

Using Color in R

Stowers Institute for Medical Research
R/Bioconductor Discussion Group

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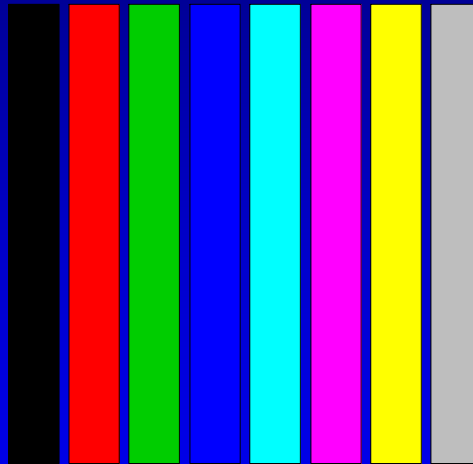
Using Color in R

- Color Basics in R
- Color Spaces
- Color Gradients / Color Ramps
- Color Blindness
- Why Don't Screen Colors Match Printout?
- Colors Tips

Using Color in R

Color Basics: Palette

```
> barplot(rep(1,8), yaxt="n", col=1:8)
```



```
> palette()
```

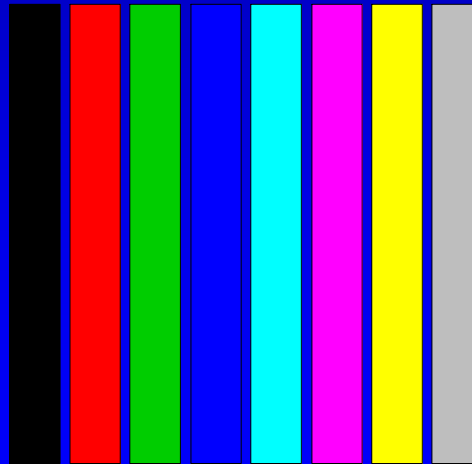
```
[1] "black"    "red"      "green3"   "blue"     "cyan"
```

```
[6] "magenta"  "yellow"   "gray"
```

Using Color in R

Color Basics: Palette

```
> barplot(rep(1,8), yaxt="n", col=1:8)
> barplot(rep(1,8), yaxt="n", col=palette())
> barplot(rep(1,8), yaxt="n",
  col=c("black", "red", "green3", "blue",
        "cyan", "magenta", "yellow", "gray"))
```



Integer color numbers represent offsets into the palette table

Using Color in R

Color Basics: Palette

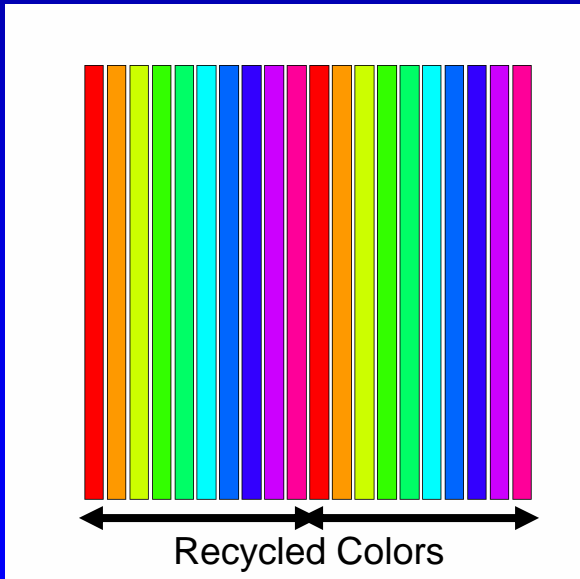
```
> palette(rainbow(10)) # Redefine palette
> palette()
[1] "red"      "#FF9900" "#CCFF00" "#33FF00" "#00FF66"
[6] "cyan"     "#0066FF" "#3300FF" "#CC00FF" "#FF0099"
> # colors are "recycled" if necessary
> barplot(rep(1,20),col=1:20, yaxt="n")

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

Color Names

RGB Hex Constants

Cut/Paste Bitmap



Recycled Colors

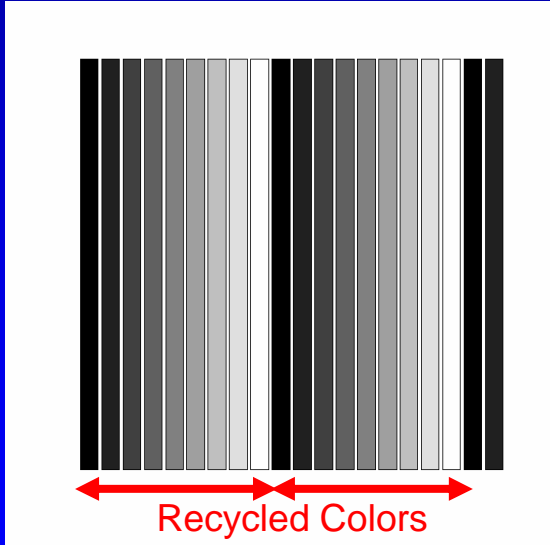
Specify number of colors with `rainbow`

Using Color in R

Color Basics: Palette

```
> 0:8 / 8
[1] 0.000 0.125 0.250 0.375 0.500 0.625 0.750 0.875 1.000
> palette(gray(0:8 / 8))
> palette()
[1] "black"      "#202020" "gray25"   "#606060" "#808080"
[6] "#9F9F9F" "gray75"   "#DFDFDF" "white"
> # colors are "recycled" if necessary
> barplot(rep(1,20),col=1:20, yaxt="n")
>
> palette("default")
> palette()
[1] "black"      "red"      "green3"
     "blue"      "cyan"
[6] "magenta"   "yellow"   "gray"
```

RGB Hex Constants



Specify vector of floats 0.0 to 1.0 with grey / gray 6

Using Color in R

Color Basics: Color Names

```
> colors() # or colours()
 [1] "white"           "aliceblue"       "antiquewhite"
 [4] "antiquewhite1"  "antiquewhite2"  "antiquewhite3"

 [655] "yellow3"         "yellow4"         "yellowgreen"

