

Lighthouse International is a leading resource worldwide on vision impairment and vision rehabilitation. Through its pioneering work in vision rehabilitation services, education, research and advocacy, Lighthouse International enables people of all ages who are blind or partially sighted to lead independent and productive lives. Founded in 1905 and headquartered in New York, Lighthouse International is a not-for-profit organization, and depends on the support and generosity of individuals, foundations and corporations.

Aries Ardit, PhD, is Vice President for Vision Science, Lighthouse International; this brochure is based on his earlier work with Kenneth Knoblauch.

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Lighthouse International has a companion brochure entitled "Making Text Legible: Designing for People with Partial Sight."



**LIGHTHOUSE**  
INTERNATIONAL

HOPE WHEN VISION FAILS™

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# Effective Color Contrast

Designing for People  
with Partial Sight and  
Color Deficiencies

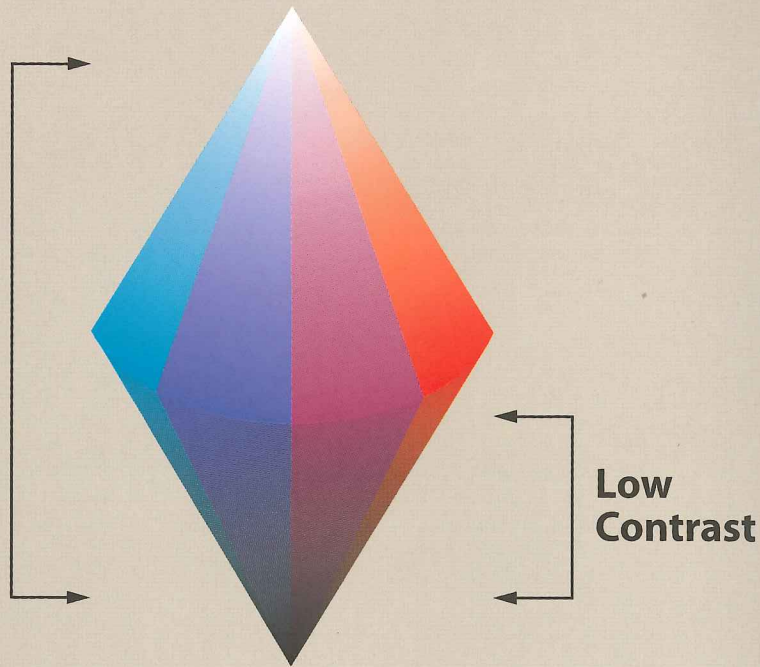
by Aries Ardit, PhD

This brochure contains basic guidelines for making effective color choices that work for nearly everyone. To understand them best, you need to understand the three perceptual attributes of color: **hue, lightness and saturation**, in the particular way that vision scientists use them. Full explanations of these terms are provided in the pages that follow.

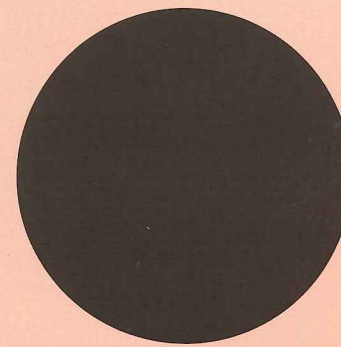
## **How does impaired vision affect color perception?**

Partial sight, aging and congenital color deficits all produce changes in perception that reduce the visual effectiveness of certain color combinations. Two colors that contrast sharply to someone with normal vision may be far less distinguishable to someone with a visual disorder.

