physically. When two hues match physically, they have the same reflectance value when measured with a spectrophotometer, and will match under all types of lighting and viewing conditions. If the reflectance values are not the same, they may match under one lighting condition and not the other. Color changes can also be influenced by changes in types of light bulbs creating warmer or cooler tones.

**Reflectance and Contrast**

Reflectance is the amount of the total light waves that strike a surface that is then returned or reflected. Recommended reflectance levels for wall surfaces are about 40 to 60 percent. Most whites and off-whites coupled with high light levels have a reflectance value of 80 to 94 percent. Paint manufacturers may list the light reflectance values on the color samples. White can produce fatigue of eye muscles in a high brightness condition and glare due to its high reflectance value. High contrast between white and dark or highly colored objects may cause problems in adapting from light to dark or eye fatigue. However, pale colors against white may look too bland.

**Recommended Reflectance for Surfaces**

<table>
<thead>
<tr>
<th>Surface</th>
<th>Reflectance Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floors</td>
<td>20%</td>
</tr>
<tr>
<td>Furniture</td>
<td>25-40%</td>
</tr>
<tr>
<td>Walls</td>
<td>40-60%</td>
</tr>
<tr>
<td>Ceilings</td>
<td>80-90%</td>
</tr>
</tbody>
</table>

A ratio of three-to-one brightness contrast or relationship between reflectance values of task area and surrounding surfaces is suggested. However, some offices and homes with large white neutral areas and black or dark furnishings, or carpets have a contrast ratio of 16-to-1.

Furnishings such as desk tops or work surfaces should be neutral and not distracting. Medium values are often used to provide the eye a uniform and comfortable level of adjustment and dark and light extremes avoided.

In dimly lit rooms, colors that reflect less than 20 percent may appear black, and the color is lost. Under low light, color reflectance values of 20 to 25 percent are needed to maintain color. For lower levels of reflectance, higher lighting levels are needed to maintain accurate color.

Knowledge about color reflectance and contrast can be used in planning color. Color tints make more efficient use of light than strongly saturated hues. Dark woods absorb color. In areas of extensive use of wood furniture and paneling, more intense color may be used.

Dark walls opposite windows will absorb much of daylight and cause reduced illumination. Darker walls and furnishings close to sources of natural light can cause contrast glare. Windows, walls, and furnishings in lighter colors can prevent contrast glare near windows.

Contrast of hue, value or intensity between walls and furniture will make the furnishings more prominent and the room appear smaller. Use color contrast when drawing attention to an area or item. Variations of hue, value and intensity or contrast will emphasize shapes or contours of rooms and furnishings. Pipes, radiators, or awkward furniture, areas or projections can be camouflaged by painting the area the same color as the background. Features and decorative moldings can be emphasized by using contrasting colors.
Bright, new, colored furnishings may contrast with the older furnishings and make them appear dull and worn. Colors of paint, wood and fabric soften or dull with time and wear. Soft, greyed colors reduce the contrast between new and old.

Too much contrast of hue value or intensity may overpower; while too little contrast may be monotonous.

**Color Near Color**

The colors we think we see are affected by many things including adjacent colors. Contrast in values accentuates the difference. A color appears lighter when surrounded by darker colors. When small areas of color are placed next to each other, they may lose their own separate hue, blend and appear a different hue from a distance. Complementary colors next to each other contrast and each hue is brightened or intensified by the other. Colors appear less intense if placed near a color of the same hue. Simultaneous contrast occurs when color projects its complement onto the color next to it.

**Color Balance and Proportion**

One guide for balancing colors is suggested by nature's example - larger areas are covered in quieter hues, while smaller areas may need more contrast in hue, value and intensity. The smaller the area the brighter the color that can be used. A small amount of intense color can balance large amounts of light, dull or dark colors.

The largest area is the background or walls and floors. Generally, muted tones in large areas, particularly walls, are suggested. Bold patterns, and bright colors can be effective, but are more difficult to use well.

If you like bright colors, one way to use them is in accessories or small areas. A smaller intense colored accessory can attract
more attention than a large item such as a sofa in a soft, neutral tone. To avoid disrupting the unity of your plan, select bright colors carefully. Plan color areas so none stand out too conspicuously.

