Color:
How to Use It

Marcie Cooperman

PEARSON

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reds and greens. The other side is in shadow, but it is not without color. The shadows have added low value blue to the apple's color at that spot.

If you have a fluorescent light, you can see amazing changes in that same apple, as the colors will appear to be different from what they were under incandescent light. Clearly, the lighting situation has something to do with what we see.

But the color also depends on something as hard to pin down as the eye's perception. Perhaps you know someone who has color blindness. That person may not have the ability to see red, or green, or some other color. Without knowing exactly how he or she sees, you still know that what the person sees is different from what you see. Because of our biological differences, even people who supposedly have no such deficiencies will see colors of the same object differently.

And just to complicate matters, our perception of the color of an object also depends on the colors adjacent to it. Surrounding colors do two things:

1. ***They influence the color that a neighboring object appears to have.*** This influence of color on color is also known as simultaneous contrast, a concept that we will examine in Chapter 3.
2. ***They reflect colored light on an object.*** For example, if a white cup is surrounded by a red tablecloth, the red of the tablecloth will reflect on the white cup. How long we look at this scene can also change our perception of it. After a few seconds, the eye tires of the red and makes us see the greenish glow of its opposite hue; this glow will also reflect on the object.

Psychologically, we evaluate and judge the colors we see from the point of view of our own cultural attitudes. Different cultures attach different meanings to the colors as well as the objects being viewed, which affects how we feel about them. For example, in some cultures white means purity while in others it is symbolic of death. In Chapter 10, we will discuss in depth the cultural meanings of color.

All in all, these differences in perception make it essential for manufacturers of such daily products as sheets, towels, cars, and clothing to evaluate and measure the colors they need to use. They need to make sure that the colors appeal to their customers. And working with colors professionally creates the necessity for standards in color language, so that all suppliers and producers are talking about the same colors.

THE VISIBLE LIGHT SPECTRUM: ELECTROMAGNETIC WAVES

Visible light, ultraviolet waves, infrared light, x-rays, and microwaves—you are familiar with all of these in some way, but did you know that they are all the same thing? They are all electromagnetic rays, essentially *radiation*, emanating from the sun through outer space to Earth.

Visible light and microwaves don't seem to have anything in common. If they are the same thing, why do they appear to be so different? More relevant to our study, why is it impossible to see all of these waves except for light waves?

The crucial difference comes from the particular wavelength of the electromagnetic ray. The only waves with dimensions that the human eye can see are light waves. They exist in a very narrow band of waves in the electromagnetic spectrum, from 400 to 700 nanometers (a nanometer is one billionth of a meter). These wavelengths produce light composed of seven different identifiable wavelengths, each of which the eye perceives as a **spectral hue**; these are the hues we identified in Chapter 1 as ROYGBIV (red, orange, yellow, green, blue, indigo, violet).

Red is the longest wavelength, and violet the shortest. When they strike your eye in a sunbeam, all the colors combine as clear white light. But many things can refract them into the rainbows of visible color: a prism, lead crystal, oil, "interference" flakes of titanium-coated mica that are sometimes used in paint finishes (for nail polish, cars, toys, and product packaging), bird feathers, butterfly wings, beetles, bubbles, ice crystals, and drops of water in the atmosphere that produce a "real" rainbow when the sun shines through. For example, the atmosphere on Maui, Hawaii, in the area where the leeward side and the windward side meet, has so much moisture that there are rainbows every day.

key terms

acromatic (hues)
additive (process)
balance
broken (hues)
chiaroscuro
chromatic hues
color circle
fluting
gradient
hue
intensity (chroma, saturation)
local color
middle gray
pigments
primary (hues)
secondary (hues)
shade
spectral hue
subtractive color
tertiary (hues)
tint
tone
unity
value
value scale

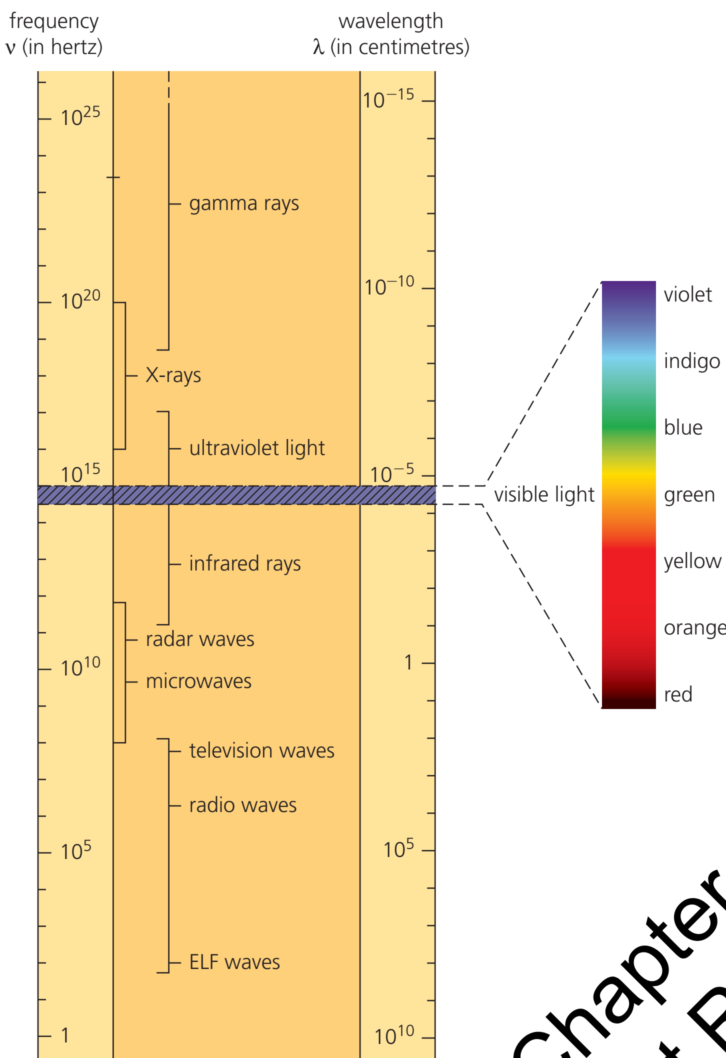


FIGURE 2.2 The visible light spectrum in the range of electromagnetic radiation.

