Plotting and Color in R

Exploratory Data Analysis

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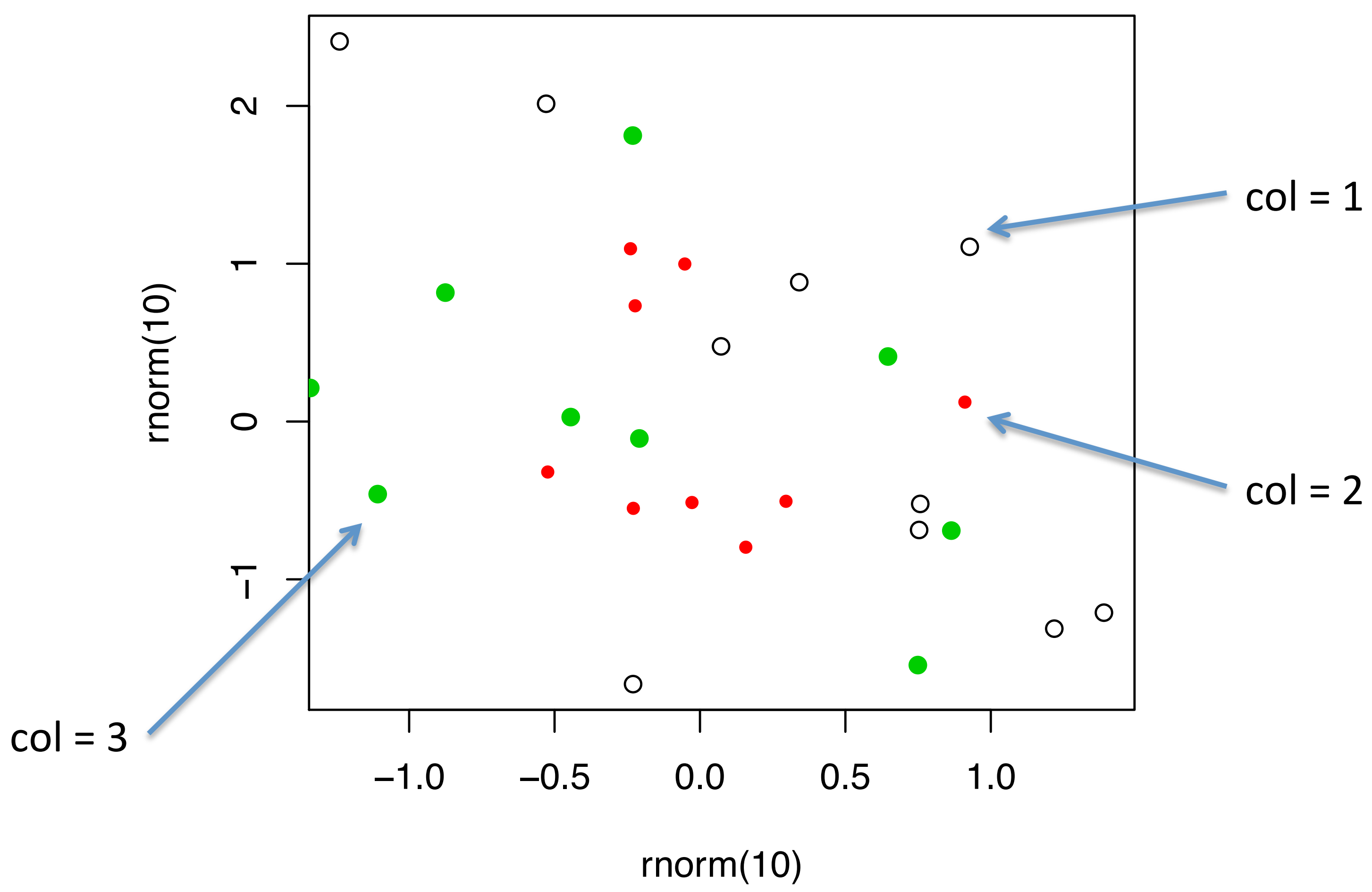
Plotting and Color

