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expolores the science of color and its effect on the world around us

PHOTOGRAPHS BY ANTHONY BAILEY

Coats of many Colors

Part 1

Although I have often used large areas of bold painted color in my furniture designs, the decisions I have made about colors have mainly been based on hunch and intuition. I have looked at colors carefully, and made a nuisance of myself at the paint store getting lots of small sample cans mixed, but in the end, the decision has simply been whether I liked a color or not. There is nothing wrong with this approach of course, but I decided that some color theory might help me make more educated and rational decisions — even if the end result is only to support my instinctive prejudices — or is it my perception of current fashion?

We don't have to use bright colors to consider color and its use and effect. We often use woods, upholstery fabrics and paint, as well as my usual brand – the kids refused to eat it, although blind taste tests apparently show that people prefer the taste of the supermarket product over other brands! Fig. 1 illustrates how you might recognize your favorite flavor of chips, your preferred brand of beans, a sophisticated rich aroma coffee or a spicy sauce just by the color of the packaging.

Emotional Responses

Fig. 1

ILLUSTRATIONS BY THE AUTHOR

There is much more to color theory than I have touched on in this article – color profoundly affects our lives in many ways. We have strong likes and dislikes. Colors can have magical, religious, and symbolic meanings. We can be green with envy. Yellow is the color of cowardice (at least within our culture). Purple is the color of bishops, rulers and power. Colors evoke emotional and psychological responses. We navigate through our world and base many of our decisions on color. The supermarkets know this, using color to make their 'own brands' appear like the named brands. I recently picked up a supermarket brand of breakfast cereal because its colors are the same

as placing furniture in rooms with certain color schemes. Color is often an important element of a client's instructions when building furniture. They may want a warm wood, a light wood, or perhaps want to create a sense of sophistication. Some color combinations feel expensive, some boring, some old, some young, some masculine and some feminine.

Exotic Color

I visited a furniture show last spring and there was plenty of color, as you might expect. Bright 50s' and 60s' colors, but used in a contemporary way to produce some really stunning furniture. Orange and pink upholstery fabrics, large flat painted panels on the cabinet furniture, and trendy Apple Computer style plastic colors.

But color in furniture is not just a modern idea – Rennie Mackintosh used whites and pinks; the Arts and Crafts Movement painted furniture in dark medieval greens and reds; Rococo furniture exploits bright gilding and deep reds; Egyptian furniture was highly decorated and colored. We have, it seems, always liked color around us!

Color Science

Color is a physical reality. Newton used a prism to split white light into the colors of the spectrum from the longest wavelength – red, through orange, yellow, green, blue and indigo to the shortest, violet (ROYGBIV is the mnemonic phrase needed to help you remember the order). You can demonstrate that white light is made of these spectrum colors by painting the colors on a disc and spinning it rapidly – the disc will appear white. Light is a form of electromagnetic energy and is that part of the electromagnetic spectrum that our eyes perceive. The electromagnetic spectrum goes from short wavelength Gamma rays to long wavelength radio waves. We are tuned into a part of it just as our mobile phones are tuned into another part. In Fig. 2: objects appear to be of one color or another because they reflect the light of that wavelength and absorb other wavelengths.

Our perception of color is both physical and psychological – although the eye behaves somewhat like a camera, the information it receives is interpreted by the brain. The eye's lens focuses light onto the retina containing receptors (rods and cones) which are activated by the light falling on them. Cones are used for color perception, and there are three types, each containing a pigment sensitive to red, blue or green – the three additive primaries. There are somewhere around seven million cones and 120 million rods in each eye.

Yellow light is naturally focused onto the retina and is the color we perceive most acutely. The longer wavelength red light focuses behind the retina so the eye's lens has to become convex to focus it and thus gives the sensation of pulling the color nearer, whereas blue light focuses in front of the retina and seems to be further away.

Fig. 2

The link between the eye and the brain is vastly complex and not fully understood, but what we see in our mind is a complex interaction between physical stimuli and our experience of things and their association. The baby putting a Lego block in its mouth is not satisfying an urge to eat, but to understand and build a picture of the world. The experience of tactile stimuli and our learned knowledge of form all contribute to the picture we 'see'.