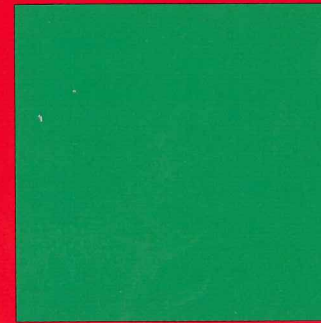
High  
Contrast



**Exaggerate lightness differences between foreground and background colors, and avoid using colors of similar lightness adjacent to one another, even if they differ in saturation or hue.**

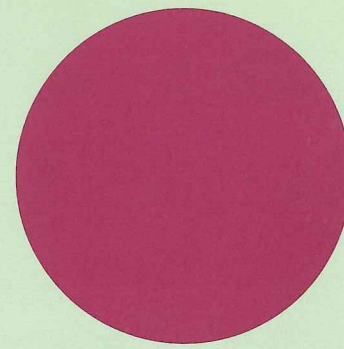


**Effective**

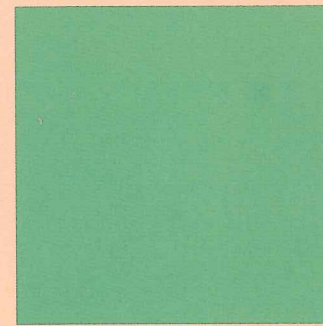


**Not  
effective**

Don't assume that the lightness you perceive will be the same as the lightness perceived by people with color deficits. You can generally assume that they will see less contrast between colors than you will. If you lighten your light colors and darken your dark colors, you will increase the visual accessibility of your design.



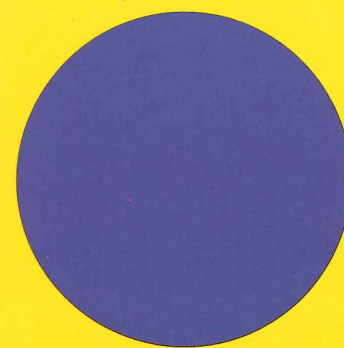
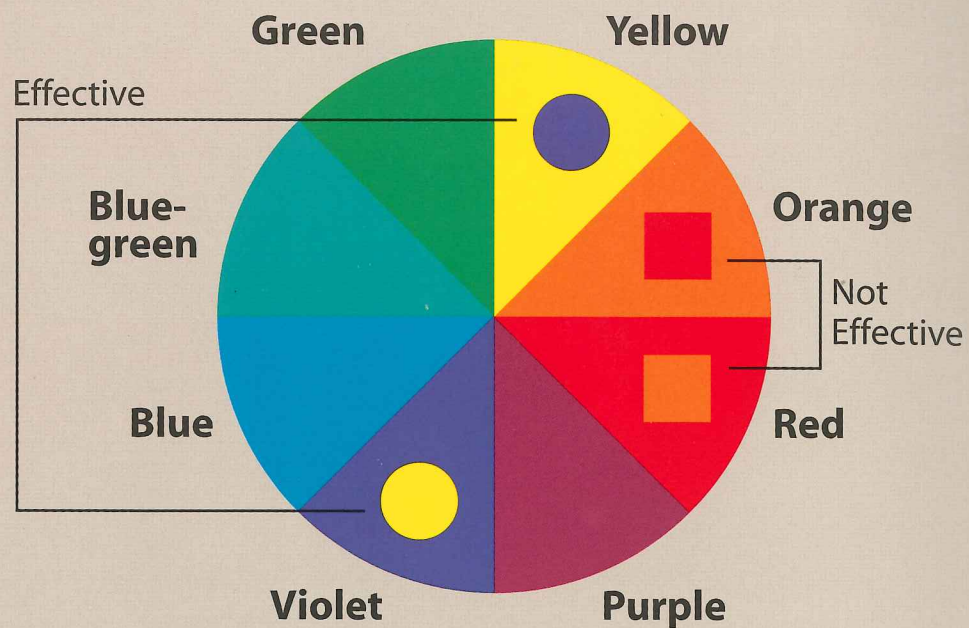
**Effective**



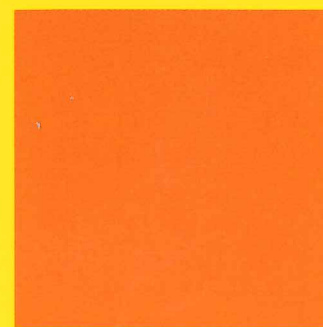
**Not as effective**

**Choose dark colors with hues from the bottom half of the hue circle against light colors from the top half of the circle. Avoid contrasting light colors from the bottom half against dark colors from the top half.**

For most people with partial sight and/or congenital color deficiencies, the lightness values of colors in the bottom half of the hue circle tend to be reduced.