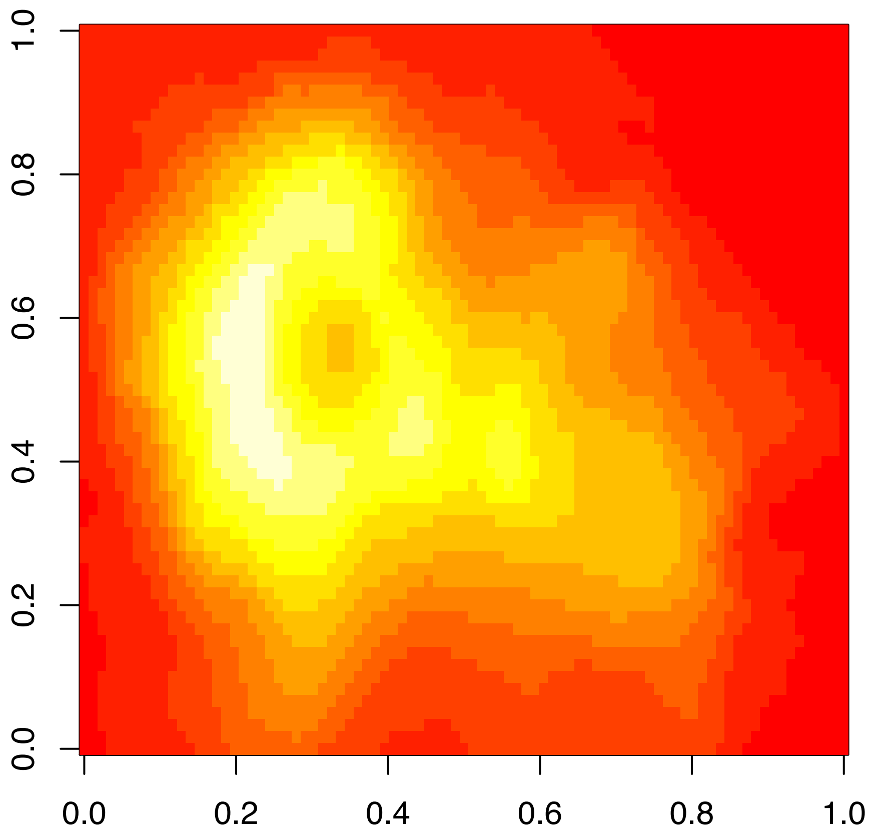
- The default color schemes for most plots in R are horrendous
  - I don't have good taste and even I know that
- Recently there have been developments to improve the handling/specification of colors in plots/graphs/etc.
- There are functions in R and in external packages that are very handy

Colors 1, 2, and 3

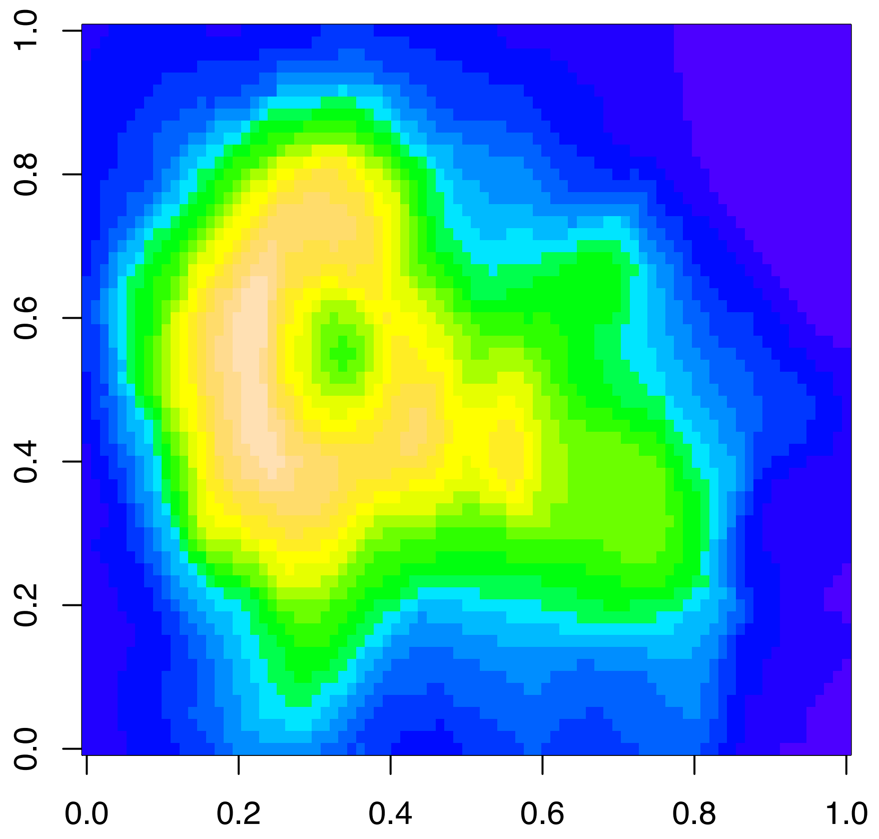


Default Image Plots in R

heat.colors()



topo.colors()