> colors()[grep("red", colors())]
 [1] "darkred"          "indianred"       "indianred1"
 [4] "indianred2"      "indianred3"      "indianred4"
 [7] "mediumvioletred" "orangered"       "orangered1"
[10] "orangered2"      "orangered3"      "orangered4"
[13] "palevioletred"   "palevioletred1"  "palevioletred2"
[16] "palevioletred3"  "palevioletred4"  "red"
[19] "red1"            "red2"            "red3"
[22] "red4"            "violetred"       "violetred1"
[25] "violetred2"      "violetred3"      "violetred4"
```

Color names from C:\Program Files\R\R-2.5.1\etc\rgb.txt

Using Color in R

Color Basics: Color Names

R colors

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225
226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250
251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275
276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300
301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325
326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350
351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375
376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400
401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425
426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450
451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475
476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500
501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525
526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550
551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575
576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600
601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625
626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650
651	652	653	654	655	656	657																		

<http://research.stowers-institute.org/efg/R/Color/Chart/index.htm>

Using Color in R

Color Basics: Color Names

R colors

1 white	#FFFFFF	255 255 255	51 chartreuse4	#458B00	69 139 0
2 aliceblue	#F0F8FF	240 248 255	52 chocolate	#D2691E	210 105 30
3 antiquewhite	#FAEBD7	250 235 215	53 chocolate1	#FF7F24	255 127 36
4 antiquewhite1	#FDF5E6	255 239 219	54 chocolate2	#EE7621	238 118 33
5 antiquewhite2	#EEDFC8	238 223 204	55 chocolate3	#CD661D	205 102 29
6 antiquewhite3	#CDC0B0	205 192 176	56 chocolate4	#8B4513	139 69 19
7 antiquewhite4	#8B8378	139 131 120	57 coral	#FF7F50	255 127 80
8 aquamarine	#7FFFD4	127 255 212	58 coral1	#FF7256	255 114 86
9 aquamarine1	#7FFFD4	127 255 212	59 coral2	#EE6A50	238 106 80
10 aquamarine2	#76EEC6	118 238 198	60 coral3	#CD5B45	205 91 69
11 aquamarine3	#66CDAA	102 205 170	61 coral4	#8B3B2F	139 62 47
12 aquamarine4	#458B74	69 139 116	62 cornflowerblue	#6495ED	100 149 237
13 azure	#F0FFFF	240 255 255	63 cornsilk	#FFF9DC	255 248 220
14 azure1	#F0FFFF	240 255 255	64 cornsilk1	#FFF9DC	255 248 220
15 azure2	#E0EEEE	224 238 238	65 cornsilk2	#EEB8CD	238 232 205
16 azure3	#C1CDCD	193 205 205	66 cornsilk3	#CDC9B1	205 200 177
17 azure4	#838B8B	131 139 139	67 cornsilk4	#8B8378	139 136 120
18 beige	#F5F5DC	245 245 220	68 cyan	#00FFFF	0 255 255
19 bisque	#FFE4C4	255 228 196	69 cyan1	#00FFFF	0 255 255
20 bisque1	#FFE4C4	255 228 196	70 cyan2	#00EEEE	0 238 238
21 bisque2	#EED5B7	238 213 183	71 cyan3	#00CDCD	0 205 205
22 bisque3	#CDB79E	205 183 158	72 cyan4	#008B8B	0 139 139
23 bisque4	#8B7D5B	139 125 107	73 darkblue	#00008B	0 0 139
24 black	#000000	0 0 0	74 darkcyan	#008B8B	0 139 139
25 blanchedalmond	#FFEBCD	255 235 205	75 darkgoldenrod	#8B603B	184 134 11
26 blue	#0000FF	0 0 255	76 darkgoldenrod1	#FFB90F	255 185 15
27 blue1	#0000FF	0 0 255	77 darkgoldenrod2	#EEAD0E	238 173 14
28 blue2	#00008B	0 0 139	78 darkgoldenrod3	#CD950C	205 149 12
29 blue3	#0000CD	0 0 205	79 darkgoldenrod4	#8B6508	139 101 8
30 blue4	#00008B	0 0 139	80 darkgray	#A9A9A9	169 169 169

Alphabetical
except first
color, which is
white

Print seven page table to compare screen colors with printed colors.
<http://research.stowers-institute.org/efg/R/Color/Chart/ColorChart.pdf>

Using Color in R

Color Basics: Hex Constants

Hex	Decimal	Index	Color Name	#rrggbb	red	green	blue	
0	0	1	white	#FFFFFF	255	255	255	"Unsaturated" shades of gray
1	1	203	gray50	#7F7F7F	127	127	127	
2	2	24	black	#000000	0	0	0	
3	3							
4	4							
5	5							
6	6	26	blue	#0000FF	0	0	255	"Saturated" Primary Colors
7	7	254	green	#00FF00	0	255	0	
8	8	552	red	#FF0000	255	0	0	
9	9							
A	10							
B	11							
C	12							
D	13							
E	14							
F	15							

Hex "FF" = $15 \cdot 16^1 + 15 \cdot 16^0 = 255$

Hex "00" to "FF" can be interpreted as 0.0 to 1.0.

Numbers represented in "base 16" are called "hexadecimal".

Hex "FF" is largest value represented by one byte (8 bits).

Using Color in R

Color Basics

In R Color can be represented by

- index into palette
- color name
- hex constant (24-bit "True Color":
 256^3 colors = 16,777,216 colors)

Using Color in R

Color Basics

In R many objects can take on different colors:

- points
- lines
- axes
- text
- legends
- background

Using Color in R

Color Basics: Points

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

```
> x <- -2:2 Five (x,y) points to plot
```

```
> y <- x^2
```

```
# Equivalent point colors
```

```
> plot(x,y, col=1:5,
       pch=CIRCLE<-16, cex=2)
```

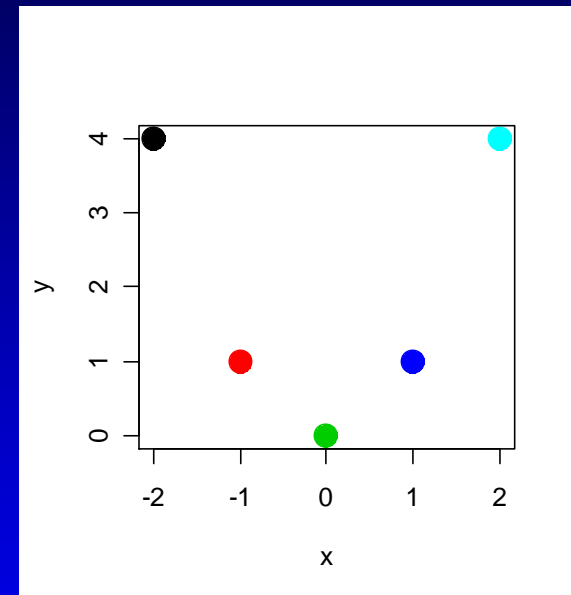
```
> plot(x,y,
       col=c("black", "red", "green3", "blue", "cyan"),
       pch=CIRCLE, cex=2)
```

```
> plot(x,y,
       col=c("#000000", "#FF0000", "green3", 4, 5),
       pch=CIRCLE, cex=2)
```

↑
Hex #rrggbb

↑
Color name

↑
Palette Index

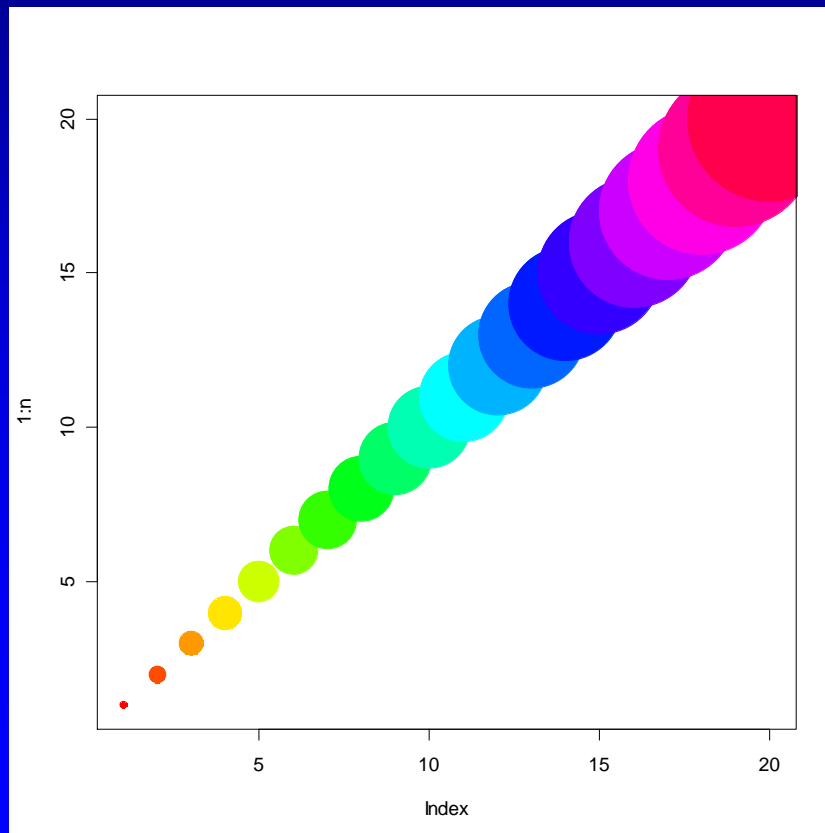


Using Color in R

Color Basics: Points

```
n <- 20
```

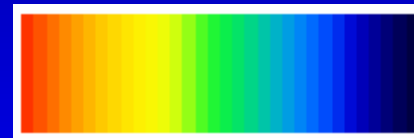
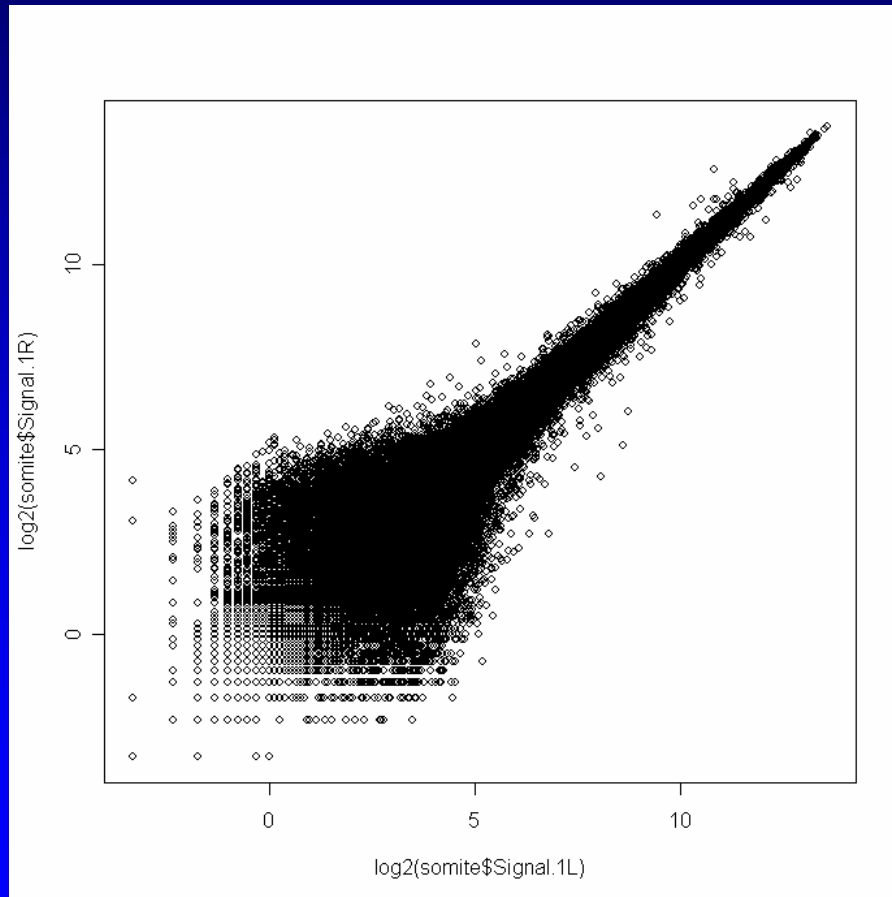
```
plot(1:n, pch=CIRCLE<-16, cex=1:n, col=rainbow(n))
```



Using Color in R

Color Basics: Points