**Effective**

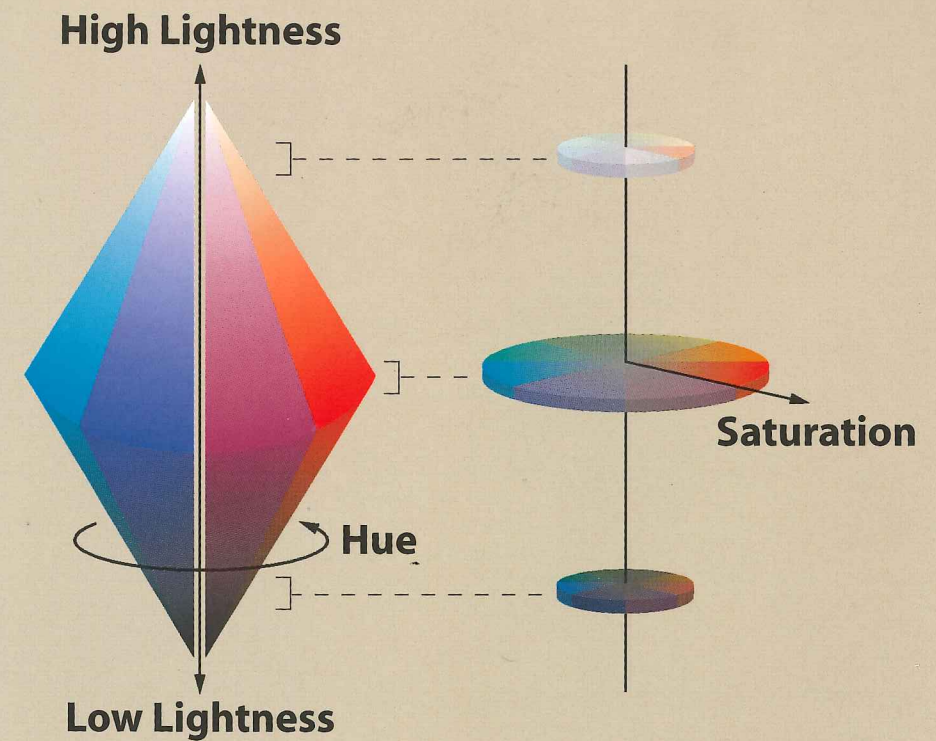


**Not effective**

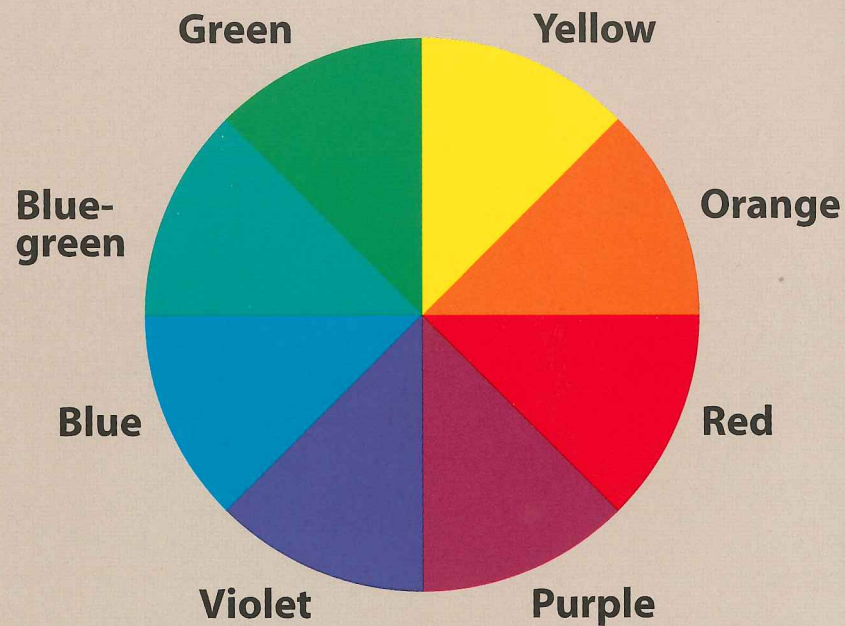
**Avoid contrasting hues from adjacent parts of the hue circle, especially if the colors do not contrast sharply in lightness.**