Color Utilities in R

- The **grDevices** package has two functions
  - `colorRamp`
  - `colorRampPalette`
- These functions take palettes of colors and help to interpolate between the colors
- The function `colors()` lists the names of colors you can use in any plotting function

Color Palette Utilities in R

- `colorRamp`: Take a palette of colors and return a function that takes values between 0 and 1, indicating the extremes of the color palette (e.g. see the ‘gray’ function)
- `colorRampPalette`: Take a palette of colors and return a function that takes integer arguments and returns a vector of colors interpolating the palette (like `heat.colors` or `topo.colors`)

colorRamp

```
> pal <- colorRamp(c("red", "blue"))

> pal(0)
     [,1] [,2] [,3]
[1,]  255    0    0
```

Red

Blue

Green

```
> pal(1)
     [,1] [,2] [,3]
[1,]    0    0  255

> pal(0.5)
      [,1] [,2]  [,3]
[1,] 127.5    0 127.5
```

colorRamp

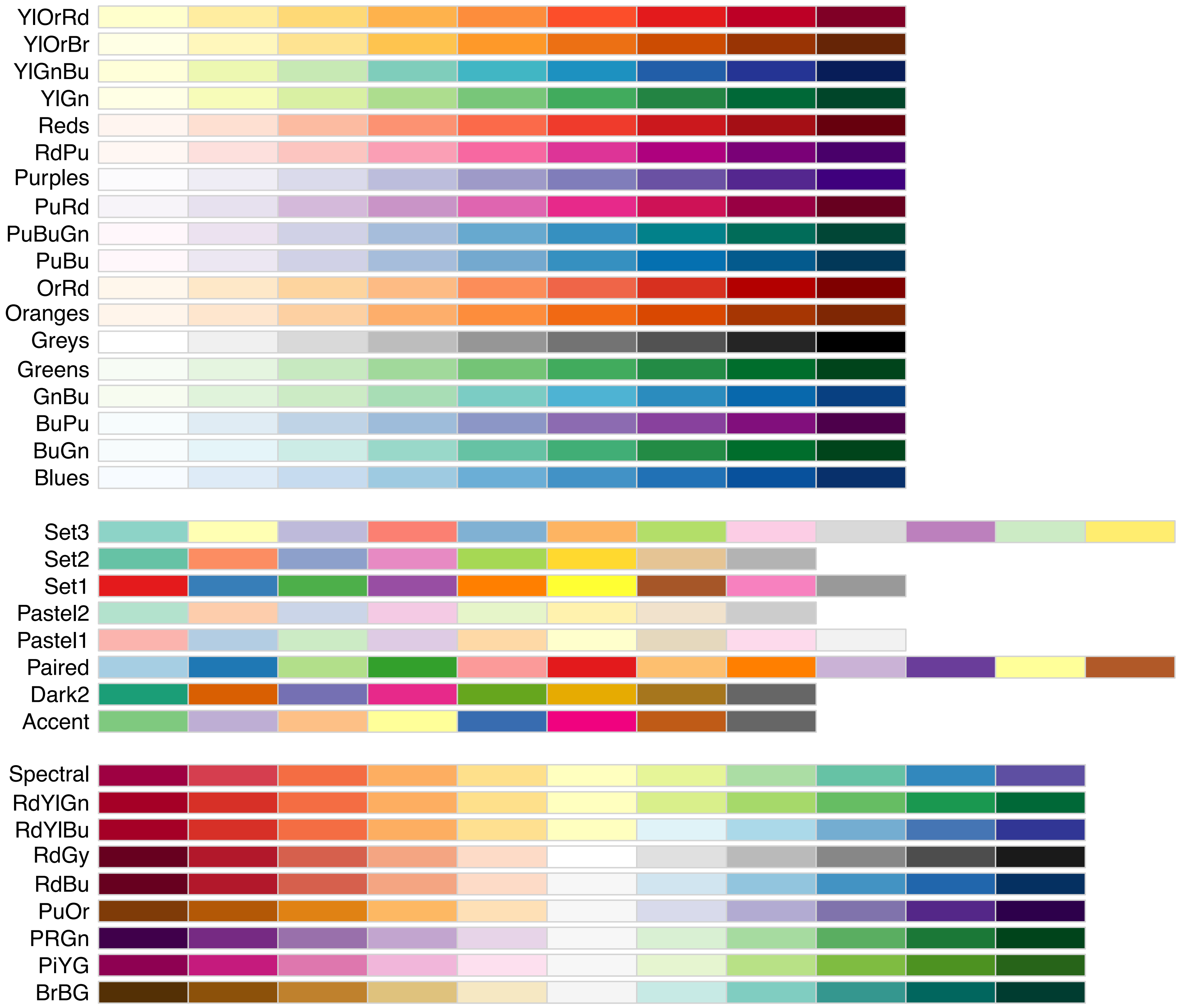
```
> pal(seq(0, 1, len = 10))
           [,1] [,2]      [,3]
 [1,] 255.00000    0   0.00000
 [2,] 226.66667    0  28.33333
 [3,] 198.33333    0  56.66667
 [4,] 170.00000    0  85.00000
 [5,] 141.66667    0 113.33333
 [6,] 113.33333    0 141.66667
 [7,]  85.00000    0 170.00000
 [8,]  56.66667    0 198.33333
 [9,]  28.33333    0 226.66667
[10,]   0.00000    0 255.00000
```