```
> plot(log2(somite$Signal.1L), log2(somite$Signal.1R))
```



p=0

p=1

```
> library(gplots)  
> palette(rev(rich.colors(32)))
```

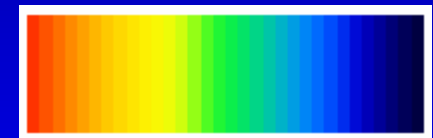
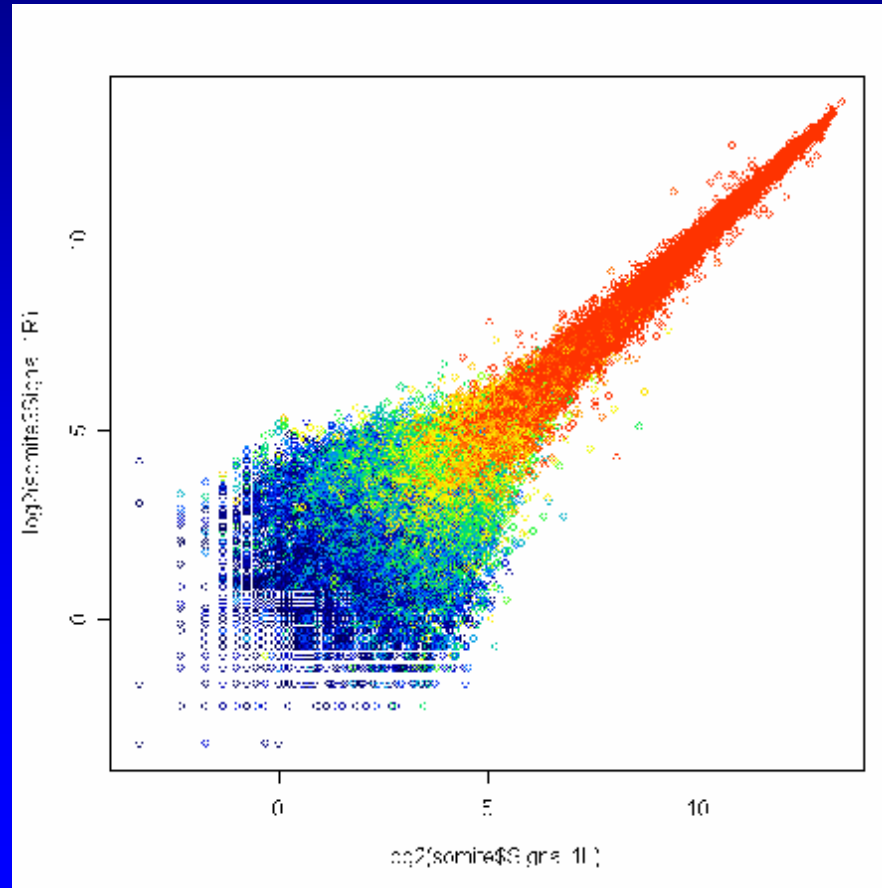
Colors 1 to 32

How to associate color with p-values at each point?

Using Color in R

Color Basics: Points

```
> palette( rev(rich.colors(32)) ) # colors: 1 to 32  
> plot(log2(somite$Signal.1L), log2(somite$Signal.1R),  
       col=1 + 31*somite$worst.p) # col values from 1 to 32
```

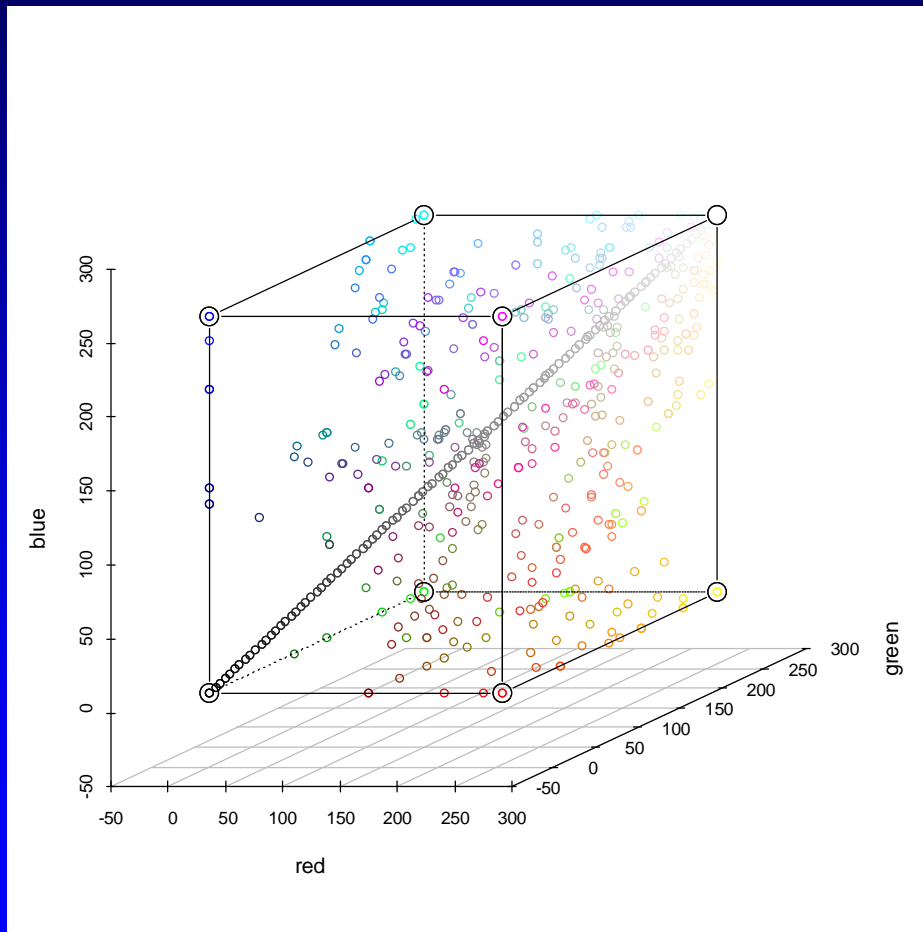


$p=0$

$p=1$

Using Color in R

Color Basics: Points and Lines



```
library(scatterplot3d)  
?scatterplot3d  
# Example 6
```

Red-Green-Blue 3D Plot of colors()

Using Color in R

Color Basics: Axes and Text

```
BOTTOM <- 1
LEFT <- 2
TOP <- 3
RIGHT <- 4

par(col.lab="orange", col.main="gray")