Color deficiencies associated with partial sight and congenital deficiencies make it difficult to discriminate between colors of similar hue.

Hue, lightness  
and saturation –  
the three perceptual  
attributes of color –  
can be envisioned  
as a solid.



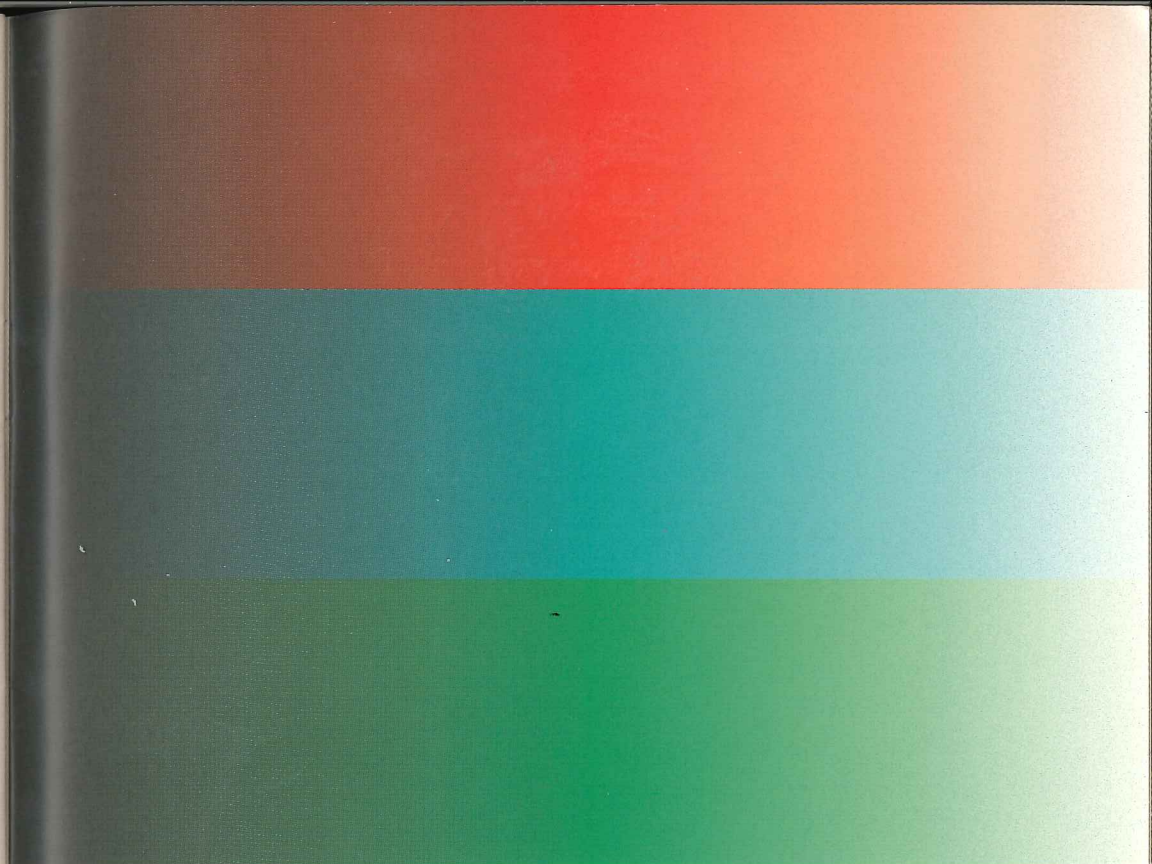
Hue varies around the solid;  
lightness varies from top to bottom  
and saturation is the distance from  
the center.