colorRampPalette

```
> pal <- colorRampPalette(c("red", "yellow"))

> pal(2)
[1] "#FF0000" "#FFFF00"

> pal(10)
 [1] "#FF0000" "#FF1C00" "#FF3800" "#FF5500" "#FF7100"
 [6] "#FF8D00" "#FFAA00" "#FFC600" "#FFE200" "#FFFF00”
```

RColorBrewer Package

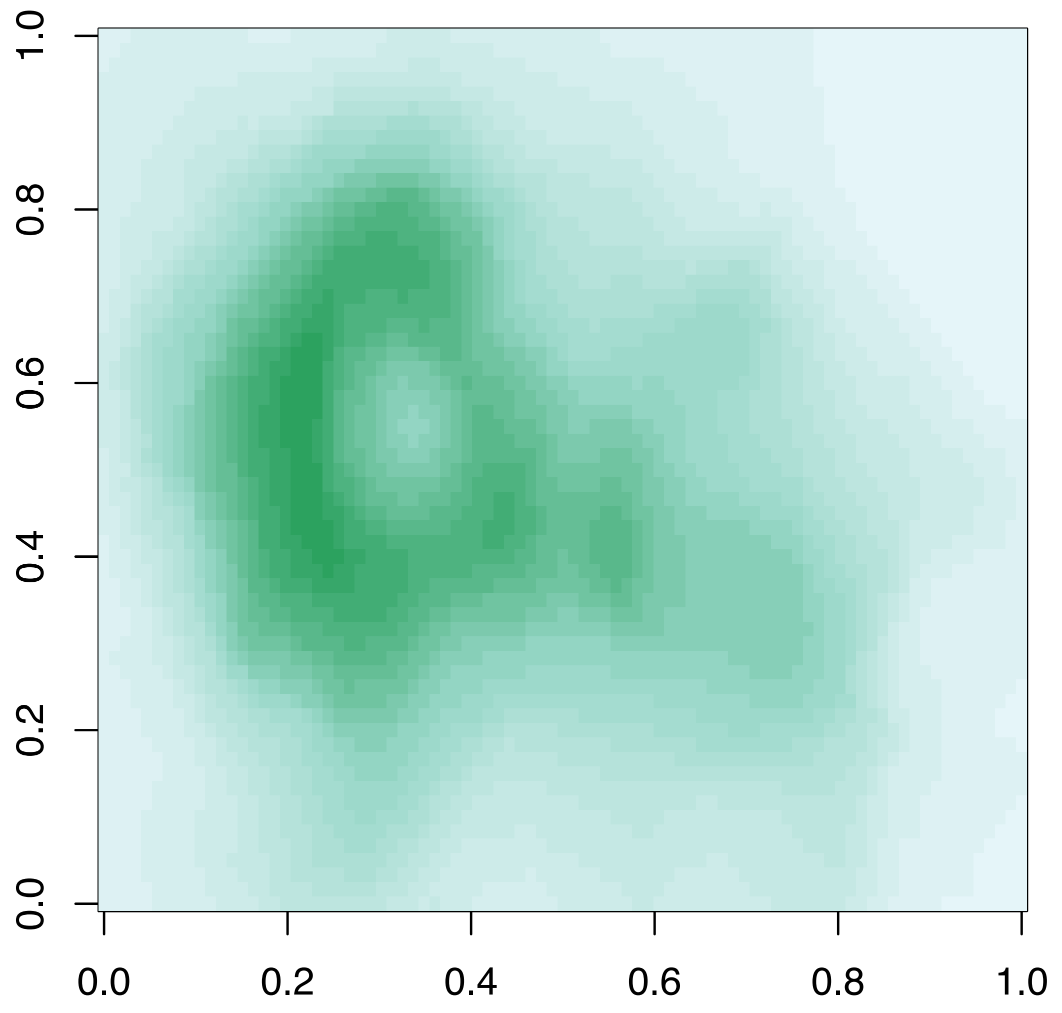
- One package on CRAN that contains interesting/useful color palettes
- There are 3 types of palettes
  - Sequential
  - Diverging
  - Qualitative
- Palette information can be used in conjunction with the `colorRamp()` and `colorRampPalette()`