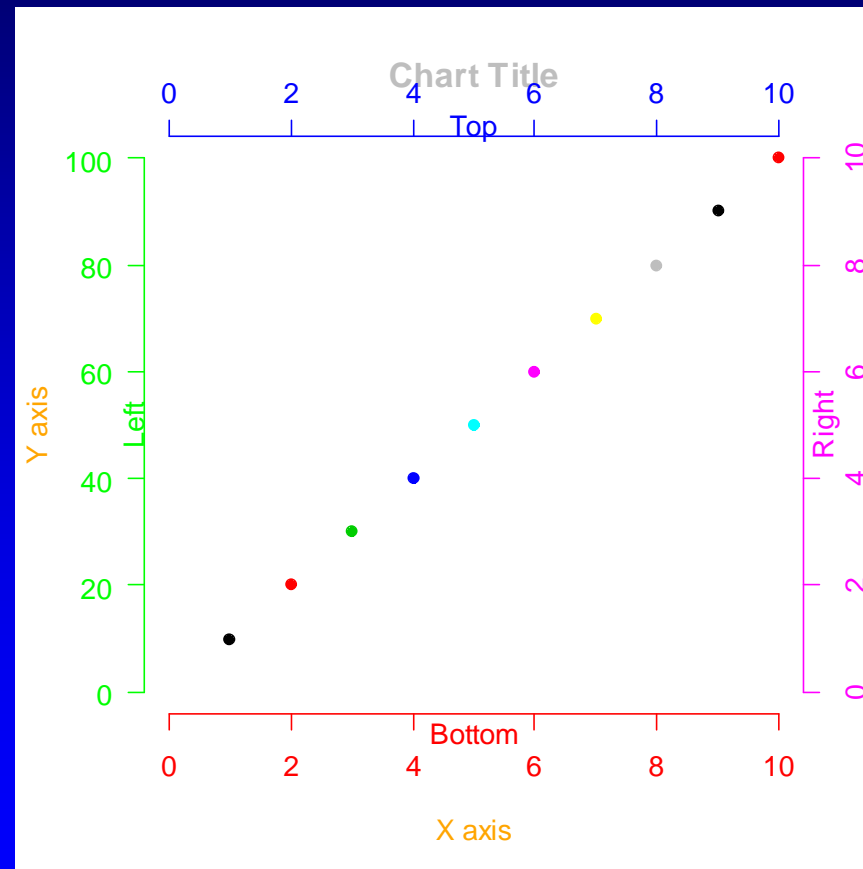
plot(0:10,0:10, col=0:10, pch=CIRCLE<-16,
     main="Chart Title", axes=FALSE,
     xlab="X axis",ylab="Y axis")

# Margin Text
mtext("Bottom", BOTTOM, col="red")
mtext("Left", LEFT, col="green")
mtext("Top", TOP, col="blue")
mtext("Right", RIGHT, col="magenta")

axis(BOTTOM, col="red",
     col.axis="red") # 2, ... 10 in red

AXIS_LABEL_HORIZONTAL <- 1
axis(LEFT, col="green", col.axis="green",
     at=2*0:5, labels=paste(20*0:5),
     las=AXIS_LABEL_HORIZONTAL)

axis(TOP, col="blue", col.axis="blue")
axis(RIGHT, col="magenta", col.axis="magenta")
```



Using Color in R

Color Basics: Legends

```
Time <- 0:120

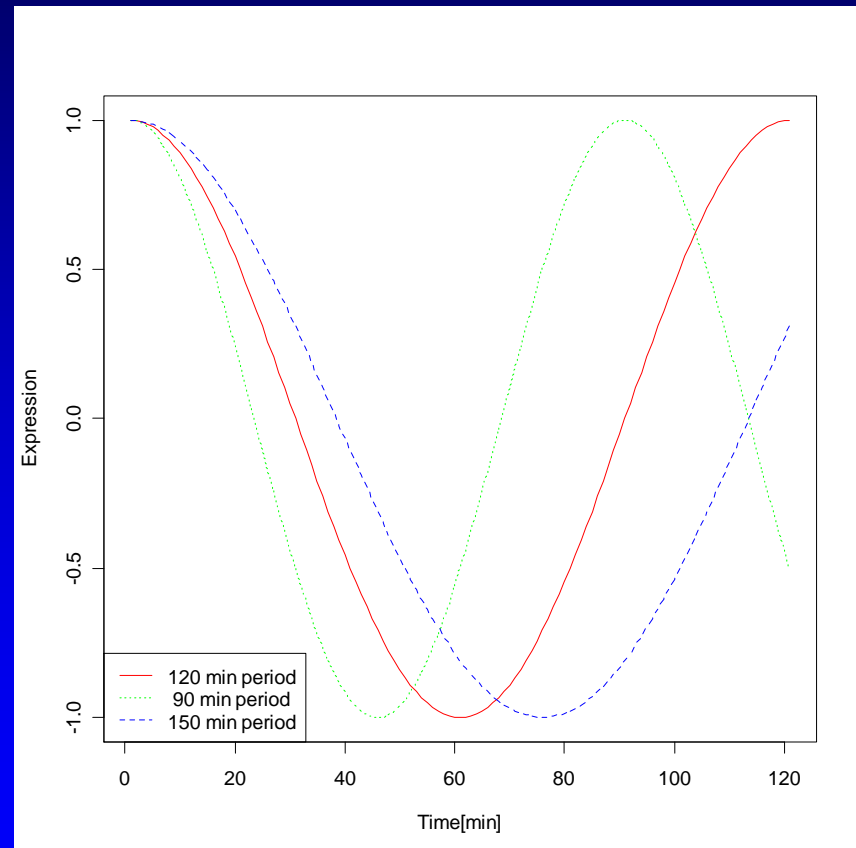
Period1 <- cos(2*pi*Time/120)
Period2 <- cos(2*pi*Time/90)
Period3 <- cos(2*pi*Time/150)

COLORS <- c("red", "green", "blue")
LINE.TYPES <- c("solid", "dotted", "dashed")

Periods <- data.frame( Period1=Period1,
                        Period2=Period2,
                        Period3=Period3)

matplot(Periods, type = "l",
        xlab="Time[min]", ylab="Expression",
        col = COLORS, lty = LINE.TYPES)

legend("bottomleft",
      c("120 min period", " 90 min period",
        "150 min period"),
      col = COLORS, lty = LINE.TYPES)
```

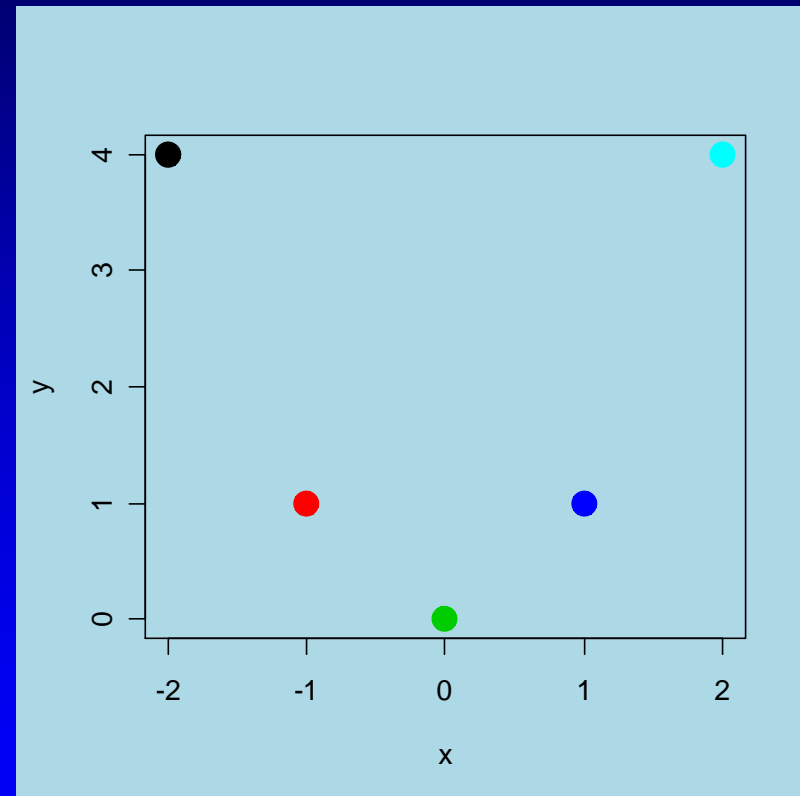


Using Color in R

Color Basics: Background

```
par(bg="light blue")  
  
x <- -2:2  
y <- x^2  
  
plot(x,y, col=1:5,  
      pch=CIRCLE<-16,cex=2)
```

R's default background color is "transparent."



*Set graphic background to simplify cutting and pasting to PowerPoint!
Avoids in PowerPoint: Format Picture | Colors and Lines | Fill Color*

Using Color in R

- Color Basics in R
- Color Spaces
- Color Gradients / Color Ramps
- Color Blindness
- Why Don't Screen Colors Match Printout?
- Colors Tips

Using Color in R

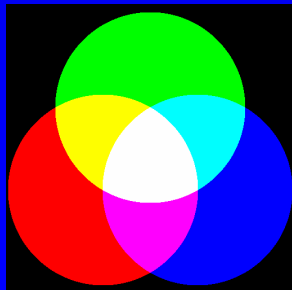
Color Space: RGB Color Model

```
> rgb(1,0,0)
[1] "#FF0000"
> rgb(0,1,0)
[1] "#00FF00"
> rgb(1,1,0)
[1] "#FFFF00"
```

```
> rgb(255,0,0, maxColorValue=255)
[1] "#FF0000"
```

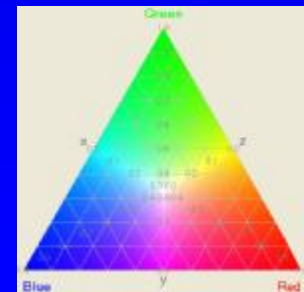
```
> col2rgb(c("blue", "yellow"))
```