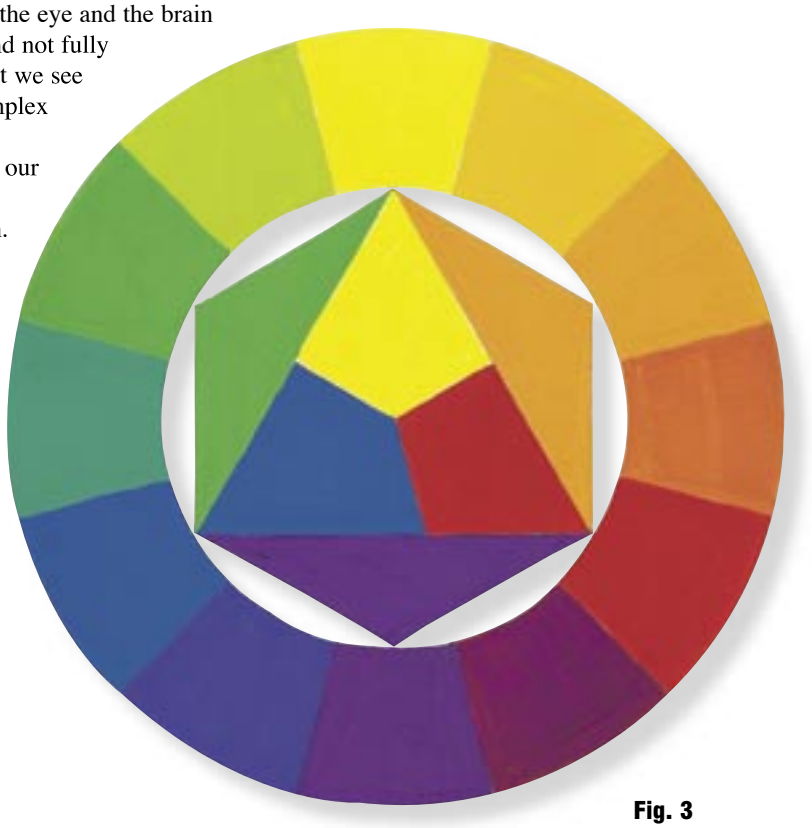


Fig. 3

Color Relationships

Fig. 4

Colors are not seen in isolation, and Johannes Itten set out his observations about color behavior in a series of diagrams on which my illustrations in this article are based.

When using color, it is important to be aware of, and exploit these relationships, although there are no real rules about how color should or should not be used.

Fig. 4 shows how the primary colors and the achromatic colors white and black produce the sharpest and most intense contrast. The right-hand diagram shows that the contrast between secondary colors is less intense, and that between tertiary colors is less still.

Color Wheel

Fig. 3

The scientific color wheel – as used by computer printers – has primary colors of cyan, magenta and yellow, but the traditional color wheel originally devised by Newton has the colors of the spectrum in their correct sequence.

Much of our color theory was set down by the Bauhaus artist and teacher Johannes Itten (1888 -1967) and is contained in his books, The Art of Color and The Elements of Color. His color wheel (Fig. 3) shows the relationship between 12 easily recognizable hues and provides a logical and objective basis for working with color.

At the center of the wheel are the three primary colors – red, blue and yellow – which cannot be mixed from other colors. Outside these are the secondary colors – green being a mixture of blue and yellow, and so on. On the outer wheel the primaries and secondaries are separated by what Itten called tertiary colors – the mixture of a primary and its adjacent secondary. So, between yellow and orange is yellow-orange. Colors near each other on the wheel are closely related and colors opposite each other on the wheel are called complementary and have a special relationship. The complementary of yellow is thus purple, made from combining the two other primaries – red and blue.

Color Terms

We talk of color in terms of hue, saturation and brightness. The hue is simply the color – there are 12 hues on Itten's wheel which could be added to – the eye can differentiate somewhere in the region of 10 million different hues. Saturation (also called chroma) is the measurement of the purity or intensity of a given hue – the amount of color. Brightness or tone describes a color's lightness or darkness.

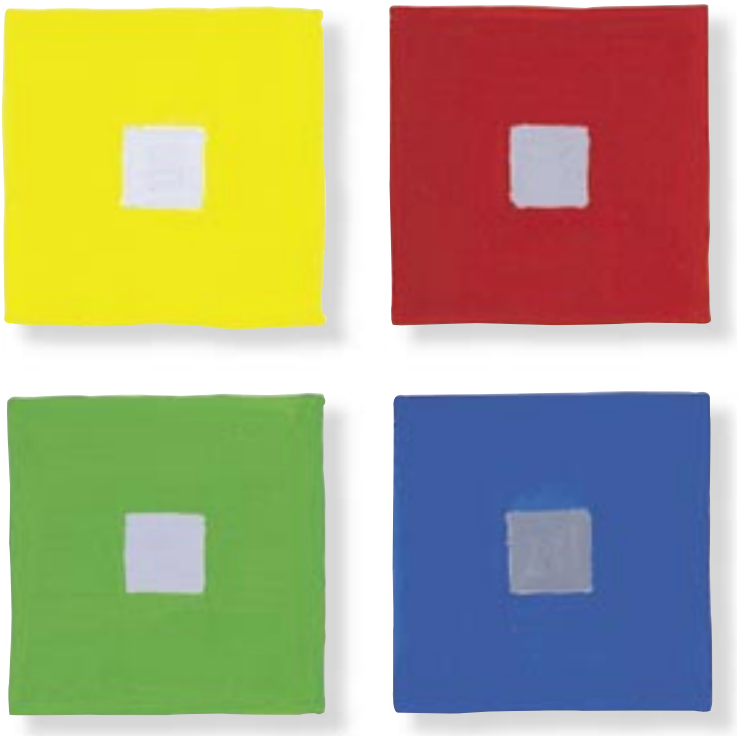
Some color charts describe a color in terms of numbers for its chroma and tone and letters and numbers for its position on a color wheel. It is nice to have a color chart like this, as not only can you see for instance, how much a green tends to blue, but you can also match it for saturation and brightness with a different hue. In color schemes it is as important to choose the right saturation and tone as it is to choose the right hue.