Figure 2.2 illustrates the range of electromagnetic waves, ranging from the lowest and longest wavelengths, which are called ELF (ultra-low frequencies), to gamma rays, which have the smallest and most energetic wavelength. Visible light waves can be seen in the middle of the spectrum as a very small band, relative to the size of the range of waves.

Visible light is a color system. Light wavelengths reflect from the surfaces of everything we look at, and determine the colors that we see. An object appears to be a certain hue because it reflects the visible light wavelengths of that hue. The other light wavelengths are absorbed, and these are the hues that we do not see in that object. For example, an object looks blue because it reflects the wavelengths that our eye interprets as blue. The blue object absorbs the red or green wavelengths, and it does not look like those hues.

The object will *always* reflect the same hue when the same light source hits it. The physical properties of an object that allow it to reflect a specific color are independent of the amount of light available. Even in a low-light situation, where there might be only 20 percent of the amount of light in a bright-light situation, the properties are intact. We may not see the actual hue because we do not have enough light to see, but the properties of reflectance are still in effect.

In Chapter 10, we will discuss measuring the reflectance of light to determine an object's hue, as well as matching color in industry.

Subtractive and Additive Systems of Color: Pigments Versus Light

Pigment and *light* are two different color systems, each with corresponding primary and secondary hues (both terms are defined later in the chapter). In this text, we will be working with pigments to produce two-dimensional compositions, and therefore we will be concerned with their primaries and secondaries, with a focus on the interaction of colors.

PIGMENTS—THE SUBTRACTIVE SYSTEM

Pigments are colors obtained from rocks and clay, organic materials like plants and flowers, and residues created by insects. They are ground and blended, boiled or combined with chemicals, ultimately producing the hues used for paints and printing inks. To make different types of paints, the pigments are blended with a medium, and sometimes driers, antifoaming agents and other substances.

The hues we see depend on the pigments used. When light hits an object, the pigment absorbs some of the light rays, and reflects others back to our eye. The light rays that are reflected are those of the hue from that object.

Why are pigments called the **subtractive color** system? This is because when two hues of paint are mixed together, the original hues disappear and a third one results. For example, mixing yellow and blue results in green (see Figure 2.3).

The pigment primaries are red, blue, and yellow. Red and blue produce the secondary hue violet; blue and yellow produce green; red and yellow produce orange. With pigments, the combination of all hues is black, and the absence of all hues is white.

LIGHT—THE ADDITIVE SYSTEM

We call mixing light rays together an **additive** process. A light-based system is relevant to anyone working with light in the theater or television, on videos, or on websites viewed on a computer monitor. This system of light has different primaries—and produces totally different results—than the subtractive system (see Figure 2.4).

Whether we see light from the sun or from lamps or on the computer screen, this system has consistent rules about its primaries and its secondary color mixtures. The primaries are red, blue, and green. Red and blue produce the secondary hue magenta; blue and green produce cyan; red and green produce yellow. In light, the combination of all hues is white, and the absence of all hues is black (because there is no light).

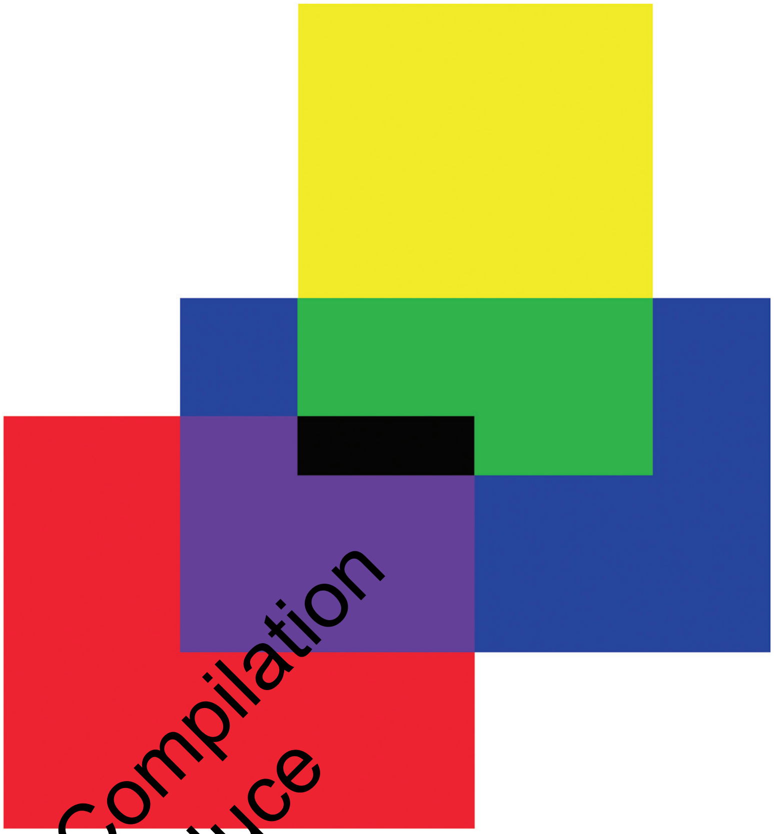


FIGURE 2.3 Subtractive system: Primary hues include red, blue, and yellow; secondary hues include orange, green, and violet. The mixture of all three primary hues is black. Marcie Cooperman.

How We See

This section describes the two influential factors responsible for the colors we see around us.

- ***Our human physical properties.*** Rods and Cones explains how our eyes perform the task of color vision. Psychological Perception and Color Comprehension examines how our brains allow us to comprehend the nature of color, and describe it to others.
- ***Type of Lighting.*** The source of light alters the color of the object, and the light levels work with our rods and cones to influence what we see.

HUMAN PHYSICAL PROPERTIES

Rods and Cones

Our retinas have two distinctive kinds of photoreceptors that allow us to see: rods and cones. The rods are much more active at low levels of light than the cones; this means that in a room with very little light, we are primarily using our rods to see. They enable us to see basic shapes.