```
      [,1] [,2]
red      0 255
green    0 255
blue    255  0
```



	#rrggbb	R	G	B
26 blue	#0000FF	0	0	255
254 green	#00FF00	0	255	0
552 red	#FF0000	255	0	0
450 magenta	#FF00FF	255	0	255
652 yellow	#FFFF00	255	255	0
68 cyan	#00FFFF	0	255	255

*Color is additive in the RGB Color Model.
Coordinate values not always obvious.*



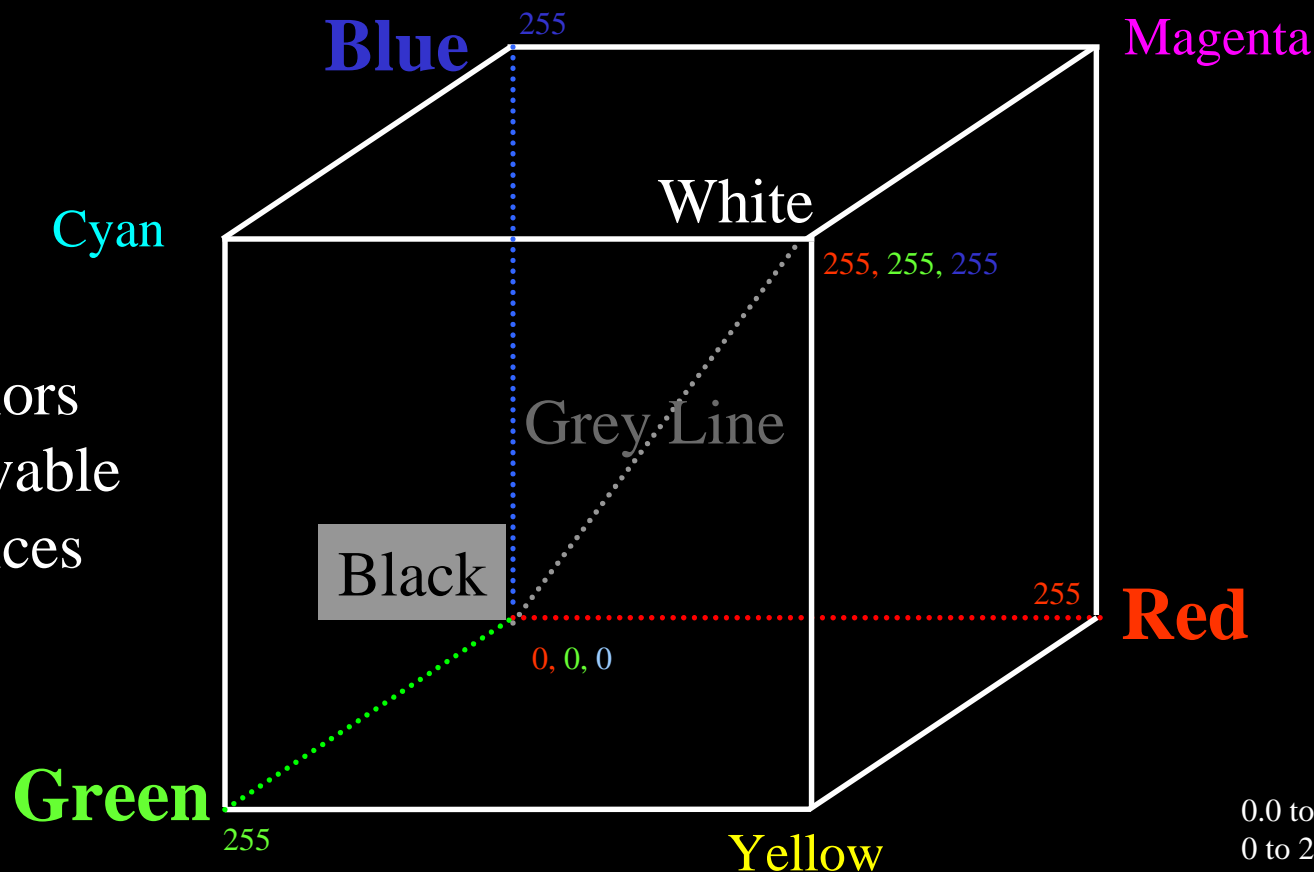
Using Color in R

Red-Green-Blue Color Cube

R = 0 to 255

G = 0 to 255

B = 0 to 255



Not all colors
are perceivable
on all devices

24-bit graphics:
 $256 \times 256 \times 256 = 16,777,216$ colors
256 shades of grey

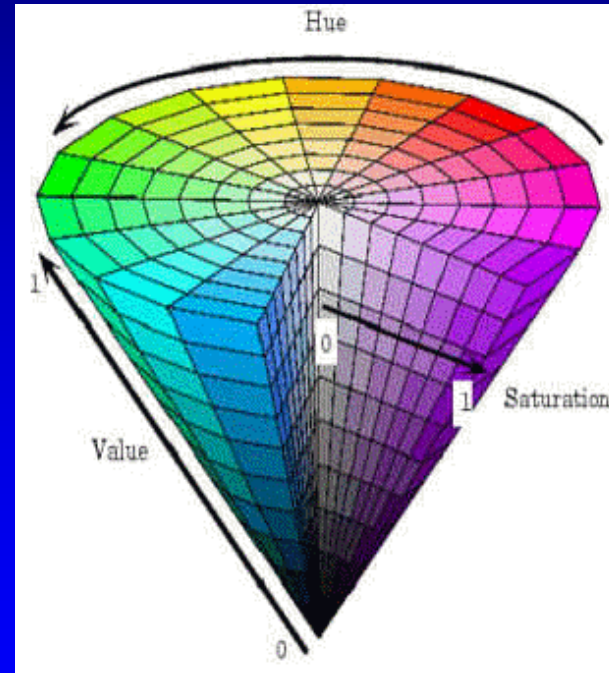
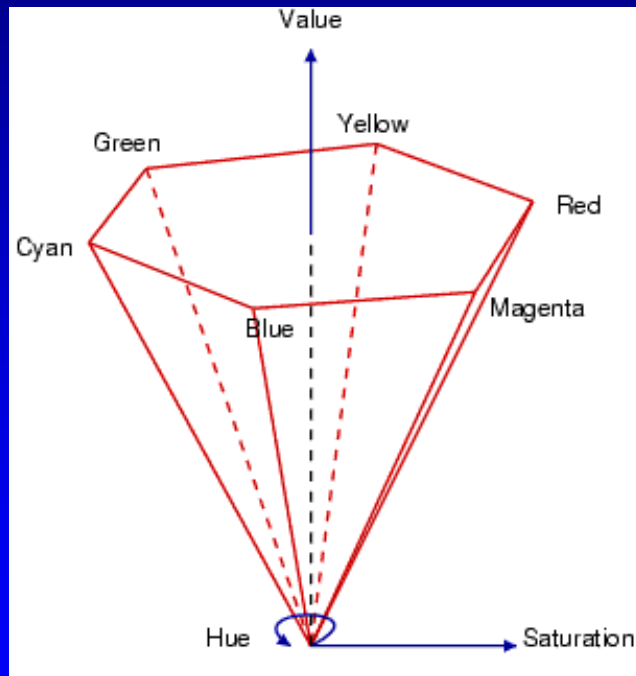
Contrasting Colors?

Using Color in R

Color Space: HSV

Hue-Saturation-Value

Match perception of color better than RGB



Source: <http://scien.stanford.edu/class/psych221/projects/02/sojeong/>

Using Color in R

Color Space: HSV

Hue-Saturation-Value

```
> hsv(1,1,1)
[1] "#FF0000"
```

```
> hsv(1/3,1,1)
[1] "#00FF00"
```

```
> hsv(2/3,1,1)
[1] "#0000FF"
```

```
hue <- seq(0.0, 1.0, by=1/40)
```

```
pie(rep(1,40),
     labels=formatC(hue, digits=3,
                    format="f"),
```

