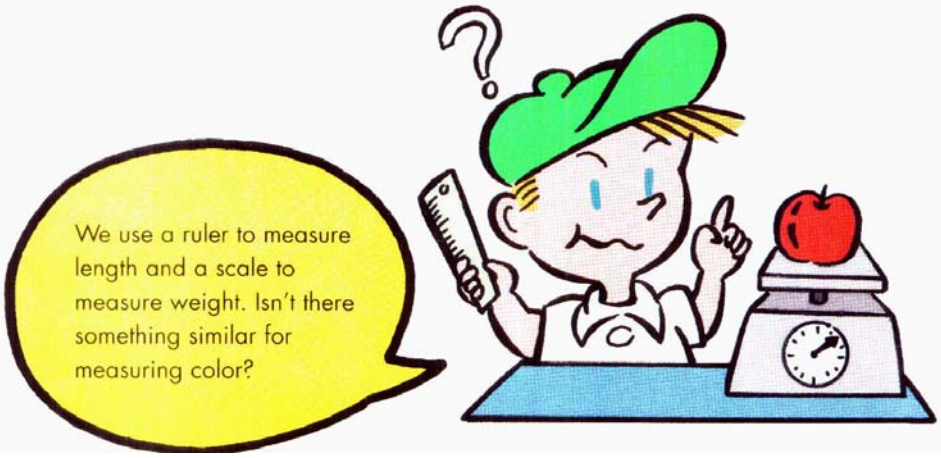
A color expression often means ten different colors to ten different people.
"Name this color" is a very difficult subject.

If you show the same apple to four different people, you are bound to get four different answers.

Color is a matter of perception and subjective interpretation. Even if they are looking at the same object (in this case, an apple), people will draw upon different references and experiences and express the exact same color in vastly different words. Because there is such a wide variety of ways to express a color, describing a particular color to someone is extremely difficult and vague. If we describe the color of the apple to someone as "burning red", can we expect them to be able to reproduce that color exactly? Verbal expression of color is too complicated and difficult. However, if there was a standard method by which colors could be accurately expressed and understood by anyone, color communication would be much smoother, simpler, and exact. Such precise color communication would eliminate color-related problems.

To what extent can words express color? Common color names and systematic color names.

Words for expressing colors have always changed with the times. If we consider, for instance, the red we've been talking about, there are "vermillion", "cinnabar", "crimson", "rose", "strawberry", and "scarlet", to mention just a few. These are called common color names. By analyzing the color condition and adding adjectives such as "bright", "dull", and "deep", we can describe the color a little more precisely. Terms such as the "bright red" used by the man on the facing page are called systematic color names. Although there are a variety of such ways to describe color, different people hearing just "crimson" or "bright red" will still interpret such expressions in different ways. So verbal expression of colors is still not accurate enough. Then how should colors be expressed to avoid the possibility of misunderstanding?



A variety of conditions affect how a color looks.

Light-source differences

An apple which looks so delicious under sunlight in front of the green grocer somehow doesn't look so good under the fluorescent lights at home. Probably many people have had such an experience. Sunlight, fluorescent light, tungsten light, etc.; each type of illumination will make the same apple look different.

Observer differences

The sensitivity of each individual's eyes is slightly different; even for people considered to have "normal" color vision, there may be some bias toward red or blue. Also, a person's eyesight generally changes with age.
Because of these factors, colors will appear differently to different observers.

Size differences

After looking at small sample pieces and selecting a wallpaper which looks good, people sometimes find that it looks too bright when it's actually hung on the wall. Colors covering a large area tend to appear brighter and more vivid than colors covering a smaller area. This is referred to as area effect. Selecting objects which will have a large area based on color samples having a small area may result in mistakes.

Background differences

If the apple is placed in front of a bright background, it will appear duller than when it was placed in front of a dark background. This is referred to as contrast effect, and is undesirable for accurately judging color.

Directional differences

When looking at a car, viewing the car from just a slightly different angle can make a point on the car appear brighter or darker. This is due to the directional characteristics of the car's paint. Certain coloring materials, particularly metallic paints, have highly directional characteristics. The angle from which the object is viewed, and also the angle from which it is illuminated, must be constant for accurate color communication.

Hue, lightness, and saturation: This is the world of color.

Hue

Red, yellow, green, blue...
Hues form the color wheel.

Apples are red, lemons are yellow, the sky is blue; that's how we all think of color in everyday language. Hue is the term used in the world of color for the classifications of red, yellow, blue, etc. Also, although yellow and red are two completely different hues, mixing yellow and red together results in orange (which is sometimes referred to as yellow-red), mixing yellow and green results in yellow-green, mixing blue and green results in blue-green, and so on. The continuum of these hues results in the color wheel shown in Figure 1.

Lightness

Bright colors, dark colors.
The lightness of colors changes vertically.

Colors can be separated into bright and dark colors when their lightnesses (how bright they are) are compared. Take, for example, the yellows of a lemon and a grapefruit. Without a doubt, the yellow of the lemon is much brighter. How about the yellow of a lemon and the red of a sweet cherry. Again, the yellow of the lemon is brighter, right? This lightness can be measured independently of hue. Now take a look at Figure 2. This figure is a cross section of Figure 1, cut along a straight line between A (Green) and B (Red-purple). As the figure shows, lightness increases toward the top and decreases toward the bottom.

Saturation

Vivid colors, dull colors.
Saturation changes outward from the center.

Going back to yellow, how do you compare the yellows of a lemon and a pear? You might say the yellow of the lemon is brighter, but more to the point in this case, it is vivid, while the yellow of the pear is dull. This is another big difference, but this time one of color saturation or vividness. This attribute is completely separate from those of both hue and lightness. If we look at Figure 2 again, we can see that saturation changes for red-purple and green respectively as the horizontal distance from the center changes. Colors are dull near the center and become more vivid as we move away from the center. Figure 3 shows general adjectives used to describe the lightness and saturation of colors. To see what the words express, look back at Figure 2 again.

Hue, lightness, saturation. Let's create a color solid.

If we use the change of lightness as the axis of the color wheel and the change of saturation as the spokes...

Hue, lightness, and saturation. These three elements are the three color attributes, and can be put together to create the three dimensional solid shown in Figure 4. Hues form the outer rim of the solid, with lightness as the center axis and saturation as the horizontal spokes. If the actual colors which exist in the world were distributed around the solid shown in Figure 4, the color solid shown in Figure 5 would be created. The shape of the color solid is somewhat complicated because the size of the steps for saturation are different for each hue and lightness, but the color solid helps us to better visualize the relationship between hue, lightness, and saturation.

Figure 4:
Three-dimension
(hue, lightness, saturation) solid