But the rods do not perceive color. Only the cones are responsible for our ability to see color. Since the cones need light to work, we have no color vision at low levels of light. You might have noticed that you can't see clearly what color things are at night.

There are three different types of cones in the retina, each of which can absorb one color of the light that is reflected from an object: red, green, or blue. These three colors are called the eye's **primary** colors. When an object appears to us to be a certain hue, it is reflecting that hue's wavelengths and absorbing all other hues. Objects that are colors other than red, green, or blue are a combination of these primary hues, and they cause the corresponding cones to respond.

From person to person, there is a wide variation in the shapes and distribution of rods and cones, just like other

FIGURE 2.4 Additive system: Primary hues include red, blue, and green; secondary hues inclide yellow, cyan, and magenta. The mixture of all three primaries is white. Marcie Cooperman.

physical variations. This variation affects the way a person sees shapes and color. Some people are color blind because the type of cone that perceives a certain color is missing in their retinas.

Did you know that birds see with far greater acuity than humans? Birds can actually see ultraviolet light, magnetic fields (produced by magnets and electrical currents), and polarized light. Their retinas have four types of light receptors, as opposed to our two, and birds have more nerve connections between the photoreceptors and the brain. They need better vision to navigate their relatively tougher life, flying and foraging for food. Birds of prey need to see their food source from high in the air. Sea birds especially need the ability to see amid misty conditions and water reflections.

Psychological Perception

In tandem with the lighting situation and the physical aspects of the eye, we see color because our brain allows this sense to exist. Here's an example of how your brain controls what you see: Press your fingers gently against your closed eyes. Do colors appear? They do, but your eyes were closed! Another example: Do you dream in color? If you have ever seen a color in your dreams, with your eyes closed during sleep, then you know that vision is actually a sense that does not completely depend on what the eye sees.

Color Comprehension

Our brains allow us to perceive and identify color as well as forms, even in less than ideal situations when information is missing. We can identify the color of a white piece of paper that is partly in shadow, where some of the sides appear to be gray. If lit by colored lights, we still understand the paper to be white. Even with the variations produced by different materials such as shiny silk, rubbed suede, or translucent neon light, we can interpret the hue. The human brain ignores the variations that are actually there, and identifies the color that we understand should be there. Even if we don't actually perceive the color, we think we know what color it is.

TYPE OF LIGHTING

What color is an object on the table in front of you? Do objects really have their own color—their local color? Does that color always appear to be the same, no matter what time of day it is seen? Since light and shadow influence an object's color, the question arises as to whether there is in fact something called *local color*.

FIGURE 2.5 Tungsten and other types of lightbulbs. BlackSnake / Shutterstock.com.

Color perception depends on the light source, in addition to the cones in our retinas. We know this is true because we can see that the color of an object sometimes changes when it is placed under different types of lights. Incandescent light has a slightly yellow cast, but is closest to the white light of the sun. Fluorescent light can be bluish or pink. Sodium light, in many streetlights, has an orange glow. Should you be lucky enough to have a color-viewing light box, the traditional tool for color physicists, you would be able to turn on various types of lights and see how they change the color of an object. To provide the whitest light for your design work, it is best to use a combination of incandescent and fluorescent bulbs. Figure 2.5 illustrates various types of light bulbs.

Balance and Unity—Basic Definitions

Balance and *unity* are two concepts that are important to any composition, and even before we discuss them in depth later in this book, it is a good idea to have a rudimentary understanding of both terms. As we discuss the elements of color in this chapter, and move through succeeding chapters, keep the concepts of balance and unity in mind. In Chapter 6, we will examine them in detail, and you will then gain a full understanding of how to achieve them.

Simply defined, **balance** means that no side of the composition seems to be heavier than the other side, appearing as if it were about to fall over.

Unity means that no element appears to be overwhelming in terms of hue, value or intensity, or size or location. It means that every element in the composition works together in conveying the same visual idea. This doesn't mean that the design elements are all the same, just that there isn't one that appears to be too strong compared to the others. As you gain expertise in creating successful compositions, you will also learn how to create excitement in your work by using various levels of strength in color.

The Three Elements of Color: Hue, Value, and Intensity

If your friend asks you to paint a room blue, very shortly you will feel the need to ask more questions. What kind of blue should it be? A blue that looks like the summer sky? A blue that is like the color of the Caribbean Sea? Or a blue like the deep part of the Pacific Ocean? Light or dark? A bright blue or a dull blue? These questions illustrate that describing a color is more complex than saying, "It is blue." In your quest to understand what your friend meant, you have actually referred to the three basic elements of color: hue, value, and intensity. Let's explore these concepts in depth.

HUE

Hue is the color name (blue, red, etc.). The word *hue* tells us nothing about how light or dark a color is (that refers to *value,* which is discussed later), or about how saturated and intense it is (that refers to *intensity*, also discussed in the following text); it tells us only what we would call it. We differentiate *hue* from *color* because when we use the word *color*, we are referring to the total combination of the three elements of color: hue, value, and intensity. When we ask what hue an object is, we want to know only the color name, such as red or blue.

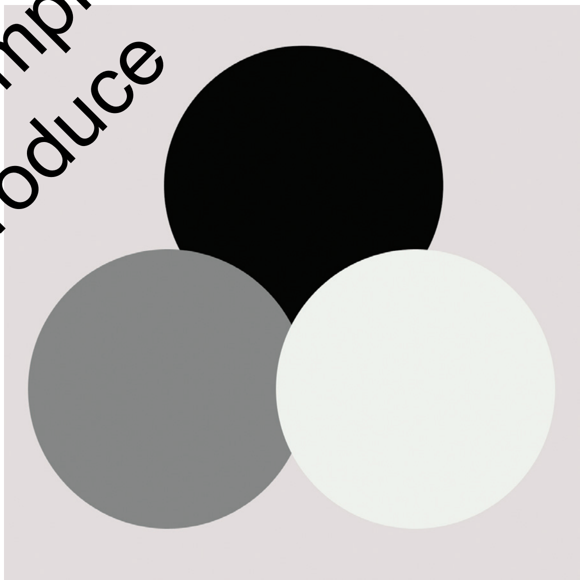


FIGURE 2.6 Achromatic hues: Black, white, and gray. Marcie Cooperman.

