Advanced Graphics in R: Color

Through packages, the R graphics system may be extended in a number of powerful ways. The "Graphics" taskview at CRAN documents the available packages. Today we'll focus on

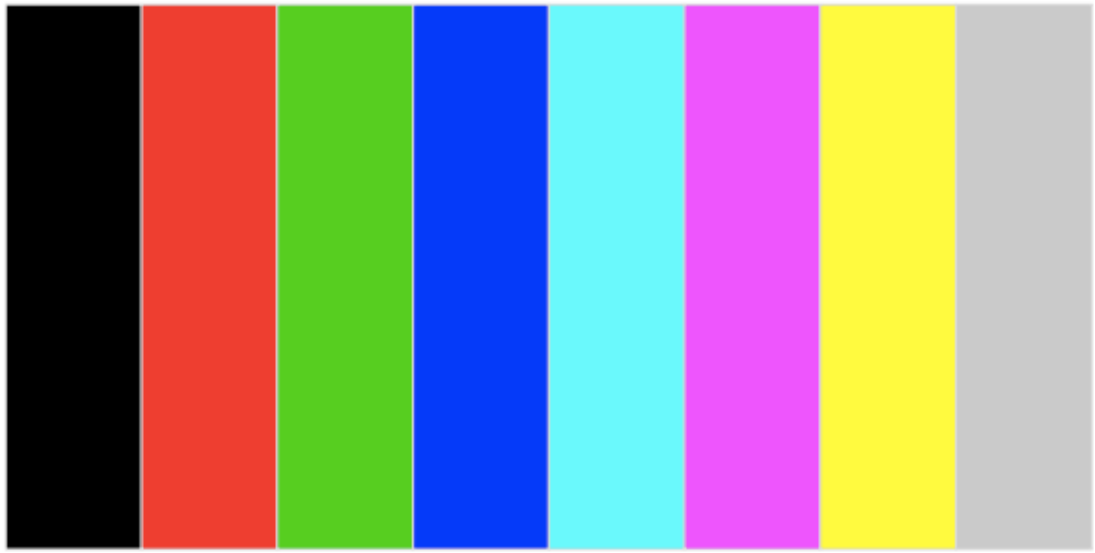
- fine control of color
- making 3D scatterplots and surfaces

You will need R packages `colorspace`, `dichromat`, `RColorBrewer`, and `scatterplot3d`, all of which are available on CRAN.

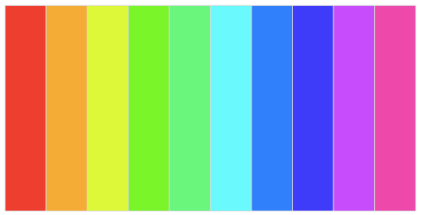
The `palette` function shows/changes the default palette.

- Called with no arguments, it shows the palette.
- Called with a character vector of colors (either names or RGB levels), it changes the palette.

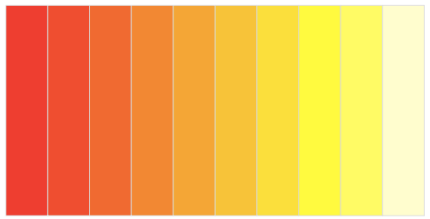
```
> palette()
[1] "black"   "red"     "green3"  "blue"    "cyan"
[6] "magenta" "yellow"  "gray"
```



There are several built-in functions for generating palettes:

rainbow 

terrain.colors 

heat.colors 

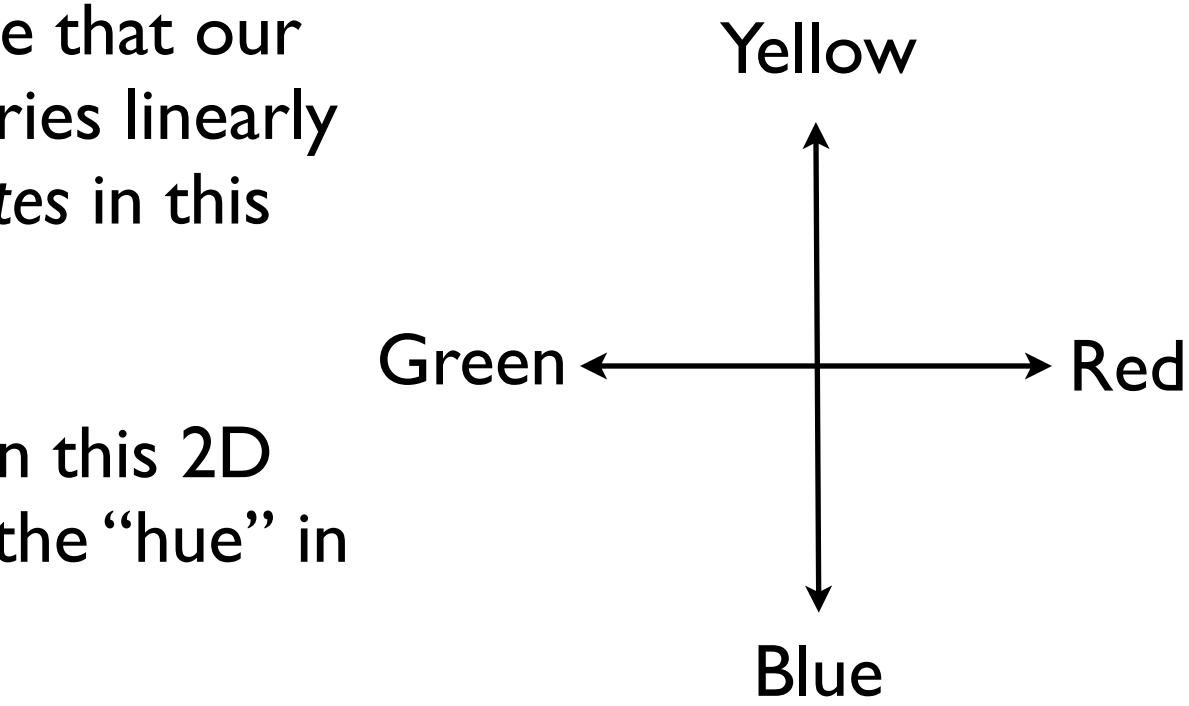
These are all built on the “hsv” parameterization of the colorspace.

A simplified summary of human color perception...

The space of human color perception is three dimensional. We can view the space as consisting of two axes, yellow-blue and green-red, as well as a "brightness" axis.

There is some evidence that our perception of color varies linearly with the *polar coordinates* in this parameterization.

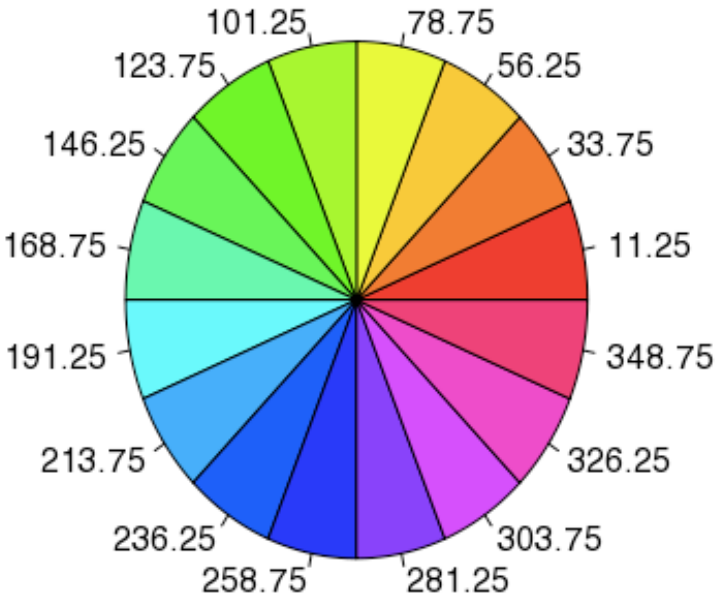
The angle of rotation in this 2D space corresponds to the "hue" in hsv parameterization.