```
     cex=0.75,
     col=hsv(hue, 1.0, 1.0),
     radius=1.0,
     main="HSV (S=1, V=1)" )
```

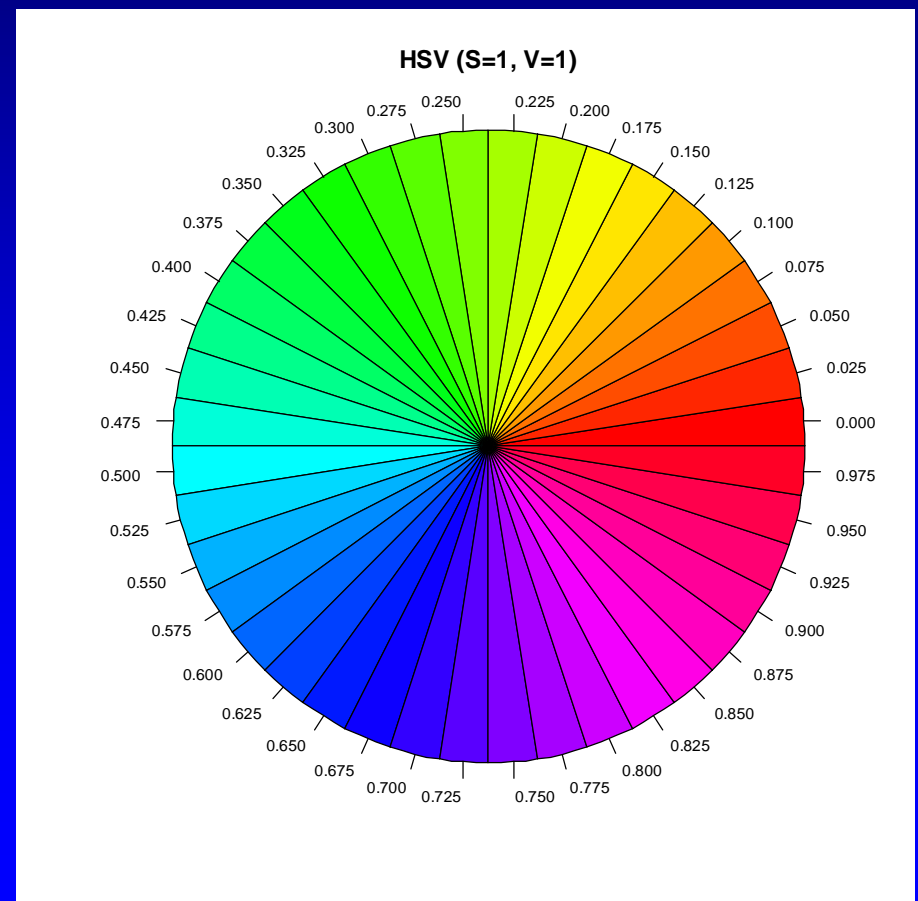
```
> rgb2hsv(col2rgb("blue"))
      [,1]
```

```
h 0.6666667
```

```
s 1.0000000
```

```
v 1.0000000
```

Contrasting Colors?



Using Color in R

Color Spaces

help(package=colospace)

```
HSV          Create HSV Colors
LAB          Create LAB Colors
LUV         Create LUV Colors
RGB         Create RGB Colors
XYZ         Create XYZ Colors
color-class  Class "color"
coords      Extract the numerical coordinates of a color
hex         Convert Colors To Hexadecimal Strings
hex2RGB     Convert Hexadecimal Color Specifications To RGB
           Objects
mixcolor    Compute the convex combination of two colors
polarLAB    Create polarLAB Colors
polarLUV    Create polarLUV Colors
readRGB     Read RGB Color Descriptions
readhex     Read Hexadecimal Color Descriptions
writehex    Write Hexadecimal Color Descriptions
```

Using Color in R

- Color Basics in R
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- Color Blindness
- Why Don't Screen Colors Match Printout?
- Colors Tips

Using Color in R

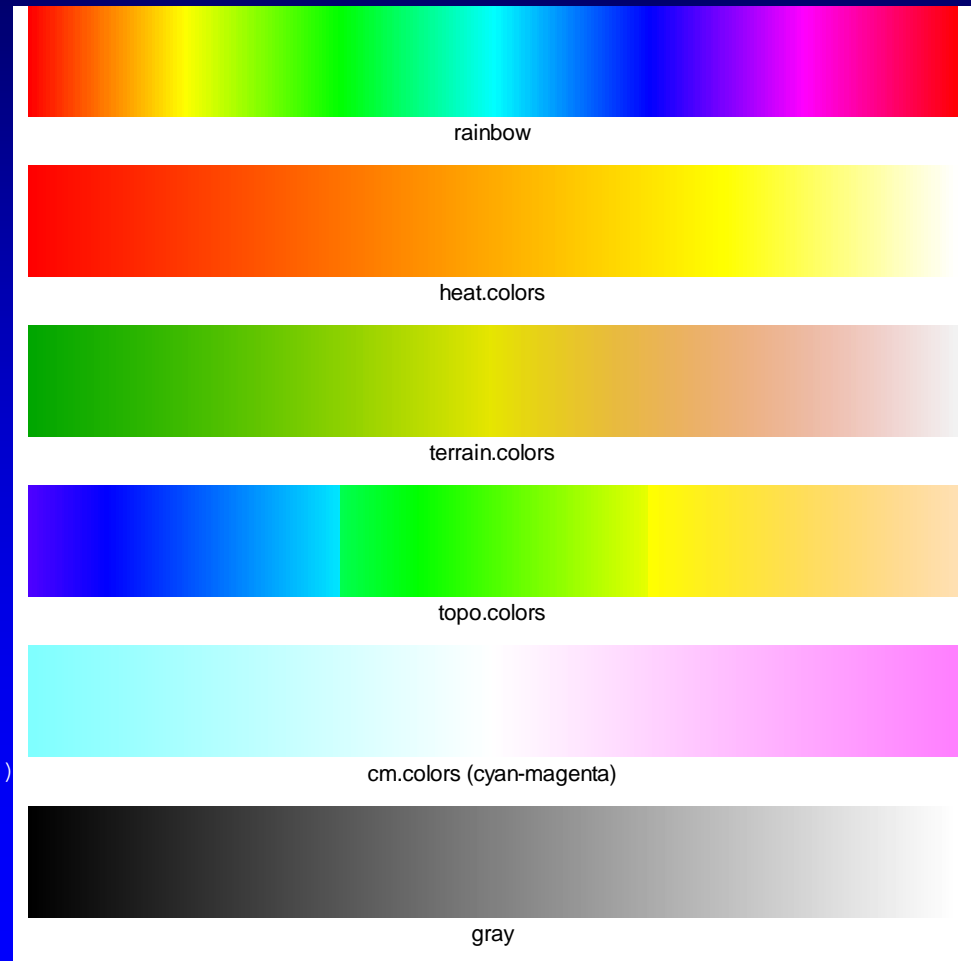
Color Gradients / Color Ramps

```
par(mfrow=c(6,1), mar=c(3,1,0,1))
BOTTOM <- 1

colorstrip <- function(colors, description,
                        ShowAxis=FALSE)
{
  count <- length(colors)
  m <- matrix(1:count, count, 1)
  image(m, col=colors, ylab="", axes=FALSE)

  if (ShowAxis)
  {
    axis(BOTTOM)
  }
  mtext(description, BOTTOM, adj=0.5, line=0.5)
}

COLOR.COUNT <- 256
colorstrip(rainbow(COLOR.COUNT), "rainbow")
colorstrip(heat.colors(COLOR.COUNT), "heat.colors")
colorstrip(terrain.colors(COLOR.COUNT), "terrain.colors")
colorstrip(topo.colors(COLOR.COUNT), "topo.colors")
colorstrip(cm.colors(COLOR.COUNT), "cm.colors (cyan-magenta)")
colorstrip(gray(0:COLOR.COUNT / COLOR.COUNT), "gray")
```

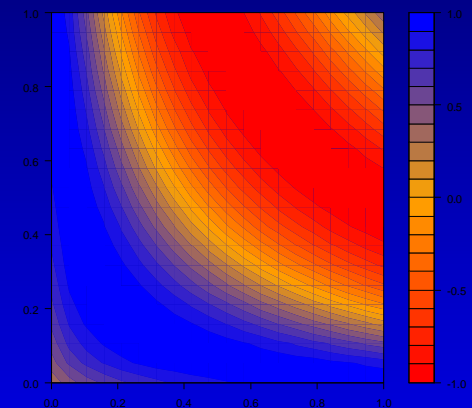


Using Color in R

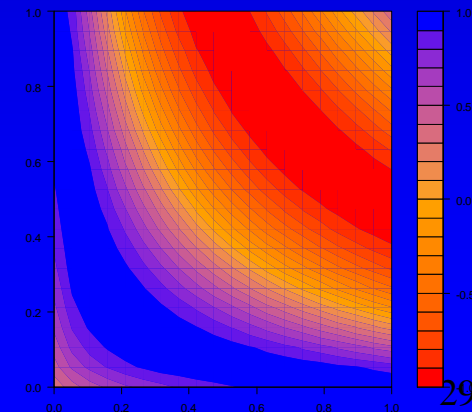
Color Gradients / Color Ramps

colorRamp and colorRampPalette added in R 2.1.0

```
m <- outer(1:20,1:20,function(x,y) sin(sqrt(x*y)/3))  
  
rgb.palette <- colorRampPalette(c("red", "orange",  
"blue"), space = "rgb")  
filled.contour(m,col = rgb.palette(20))
```