Spectral Hues

Spectral hues are the seven hues that can be refracted from the white light of the sun (see the discussion of ROYGBIV in Chapter 1).

Chromatic Hues

Chromatic hues include the spectral hues, their mixtures, and any hues that are mixed with black, white, or gray, such as broken hues. We say these hues have **chroma**, as opposed to black, white, and gray. Only black, white, and gray are not chromatic hues because they have no chroma.

Achromatic Hues

Black, white, and gray are considered **achromatic** because they have no chroma (Figure 2.6). They are not found in the spectrum, and they are not mixtures of chromatic hues. White is the lightest hue possible because it reflects 100 percent of the light. Black is the darkest hue possible because it reflects none of the light and absorbs all of it, and each value of gray reflects a portion of the light.

Primary Hues

Red, yellow, and blue are the three pigment **primary hues** (Figure 2.7). They are primary because you cannot mix other colors together to get them. Mixed together two at a time in specific but not equal percentages, primaries produce the secondary hues. Each primary hue is pure, meaning that it has absolutely none of the other primaries in it.

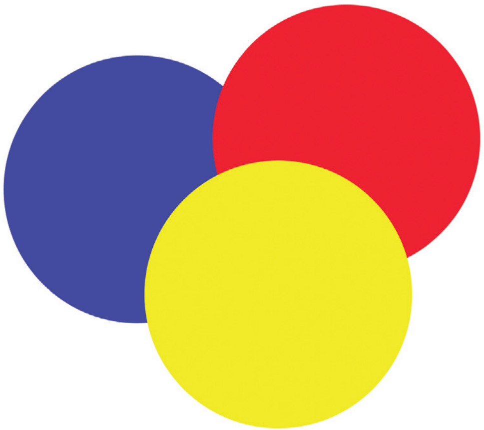


FIGURE 2.7 Primary hues: Red, yellow, and blue. Marcie Cooperman.

Secondary Hues

Orange, green, and violet are the **secondary hues** (Figure 2.8). Orange is the result of mixing red and yellow; green comes from mixing blue and yellow; and violet is the result of mixing blue and red. When using pigments in your paint box to mix

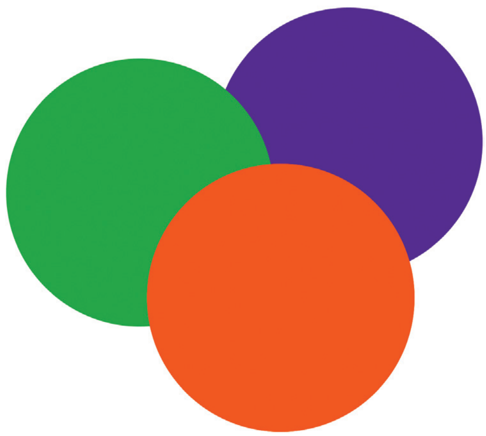


FIGURE 2.8 Secondary hues: Orange, green, and violet. Marcie Cooperman.

FIGURE 2.9 Cynthia Packard: *Beach-Forest.* 154″ × 96″, oil and wax on board, 2010. Cynthia Packard.

secondary hues from primary hues, you must choose hues that are as similar to the pure primary hues as possible. This means that the red you choose should not appear to have any yellow in it, which would make it lean toward orange, and it should not seem to have blue in it, which would make it lean toward violet. Your blue should not have any red in it, which would make it appear more violet, and it shouldn't have yellow in it, which would make it look greenish. Your yellow should not have any red in it, which would make it look more orange, and it shouldn't have blue in it, which would make it look greenish. If your hues are not pure, you are actually mixing *three* primaries together, and your result will be brown.

Cynthia Packard's *Beach-Forest* in Figure 2.9 illustrates how the secondary hues of orange and green look when placed in a composition together with black and a high value red.

Tertiary Hues

Tertiary hues are those between the primary and secondary hues on the color circle (Figure 2.10). To name them, use the descriptive color name first, and the color being described second. For example, orange–red is actually red with some yellow in it so that it begins to move toward orange. Red–orange is actually orange, but it leans toward red. True orange, in comparison, is usually in the middle between yellow and red. The other tertiary hues can be named in the same way.

Broken Hues

Broken, or intermediary, hues are hues that have been mixed with gray, black, or white (Figure 2.11). In pigments, two complementary hues can also be mixed together to make a broken hue. Complements are opposite each other on the color circle. (We will discuss complements and other color relationships in Chapter 3.) Browns are a good example of broken hues made by mixing complements. The term *broken* most likely refers to the fact that they are not hues that are found on the color circle, and their intensity is lower than that of pure hues. (We will discuss intensity later in this chapter.)

Hue Names

Describing a color accurately involves translating a visual image into language. To be consistent, we need a good system and commonly accepted words. But even though we do have a system that is used by professionals, laypeople generally use words of their own preference to describe colors. Their meanings are inexact and are subject to many interpretations. For example, the words *shade* and *tone* are both often used incorrectly to mean varieties of one color. Does the phrase "a shade of green" mean a lighter or darker version, or a green slightly different because it has a yellowish cast to it? Or does it mean a bright or dull green? You might be using the phrase "a shade of green" to mean all of these things.

Many of our descriptive words come from animals, plants, or minerals. We use them with confidence, not realizing that they have different meanings to different people. How dark is forest green, and what kind of green is it—yellowish or bluish? Is taupe dark or light, brownish or grayish, or tending toward some hue? Which is darker, beige or tan? How bright a pink is salmon, and have you ever actually seen coral that was coral pink? Does sage appear to be more of a gray, more of a green, or is it a yellow? Is khaki actually a green, a beige, or a gray? What is the difference between sky blue and baby blue? Some more inaccurate, yet well-used, names are aqua, teal, and periwinkle, and the inscrutable mauve. Since we cannot agree about hue names like these, and we do not all have the

FIGURE 2.10 Some tertiary hues: Orange–yellow, orange–red, red–violet, violet–blue, blue–green, yellow–green. Marcie Cooperman.