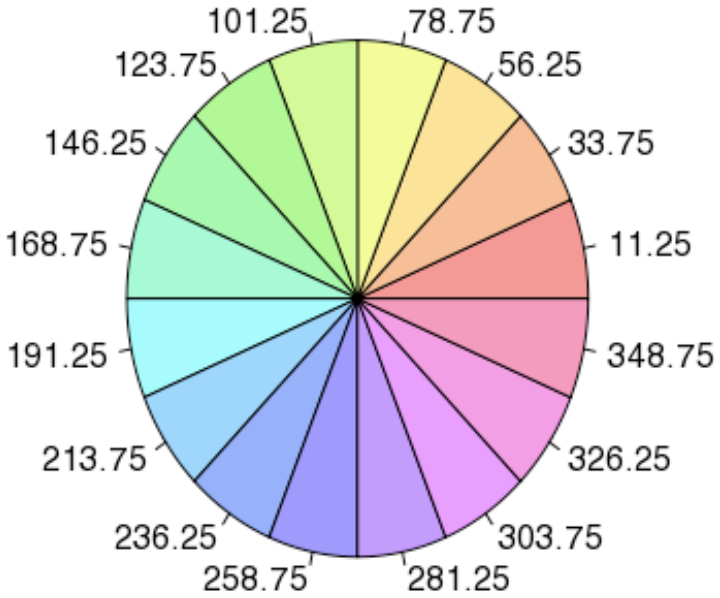
s = saturation (measure of colorfulness)
v = value (measure of brightness)

The `rainbow` function varies hue while keeping saturation and value constant.

pie(rep(1, n), col = rainbow(n), labels = vals)



pie(rep(1, n), col = rainbow(n, s = 0.5), labels = vals)

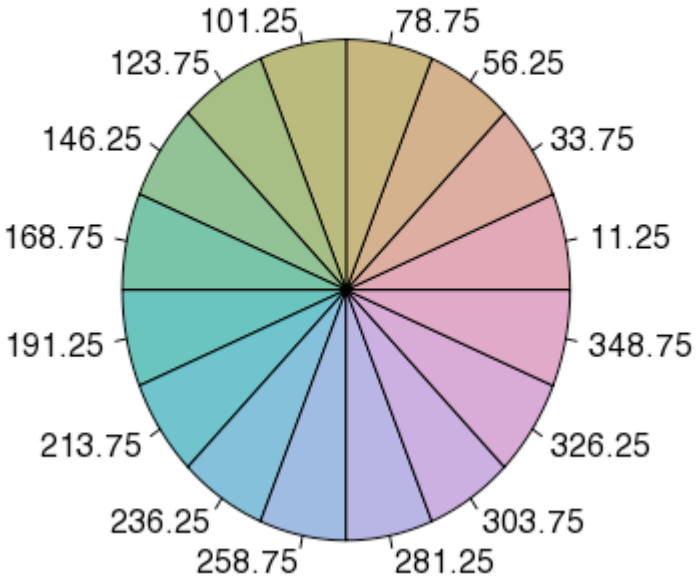


The problem with hsv is that saturation as a measure of "colorfulness" is relative. The absolute measurement is called *chroma*. Our eyes see colors with similar chroma, not saturation, as being close together.

The hcl (hue, chroma, luminance) color scale is similar to hsv, but it allows us to create colors that are more comparable from a perceptual standpoint. This is good because

- it gives equal perceptual "weight" to different groups
- it avoids optical illusions in which areas of lighter color (higher luminance) appear larger.

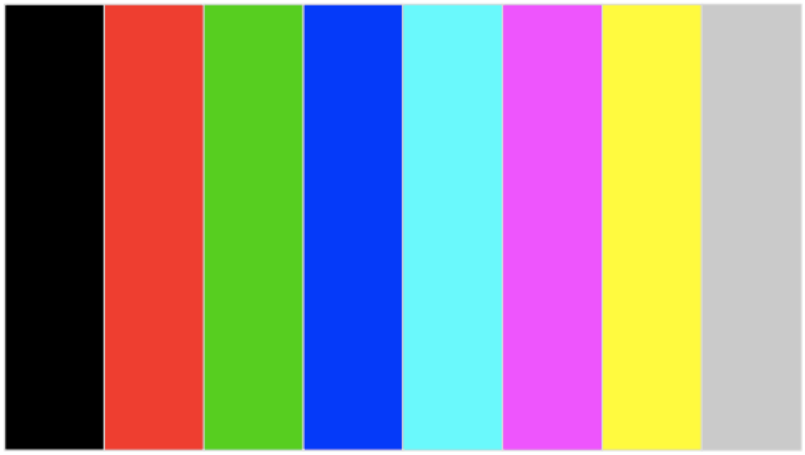
pie(rep(1, n), col = rainbow_hcl(n), labels = vals)



7-8% of men (and very few women) have some form of color blindness. The most common (> 95% of cases) is difficulty distinguishing along the red-green color axis.

The R package `dichromat` simulates the look of colors for someone who is color blind. The object `colorschemes` contains some palettes that work better.

showpal(palette())



showpal(dichromat(palette()))