YlOrRd
YlOrBr
YlGnBu
YlGn
Reds
RdPu
Purples
PuRd
PuBuGn
PuBu
OrRd
Oranges
Greys
Greens
GnBu
BuPu
BuGn
Blues
Set3
Set2
Set1
Pastel2
Pastel1
Paired
Dark2
Accent
Spectral
RdYlGn
RdYlBu
RdGy
RdBu
PuOr
PRGn
PiYG
BrBG

RColorBrewer and colorRampPalette

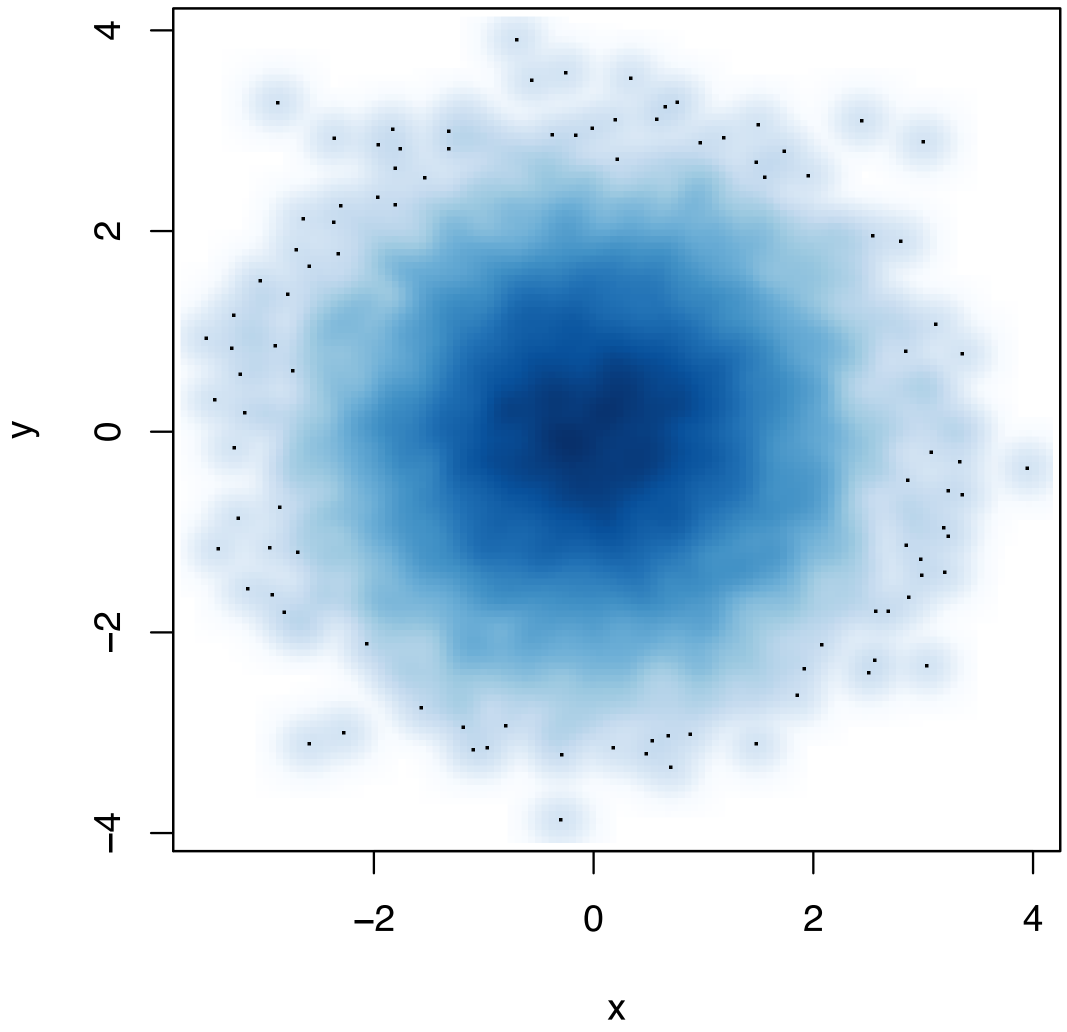
```
> library(RColorBrewer)

> cols <- brewer.pal(3, "BuGn")

> cols
[1] "#E5F5F9" "#99D8C9" "#2CA25F"

> pal <- colorRampPalette(cols)

> image(volcano, col = pal(20))
```