CHAPTER

3 Color Relationships

key terms

adjacent hue
afterimage
analogous hue
color circle
color relationship
complement
Goethe's proportions
harmony
simultaneous contrast
split complement
triad

Michel Chevreul and Simultaneous Contrast

> *In the case where the eye sees at the same time two contiguous colors, they will appear as dissimilar as possible, both in their optical composition, and in the height of their tone. We have then, at the same time, simultaneous contrast of color properly so called, and contrast of tone."*[1]
>
> —*Michel Chevreul,* founder of color theory

Colors are slippery characters, always ready to deceive. Although we may feel like we can trust our eyes, we really can't. Our perception of any particular color depends on its surroundings. The characteristics of any color are relevant to the adjacent colors. Amazingly, two different colors can appear to be the same when each is placed on a different background. Even more surprisingly, a dull color can suddenly appear to be much more saturated when placed on a less intense background. Apropos to this question, one might wonder: Why are

FIGURE 3.1 Joel Schilling: *Manarola From the Sea.* Manarola, Italy, photograph, 2004. Joel Schilling.

the colors of the houses in Figure 3.1, *Manorala From the Sea,* so vibrant? After reading this discussion, see if you can answer that question.

How can we explain the effect that colors have on each other? Why do some combinations create balance while others repel each other or disrupt balance? A good question; it is the basis for color theory, and the issue that concerns us in this chapter.

Leonardo da Vinci was the first scientist to notice that adjacent colors in a painting influence each other. But after commenting on it, he explored the phenomenon no further. For centuries afterward, rather than attempting to understand color interactions, scientists were engrossed with the problem of how to illustrate all possible colors on a model, using shapes like a circle, triangle, rectangle, or sphere.

The first person to understand and comprehensively explain color interaction was Michel Chevreul. In 1839, after years of careful research, he introduced to artists a topic that had been debated previously only within the scientific community: the impact of color next to color. He realized that all of the colors within a composition influence each other enough to completely alter how we perceive them. He called this phenomenon the **law of simultaneous contrast**. Chevreul explained how his experiments could be reproduced, and showed that they substantiated his rules for the changes that can occur. His point was that color behavior is based on fact, and is not capricious or dependent on subjective opinion.

How did Chevreul come across this amazing discovery? In the 1800s, Chevreul was renowned as a chemist who had discovered margarine, and who made important contributions to animal and vegetable fats. When he was 40, in his capacity as director of the Gobelins Tapestry Works, it was his job to consider complaints from customers about the clarity of certain colors in their rugs and fabrics, which were produced by his factories. The chemist was thus drawn into the world of color theory. One major complaint was that the black wasn't dark enough. When he compared his black yarns with those of his competition, he saw that his were indeed as dark as their yarns. Apparently the problem was due to some factor other than the Gobelins black dye.

As the scientist that he was, Chevreul researched the situation carefully, and he realized that the visual interaction of the black with adjacent colors was actually altering the appearance of the colors. Blue gave an orange cast to the black next to it, and this made it appear lighter than it actually was. Why was this happening? His interest piqued and he methodically placed color next to color and noted the effects, embarking on a 10-year course of intense and thorough research into colors and their interactions. In 1839, he compiled his observations in *The Principles of Harmony and Contrast of Colors.* Sparing no expense, he illustrated them with carefully chosen colors on large, full-color plates—quite an achievement at that time.

Initially published in France, after 20 years the book was no longer in print in that country. In 1854, *The Principles of Harmony and Contrast of Colors* was translated and printed in England, the first English book there to use color printing. In 1855, an English reprint of his book called *The Principles of Harmony and Contrast of Colors and Their Applications to the Arts* included specific applications of his law of simultaneous contrast to many visual fields such as furniture, uniforms, painting, printing, maps, lighting in museums, frames, textiles, interior decoration, stained glass, and horticulture. Fifty years after his laws were first published, France celebrated the great man's 100th birthday with a centennial edition of his original book, which we can still find in public libraries.

CHEVREUL'S LAW OF SIMULTANEOUS CONTRAST

When viewed simultaneously, two colors force each other to appear as dissimilar as possible. In other words, color A forces its neighbor B to look as unlike A as possible, while color B forces its neighbor A to look as unlike B as possible. We use the word *color* because this law refers to the three elements of color: hue, value, and intensity. Chevreul warned that a painter or designer unaware of the law could mistakenly use color combinations that either are unappealing, or that exaggerate their contrasts and create an unbalanced composition.

Chevreul emphasized that the law of simultaneous contrast is constant, and that it has a huge effect on all colors in any two- or three-dimensional composition, including the compositional figures, the background, and the borders. The law can be applied to any field of design or art: paintings, clothing, fabrics and furniture, frames and borders of paintings, and even gardens.