**Hue is the perceptual attribute associated with elementary color names.**

Hue enables us to identify basic colors, such as blue, green, yellow, red and purple. People with normal color vision report that hues follow a natural sequence based on their similarity to one another.

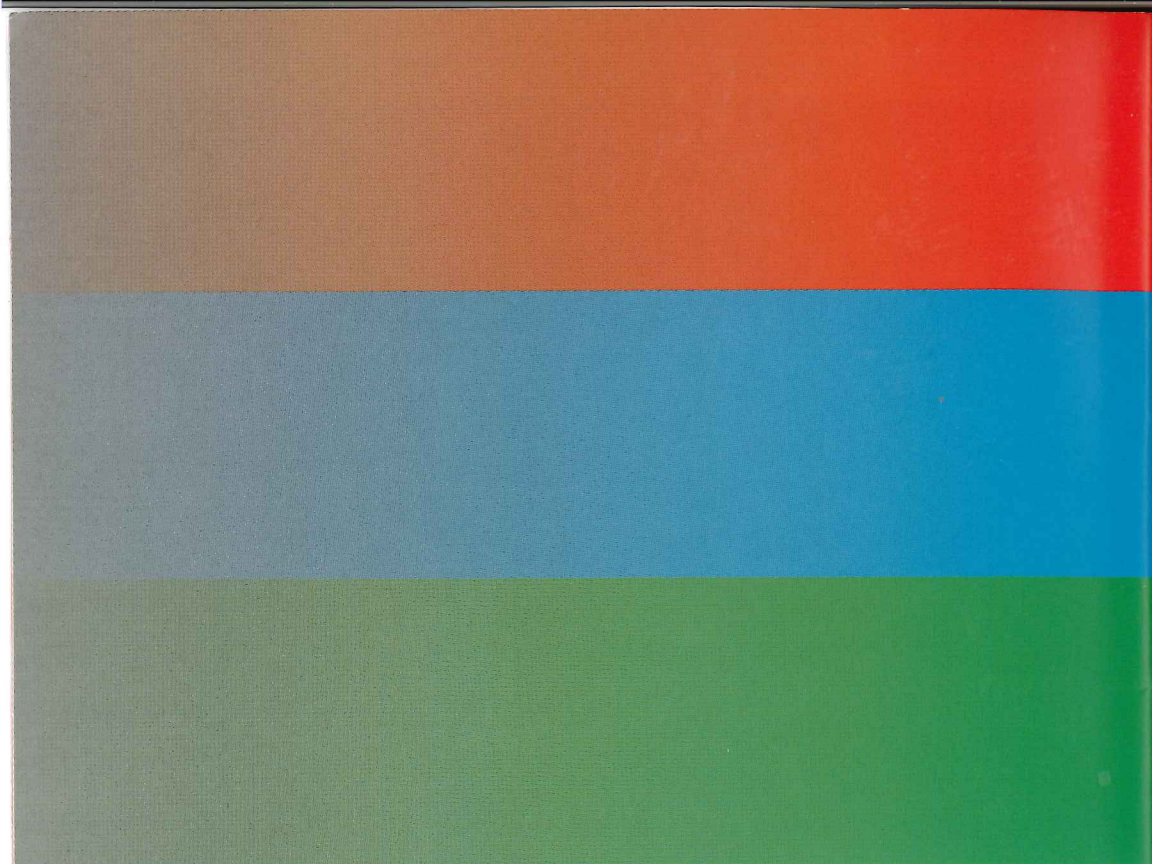
With most color deficits, the ability to discriminate between colors on the basis of hue is diminished.