```
# space="Lab" helps when colors don't form a  
# natural sequence  
Lab.palette <- colorRampPalette(c("red", "orange",  
"blue"), space = "Lab")  
filled.contour(m,col = Lab.palette(20))
```

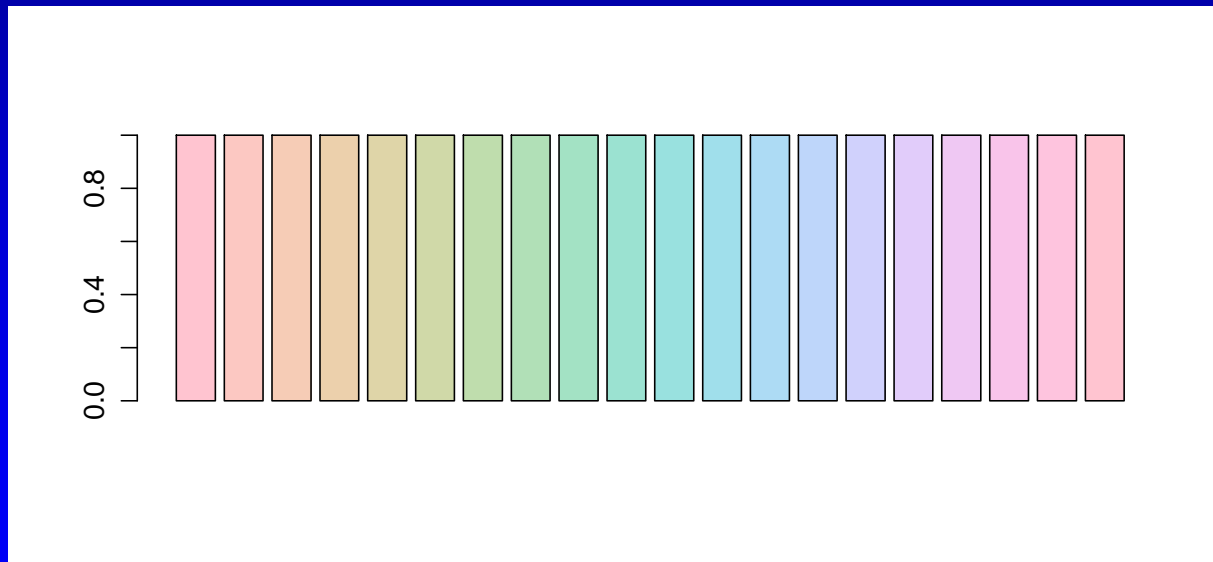


Using Color in R

Color Gradients / Color Ramps

HCL (Hue, Chroma, Luminance)

```
> ?hcl  
> barplot(rep(1, 20), col = hcl(seq(0, 360, length = 20)))
```



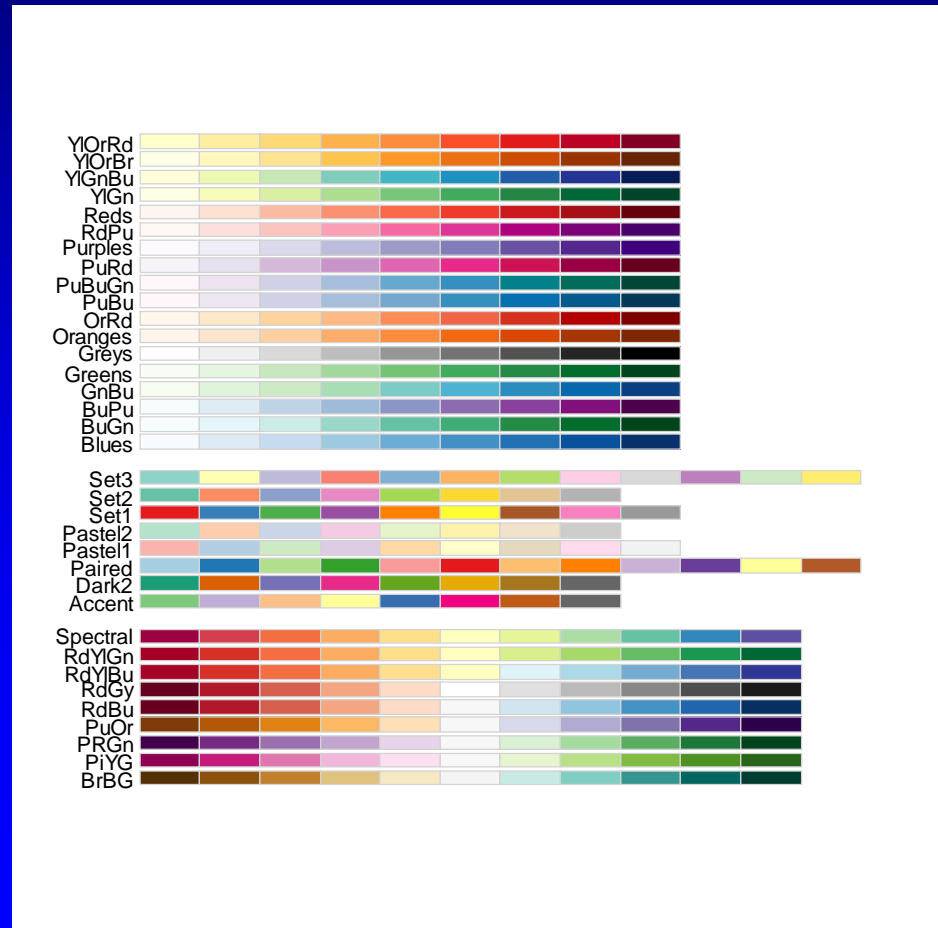
See: [HCL\(Hue-Chroma-Luminance\)-based Color Palettes in R](http://cran.r-project.org/doc/vignettes/vcd/hcl-colors.pdf)
<http://cran.r-project.org/doc/vignettes/vcd/hcl-colors.pdf>

Using Color in R

Color Gradients / Color Ramps

RColorBrewer Package

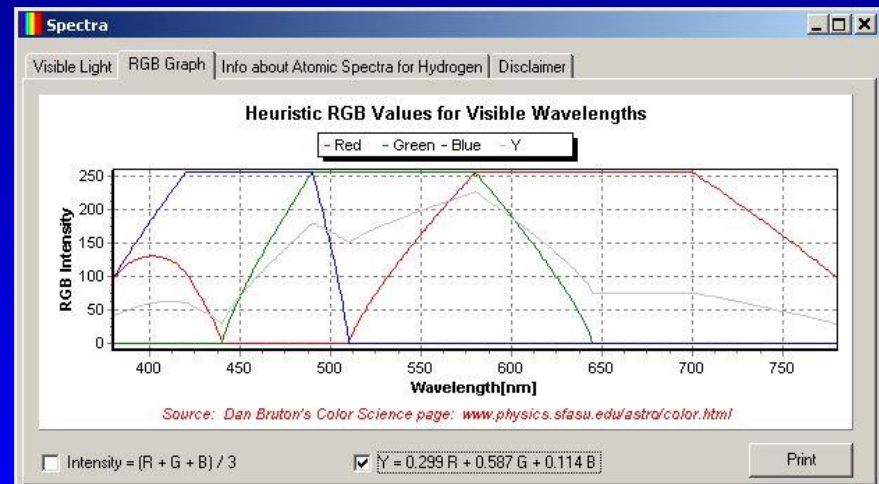
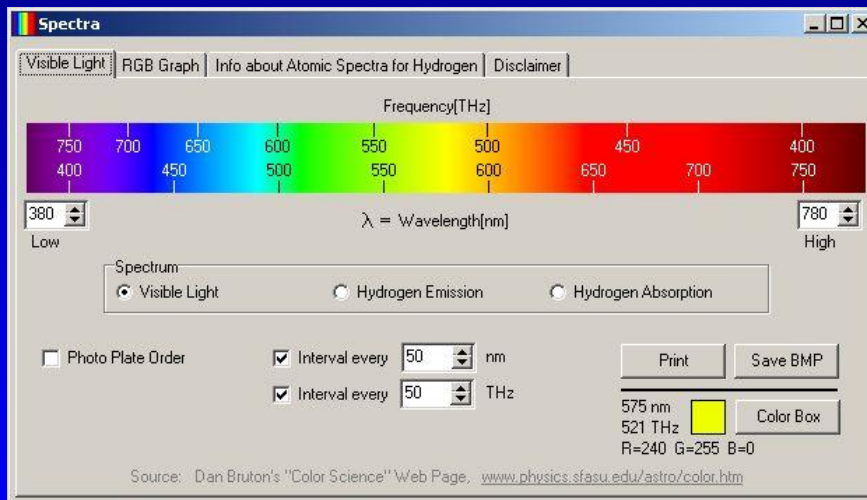
```
> library(RColorBrewer)
> display.brewer.all()
```



Using Color in R

Color Gradients / Color Ramps

Representative Color for Given Wavelength



Source: <http://www.efg2.com/Lab/ScienceAndEngineering/Spectra.htm>

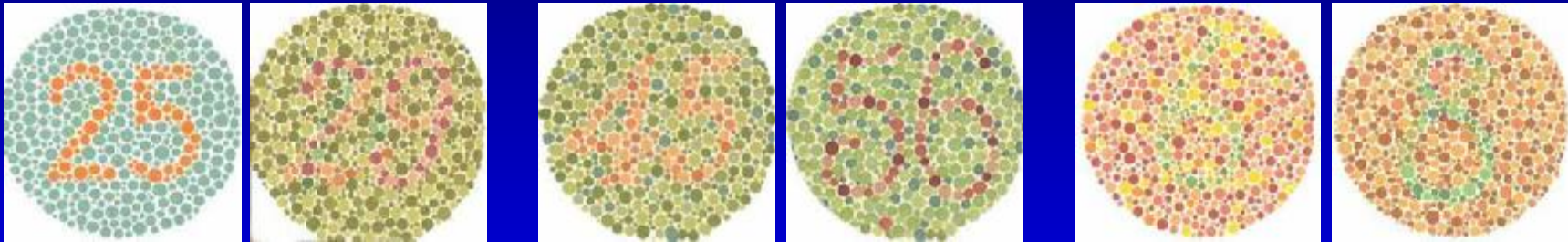
Using Color in R

- Color Basics in R
- Color Spaces
- Color Gradients / Color Ramps
- Color Blindness
- Why Don't Screen Colors Match Printout?
- Colors Tips

Using Color in R

Color Blindness

Ishihara Test for Color Blindness



Normal Color Vision: 25, 29, 45, 56, 6, 8

Red-Green Color Blind: 25, spots, spots, 56, spots, spots

Source: <http://www.toledo-bend.com/colorblind/Ishihara.html>

*About 1 in 12 have some sort of color deficiency:
About ~8% of men and ~0.4% of women in the US.*

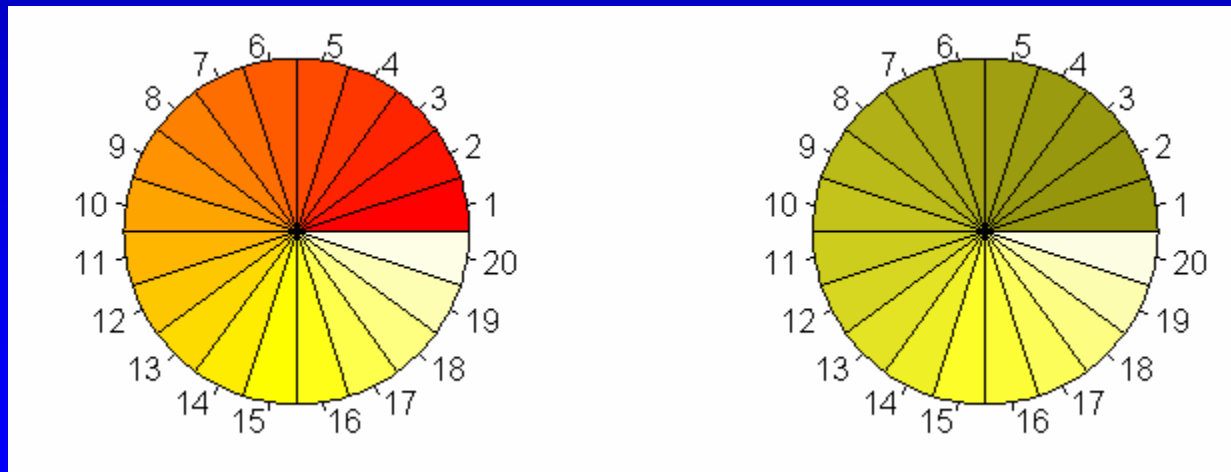
http://en.wikipedia.org/wiki/Color_blindness

Using Color in R

Color Blindness

R dichromat Package: Color Schemes for dichromats