How It Works for Hue

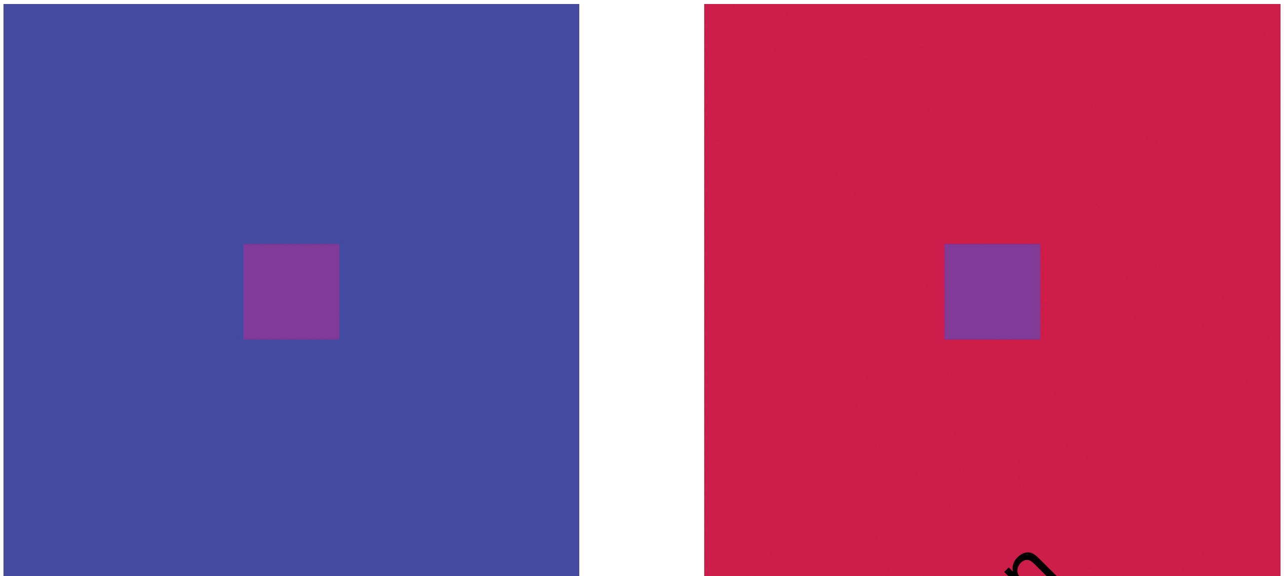
Adjacent hues force each other to look as opposite as possible—and there is no more opposite hue than the complement. For example, if one hue in the composition is red, it will force nearby hues to look as "un-red" as possible, and that means greenish. Green is the most un-red color because it is red's complement. (We will discuss complements later in this chapter.) This effect is strongest when we see hues right next to each other, but it also works to a lesser degree for all hues in the composition. For example, in Figure 3.2, notice how different the very same gray appears on the two different backgrounds. The violet background pushes the gray away from violet, toward yellow. And the yellow pushes the gray away from yellow and toward violet. The red square in Figure 3.3 is redder and more intense the green

(a) (b)

FIGURE 3.2 (a) The red–violet pushes the gray to have a yellow cast and makes the gray look lighter. (b) The yellow pushes the gray to look like red–violet, and darkens it. Marcie Cooperman.

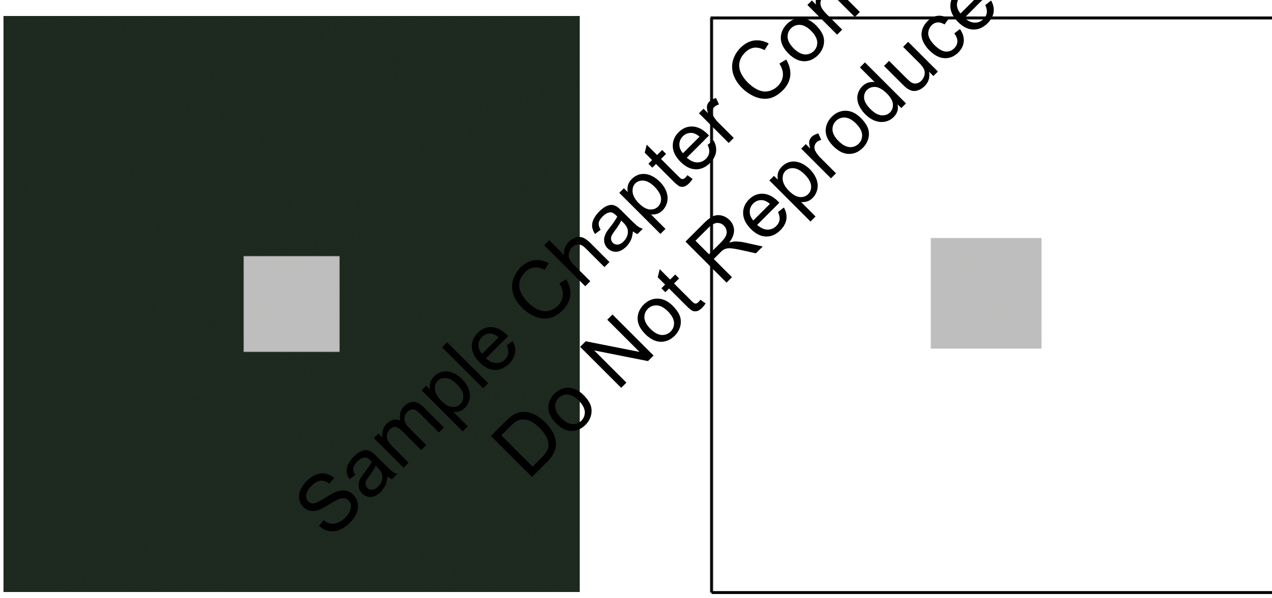
(a) (b)

FIGURE 3.3 The green background in (a) forces red, its complement, to be as strong as possible. Consequently, it is redder, and more intense, than it is on the gray background (b). Marcie Cooperman.



(a) (b)

FIGURE 3.4 The same color looks different! The red–violet square looks redder on the blue background (a) and bluer on the red background (b). Marcie Cooperman.



(a) (b)

FIGURE 3.5 Simultaneous contrast affects value. The gray looks lower in value on the white (a) than on the black (b). Marcie Cooperman.

background—its complement. In Figure 3.4, the violet looks bluer on the red background, and redder on the blue background. This is because the blue ground "steals" the blue from the violet, and the red "steals" the red from the violet.

How It Works for Value

Simultaneous contrast changes the values we perceive, too. The value of a color has a strong opposite effect on the value of an adjacent color. For example, the lightness of the white background in Figure 3.5a darkens the value of the gray square, but the black background has the opposite effect on the same gray, making it seem lighter.

FIGURE 3.33 **Catherine Kinkade:** ***Fall Marsh.*** Pastel, 17" × 21". © Catherine Kinkade.

the present mood at any particular time. Even the next day, our opinions can vary enough to change our decisions about whether certain colors look harmonious together.

But even more important, in a composition the shapes and sizes of color spaces, the surrounding colors, and other compositional elements influence the appearance of the colors themselves. These factors make it possible to negate any broad, general rule of what colors look good together. Just change their sizes, and those colors have to be reevaluated. The context in which we find any combination of colors will also determine whether we like them. For example, colors that look fine in an abstract painting will be shocking in a realistic landscape.