In theory you can mix all the colors using the three primaries, black and white. In practice paint pigments are not pure, so that if a blue is slightly red you cannot use it to mix a pure green. There are plenty of books and websites on color mixing.

Other than having difficulty getting a pure purple, I have mixed all the colors in these illustrations using five tubes of Gouache (red, blue, yellow, black and white).

Complementary

Fig. 5

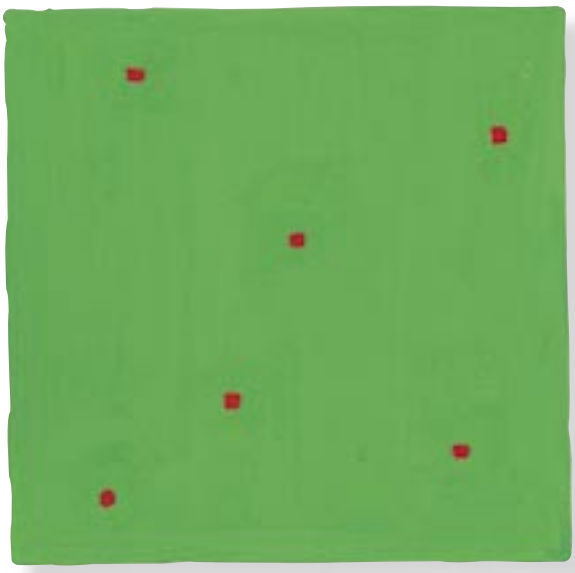


In the mind, a color will tend to shift an adjacent color towards its complementary which Itten called simultaneous contrast. In Fig. 5, the gray squares are of the same brightness as their surrounding colors, and if you stare at them, you will see the gray squares tinged with the complementary – yellow with violet, green with red and so on. This effect can be used to enliven color schemes, but if not used properly can deaden adjacent colors. Placing cherry with green paint might make it look warmer, but yellower oak might need a really blue green to enhance its color.

Create Harmony

Fig. 6

Fig. 6 illustrates the amount of color required to produce a harmonious balance. Yellow is clearly the most dominant color because as explained above, its wavelength means it focuses naturally on the retina. To achieve balance, red and green should be present in approximately the same proportion, whereas in order for yellow to be in harmonious balance with its complementary violet, it should make up only about a quarter of the area.



Liven it Up

Fig. 7

We all know how a small accent of a complementary color can liven up a color scheme, and Fig. 7 shows how small red dots appear active on a green background – this effect was exploited by Constable using reds to liven uphis greens, and by Clausen whose paintings often feature a small red scarf, which dances in an otherwise green and pastoral scene.

To the Foreground

Fig. 8

In certain combinations, some colors appear to be in front of others and create spatial relationships. This effect can look awful on a flat wallpaper pattern, making colors jump forward and back, but is exploited in painting to give a sense of depth and space.

Warm tones appear to advance in front of cold tones, and pure colors seem to advance in front of less pure colors. This can make areas of color appear bigger when placed against different colored backgrounds. In Fig. 8, yellow retreats into a white background, whereas red advances, and the opposite on the black background. Against the black, the yellow square appears smaller and the red square bigger.

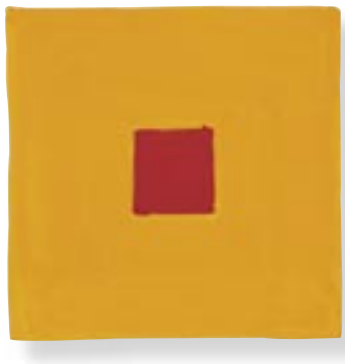
Backgrounds

Fig. 9

Fig. 9 shows many of the effects discussed above. The yellow frames and red squares appear to be slightly different colors and sizes against the different backgrounds.

The yellow frame against the violet background seems the most yellow as they are complementary, whereas on a red background the yellow is slightly green. (the red forcing it towards its complementary)

The red square on the orange background appears lifeless, whereas against the blue -green background it is vibrant – as is the yellow frame on the purple background.



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