Warm color schemes tend to require a small amount of cool colors for balance, while cool colors need some warm. A small amount of warm color can dominate large amounts of cool colors as suggested in nature’s example.

Harmonies with one dominant color are more interesting than those with equal amounts of different colors. One dominant color with two or three accented colors is suggested. When two colors are used in equal amounts, they may compete for attention and the room appears fragmented.

Balance also requires variety in value and intensity of hue. When fewer colors are used (one or two) vary the value and intensity, texture and pattern for interest.

In color schemes using three or more hues, harmony is achieved if one hue is allowed to dominate and contrasts are limited. Avoid trying to see how many colors you can use. Keep the color scheme simple.

**Color Emphasis**

Colors can draw attention to particular features or items in a room. For example, the color of a drapery may make the window the most conspicuous element. For a blended background, choose a drapery that is the same hue, value, and intensity as the wall. For emphasis, select colors that contrast with the background in hue, value, or intensity, but relate to the other colors throughout the room.

**Color Rhythm**

Color rhythm may cause the eye to move from one area to another through gradual changes in hue, value or intensity. Eye movement also results from repeating colors in several places to interconnect the entire scheme.

**Neutrals**

Neutrals can be used as background or accent colors. Although neutrals such as cream or grey may seem safe, they can be dull or monotonous when used overall. Contrasting colors may be needed for stimulation. Accessories such as paintings, cushions and lamps can add bright spots of color, variety, and interest.

In some areas, the use of white and off-white interiors is diminishing. Why? In color preference tests, white tends to be of disinterest and people tend to choose color over white. The presence of color has had positive evaluations in studies while the absence is generally considered negative. In high density housing complexes and cities with few
trees, color can bring relief to monotony and drab environmental colors. Research has shown people are negative and critical of austere colorless environments.

When using a neutral such as white or off-white with color, the whites will be more harmonious if they are tinted with the same color. For example, sheer curtains with a slight yellow tint can be more closely matched with white paints if yellow is present in the white paint.

Although woods are sometimes considered neutrals, their various colors should be considered in the color plans. Wood may have red, yellow or blue undertones. Woods with blue tones may blend with cool colors. Red and yellow tones may blend with warm colors. Sometimes complementary colors can be used to highlight wood tones.

Color Me Ready

Because of the emotional effect of color, it can make living space feel exciting or subdued. People working in a dull environment may want a bright place to recharge. Others, in high pressure work, may want a quiet sanctuary.

Both understimulation and overstimulation in our environment may create problems. In an environment of monotony, sensory deprivation occurs. The ability to concentrate may be affected. Taking research as a whole, color variety is suggested. It is not that one color is better for a specific purpose, or that one is exciting and another is calming, but a variety of visual stimulation and change is needed.

Colors in changing degrees of intensity, and the complements of the dominant colors should be present to some extent. Color harmony depends on variety and contrast with reason.

The home should be considered as a whole. The psychological power of one color will not satisfy all the needs of those who live there.

Now that you understand color and how it can affect human response, develop confidence in your ability to use color. There are no "right" or "wrong" colors. Almost any color combination can look harmonious when value and intensity are varied. The more you experience color, observe color, use color, and study color, the easier it is to create color harmony and to make it work for you in your environment.

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Color Decisions Guide to Planning

1. Color preferences of those who use the area/home:

2. Color effect desired:

3. Color of existing furnishings, accessories, and adjacent area to consider in the plan:

4. Characteristics of area/room:
   - large/small
   - fixed/flexible
   - orientation
   - use
   - high/low light level
   - wood color

5. Illusions desired:
   - size of room
   - shape of room
   - ceiling height
   - temperature of room
   - light/darkness
   - features/trim to camouflage or emphasize

6. Color plan for area/room:
   - Main areas:
     - Color(s):
     - floors
     - walls
     - ceiling
     - When
     - Estimated cost
   - Secondary areas:
     - windows
     - furnishings
     - When
     - Estimated cost
   - Accent areas:
     - When
     - Estimated cost
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