Each time period and culture is associated with color preferences that seemed wonderful to the people of that time. (We will discuss relating color to cultural meaning in Chapter 10.) But looking back from a different location and a later generation, those color choices seem quaint and evocative of a specific era. Even color experts like Wilhelm Ostwald have created color harmony schemes that are now outdated.

In 1993, in *Colour and Culture, Practice and Meaning from Antiquity to Abstraction,* John Gage said that color harmony was a sustaining ideal for color theorists until "well into the twentieth century,"[6] implying that the relevancy of the issue has diminished. However, it appears that color professionals today, and others in many fields involving color, are still interested in finding harmonizing color combinations.

Now that paint companies offer almost unlimited numbers of paint colors, the search for perfect combinations has become even more complicated. Even many professionals in the world of decoration—interior designers, paperhangers, house painters—may not be knowledgeable about the makeup of colors, and they may have little ability to discern the differences between them. Portable colorimeters have been devised so that amateurs can measure a color on the job, and identify a match choosing from several popular lines of paint. One such device even offers advice about colors to use together. It seems as if the computer determines these combinations, but of course, teams of people had to work hard to program this information into it.

As you can see, our ideas of good combinations have changed as the centuries passed, and in reality, it's difficult to lay down hard and fast rules.

summary

In this chapter we learned that colors have relationships with each other based on where they are located on the color circle, and this influences their hue interactions. However, it isn't possible to state that certain hues are always harmonious combinations. Color harmony depends on the hues, values and intensities, as well as quantities of each color that we view simultaneously. Based on a particular situation, we can conclude that certain colors "play nicely" with each other and exist in harmony sometimes, and not other times.

quick ways . . .

Study your composition carefully, using the following steps, one at a time.

1. Colors: Count the number of discrete hues. Too many will be confusing and inhibit balance. Too few will be boring—a result to avoid!
2. Colors: Evaluate the predominance of one hue, to make sure it is not overwhelming.
3. Colors: What are the color relationships together in their various combinations, and what are the resulting effects of simultaneous contrast? How does their placement affect the balance of the total composition? Would moving an element change things for the better?

exercises

Parameters for Exercises
There are many factors of color and color relationships in compositions, and all of them can affect the way the colors appear to the viewer. The best way for students to learn through their color exercises is to have simple objectives and fairly strict rules about the type of lines and colors to be used. We call these rules "parameters." With strong parameters allowing only a minimum of elements, it is easier to observe the direct relationships between colors, and to see the differences between the students' compositions. When lots of compositions hang together for a critique, it becomes clear which ones are successful in achieving the goals.

As students learn the objectives and build on their skills, they will become more adept at using color. They will gain the ability to tolerate more complications because they understand the ensuing interactions. Therefore, as we move through the chapters, the restrictions on composition size and the number of lines and colors will be gradually reduced. Larger compositions, more colors, and more types of lines will be allowed. However, certain ground rules will remain the same: Flat color and nonrepresentational shapes will remain constant parameters, and the goal of every assignment will be a balanced composition. Five specific parameters include:

1. No recognizable objects are allowed.
2. All colors are to be flat and nongradient, with hard edges that don't fade away.
3. White is always considered a color, even if it is the background.
4. Only neatly cut and pasted papers are appropriate.
5. Balance and unity are *always* the singular goal of every composition.

1. ***Create a 12-step color circle.*** The objective is to make your own color circle that can be used for reference in this class, with properly placed complements, and correct variation of hues. Using the technique you learned by painting your value scale, with extender to keep your paints from drying out, mix the correct hues into plastic cups.

   Begin with red, blue, and yellow. Make sure your yellow does not tend toward red, that your red does not tend toward yellow, and that your blue is not too red. Pure primaries make the best secondaries. Mix the three secondaries from the primaries, and then mix one tertiary for in between each primary and secondary. Paint areas of your paper with each hue, evaluate for accuracy, then cut 1" × 1" squares of each hue. Place them in a circle properly, with complements directly across from each other.

Parameters: For the following exercises, only vertical lines that run from top edge to bottom edge are allowed. Total size should be 5" × 7". Choose your hues, paint large areas for each color on your paper, then cut out the shapes you need and glue them on your foam core using a removable glue stick. Your goal is overall balance, as always. Your second goal is to learn what quantity of each color will achieve balance.

2. ***Find complements.*** The objective of this exercise and exercise 3 is to find the successful quantities of each complement in a pair, keeping the other elements of design very simple. Make a balanced composition using two complementary hues (so that one hue does not appear to overwhelm the other). First, plan for the locations and widths of your vertical lines for each hue in the composition. Then, cut one hue 5" × 7"—this will be the background. Cut the other hue into the widths you need, and place them on the first one, evaluating the balance as you move them around. While you are thinking about proper line widths, cut extra lines of different widths, and evaluate the success of using them instead. Glue down the ones that satisfy you.
3. ***Find complements (continued).*** Make another balanced composition, as in exercise 2, using a different set of complements. This one will require different amounts of each hue, which you can evaluate.
4. ***Find harmony with intensity.*** The objective is to discover the quantity of intense color that will produce a balanced composition. Choose two hues: one intense hue, and one that is much lower in intensity. Make a balanced composition, using the procedure in exercise 2.
5. ***Use split complements.*** The objective is to learn how to use split complements and achieve balance with the proper quantities. Carefully decide which are the split complements of your favorite hue, and then use the three colors to make a successful composition with vertical lines.
6. ***Find harmony with hues.*** The objective is to analyze colors and choose a relatively large quantity that together can provide a balanced composition. From the perforated pages in the back of the textbook, choose five colors that you think work together well. Hang them together for evaluation during the critique in class.

CHAPTER 9

Color Interactions—Backgrounds, Borders, Outlines, and Transparency

FIGURE 9.1 Whitney Wood Bailey. ***Extraordinary Geometries.*** Oil and mixed media on canvas, 72″ × 72″, 2012.
Whitney Wood Bailey.

In many compositions, there are a few configurations that everybody recognizes specifically because of their locations: the background, borders, and outlines. These structures seem simple and basic, but they have such a great impact on the entire composition that it's impossible to underestimate their influence, and it's essential to choose their colors carefully.