**Lightness corresponds to how much light appears to be reflected from a surface in relation to nearby surfaces.**

Lightness, like hue, is a perceptual attribute that cannot be computed from physical measurements alone. It is the most important attribute in making contrast more effective.

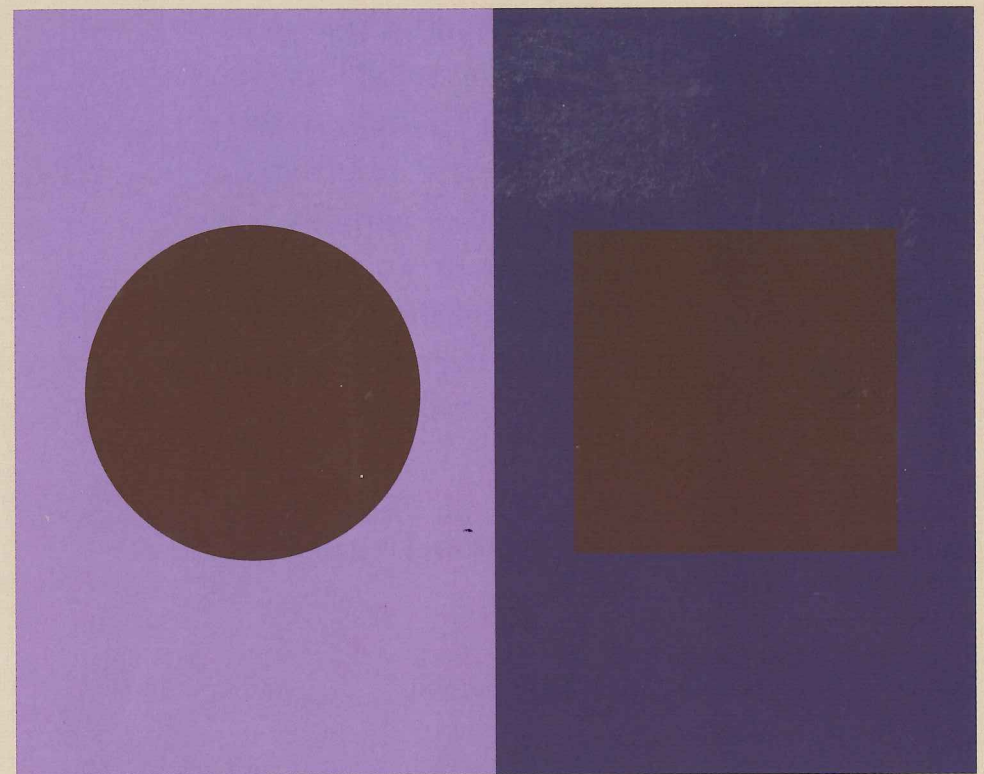
With color deficits, the ability to discriminate colors on the basis of lightness is reduced.



**Saturation is the degree of color intensity associated with a color's perceptual difference from a white, black or gray of equal lightness.**

Slate blue is an example of a desaturated color because it is similar to gray. A deep blue, even if it has the same lightness as slate blue, has greater saturation.

Congenital and acquired color deficits typically make it difficult to discriminate between colors on the basis of saturation.



**To a person with color-deficient partial sight, the left-hand panel might appear like the right-hand panel appears to a person with normal color vision.**

With color deficits, ability to discriminate colors on the basis of all three attributes – hue, lightness and saturation – is reduced. Designers can help to compensate for these deficits by making colors differ more dramatically in all three attributes.