RColorBrewer and colorRampPalette



The smoothScatter function

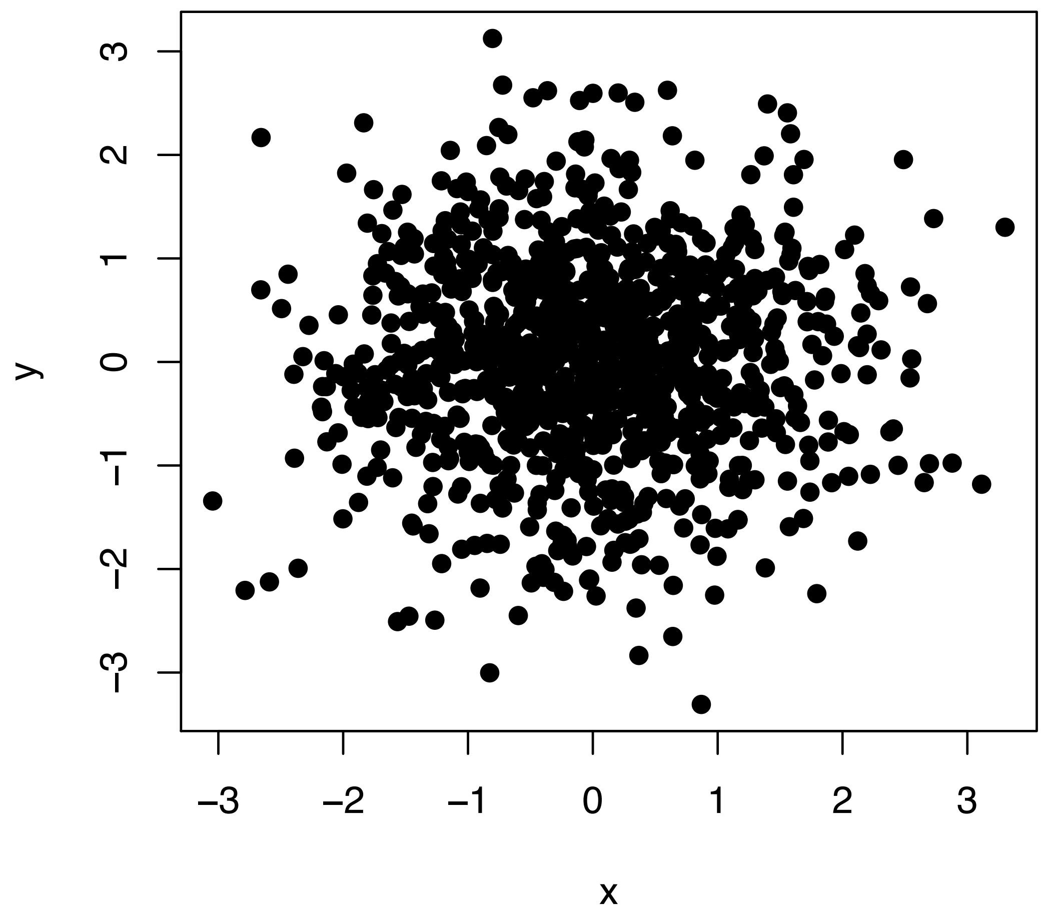
```
x <- rnorm(10000)
y <- rnorm(10000)
smoothScatter(x, y)
```