These configurations are so familiar that even those outside the design industries know what they are. Naturally we know what backgrounds are! The figure–ground Gestalt principle states that we have a tendency to simplify a scene into two parts: The main object that we are looking at (the figure) and the background (or ground). And we know instinctively that borders and outlines surround shapes. Just as recognizable, although most of us have never analyzed why we know it, are transparency effects. Like the other three configurations, transparency is influenced by color location. It involves two colors placed near each other combining in an adjacent space to form a third color that appears to be a mixture of the two.

Color relationships determine how these structures affect the objects in the composition. As we learned in Chapter 3, the Law of Simultaneous Contrast causes colors to establish relationships with each other and make things happen. For example, complementary hues blue and orange scintillate and vibrate, and are useful for creating compositional tension. You can see how blue and orange look together in the Impressionist paintings by Claude Monet, who used them in many variations of intensity and hue to illustrate the effects of sunlight. In contrast, analogous hues like blue and green together calm the soul and suggest atmospheric or watery effects, depending on whether they are located above or below the objects. And the complementary hues of red and green are balanced and together support each other's strengths.

Keeping in mind the artistic message to be communicated to the viewer, the designer can choose the color relationships that can achieve it. In this chapter, we explore each structure and its color possibilities.

key terms

atmospheric
border
child color
interstitial
outline
parent color
partial border
permeable
transparency
visual field

Backgrounds

What effect does the background color have on the composition? It's obvious but still vitally true that the more space a color takes up in an image, the stronger its effects on the other colors and the more influence it peddles in setting the mood and artistic message. And no area takes up more space than the background (or ground), the area surrounding the figure A color with so much influence has to be a primary consideration when determining the nature of all color choices. That's why it's always a good idea to try out several possibilities for background color against the other colors in your composition, in order to select the one that contrasts most effectively with them.

Let's take a look at various possibilities for background colors and the effects they impose on the composition. With different choices, we will examine the changes that occur in the color relationships, the plane locations, and in continuity.

Whitney Wood Bailey's *Extraordinary Geometries* in Figure 9.1 illustrates the effect of background color against the figure color. The complex tiny slashes of ground hues optically combine to produce gray, the benevolent achromatic hue that preserves the intensities of the colorful curvilinear lines of the figures. This is because gray does not produce the color altering effects of black or white grounds.

BACKGROUND COLORS

To simplify things, we will limit our exploration to the effects of achromatic hues black, white, and gray, and primary hues red, blue, yellow. But remember that it is all influenced further by color relationships in your composition.

FIGURE 9.2 Rembrandt: *Abraham and the Angels.* Black highlights the other values. Oleg Golovnev/Shutterstock.com.

Black

Against black, all other colors appear lighter. And in a composition, black visually separates itself from other hues because it alone is the lowest-value achromatic hue possible. True black (as opposed to a very low-value green, blue, or red) always looks like a species different from the chromatic hues. For this reason, it has great visual strength. Rembrandt's *Abraham and the Angels* in Figure 9.2 is a good example of black's separation, and the relative lightness of other colors when black is the background color. As we can see, he achieved great luminance and brightness through black's contrast with his other colors, a typical color relationship strategy for him.

White

White is extremely bright because it alone is the highest value possible. For this reason, it has a darkening effect on all other colors. By definition as an achromatic hue, it has no intensity at all, which increases the intensity of adjacent colors, even while making them darker. Even high-value colors look darker against white, like the red puzzle piece in Figure 9.3. Whitney Wood Bailey's *Extraordinary Geometries* in Figure 9.1 is an example of a white background. (Did you guess that?)

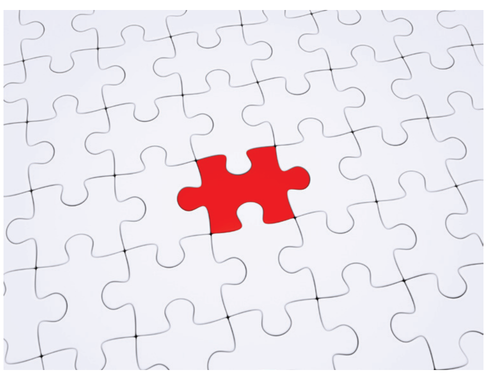


FIGURE 9.3 The white background makes the red puzzle piece darker. © masterofall686/Fotolia.

Red

As a background, red is a bully in the playground. Its power and intensity force other colors to be quieter. It steals the red from adjacent hues, and its tendency to push forward overwhelms the other colors. It's hard to stand out against red, but other colors have a chance to be somewhat visible on top of it if they contrast in value, or are complementary in hue.

The Coke ad in Figure 9.4 is a rare example of red as a background for an ad, a bold decision that often walks the thin line of visibility. Red draws attention to the ad—a noble cause—and keeps the energy high, but could easily prevent the text from being readable and the image from being understood. In Figure 9.4, white text is a good value and intensity contrast on the red ground, and the complementary contrast of the green bottle gives the image visual strength. The high value makes the face and hand contrast slightly, but not enough to stand out well because they are a tint of the same hue.

The photograph by Sarah Canfield in Figure 9.5 is a thought-provoking use of red as a background because the Queen's cape is also red. Since they are the same hue, neither stands out, allowing the face to become the focal point and creating a theatrical mood. Viewing the two types of red simultaneously heightens the hue differences: The cape has more yellow in it, and the background has more blue in it.

FIGURE 9.4 Coca-Cola advertisement. Red steals the show. © Peter Horree/Alamy.

Blue

Blue is atmospheric in character, which means it has the quality of being infinite and intangible, surrounding an image the way the atmosphere exists above the earth. Since it does not seem to have a particular plane location, it usually recedes behind other colors. If it is the color with the most visual strength, it is possible for the blue to surge forward. But colors with any warmth in them can easily move to a plane in front of it.

In Sasha Nelson's photograph of St. Mary's Cathedral in Figure 9.6, the intense blue of the sky scintillates against the complementary orange turrets of the spooky Gothic architecture, seething and vibrating, yet not usurping the forward plane of