Some Other Plotting Notes

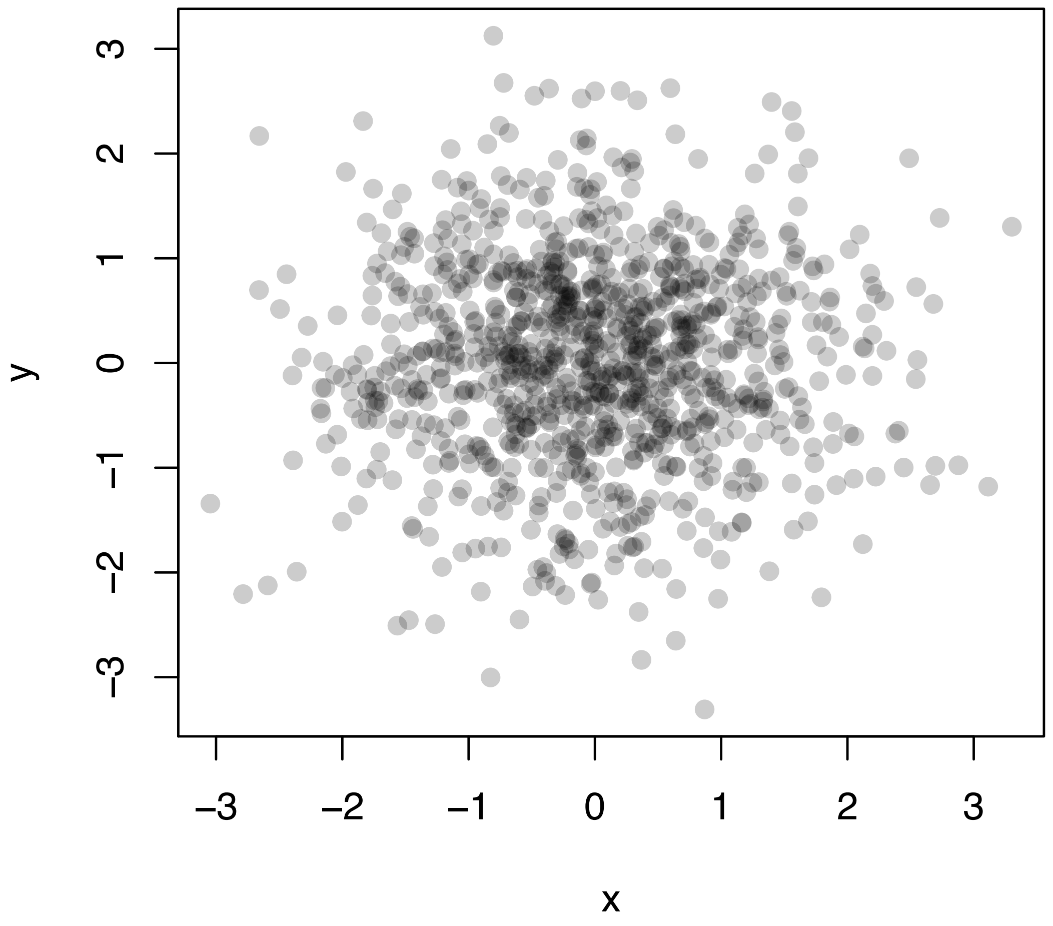
- The `rgb` function can be used to produce any color via red, green, blue proportions
- Color transparency can be added via the `alpha` parameter to `rgb`
- The **colorspace** package can be used for a different control over colors

Scatterplot with no transparency



```
plot(x, y, pch = 19)
```

Scatterplot with transparency



```
plot(x, y, col = rgb(0, 0, 0, 0.2), pch = 19)
```

Summary

- Careful use of colors in plots/maps/etc. can make it easier for the reader to get what you're trying to say (why make it harder?)
- The **RColorBrewer** package is an R package that provides color palettes for sequential, categorical, and diverging data
- The `colorRamp` and `colorRampPalette` functions can be used in conjunction with color palettes to connect data to colors
- Transparency can sometimes be used to clarify plots with many points