```
library(dichromat)
par(mfcol=c(1,2))
N <- 20
pie(rep(1,N),col=heat.colors(N))
pie(rep(1,N),col=dichromat(heat.colors(N)))
```



dichromat function collapses red-green color distinctions to approximate the effect of the two common forms of red-green color blindness, protanopia and deuteranopia.

Using Color in R

Color Blindness

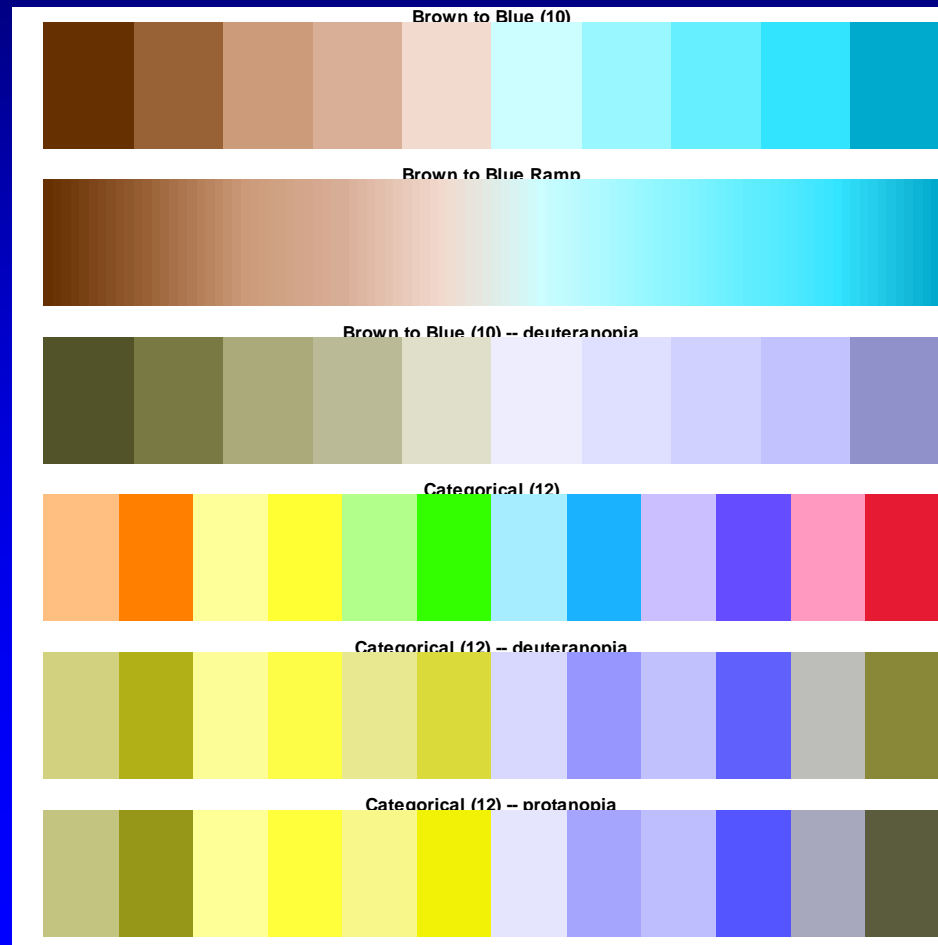
R dichromat Package: Color Schemes for dichromats

```
library(dichromat)
par(mar=c(1,2,1,1))
layout(matrix(1:6,ncol=1))
image(1:10,1,matrix(1:10, ncol=1),
      col=colorschemes$BrowntoBlue.10,
      main="Brown to Blue (10)", axes=FALSE)
image(1:100,1,matrix(1:100 ,ncol=1),
      col=colorRampPalette(colorschemes$BrowntoBlue.10 ,space="Lab" )(100) ,
      main="Brown to Blue Ramp", axes=FALSE)
image(1:10,1,matrix(1:10, ncol=1),
      col=dichromat(colorschemes$BrowntoBlue.10) ,
      main="Brown to Blue (10) -- deuteranopia", axes=FALSE)
image(1:12,1,matrix(1:12, ncol=1),col=colorschemes$Categorical.12,
      main="Categorical (12)", axes=FALSE)
image(1:12,1,matrix(1:12, ncol=1),
      col=dichromat(colorschemes$Categorical.12) ,
      main="Categorical (12) -- deuteranopia", axes=FALSE)
image(1:12,1,matrix(1:12,ncol=1),
      col=dichromat(colorschemes$Categorical.12, "protan") ,
      main="Categorical (12) -- protanopia", axes=FALSE)
```

Using Color in R

Color Blindness

R dichromat Package: Color Schemes for dichromats

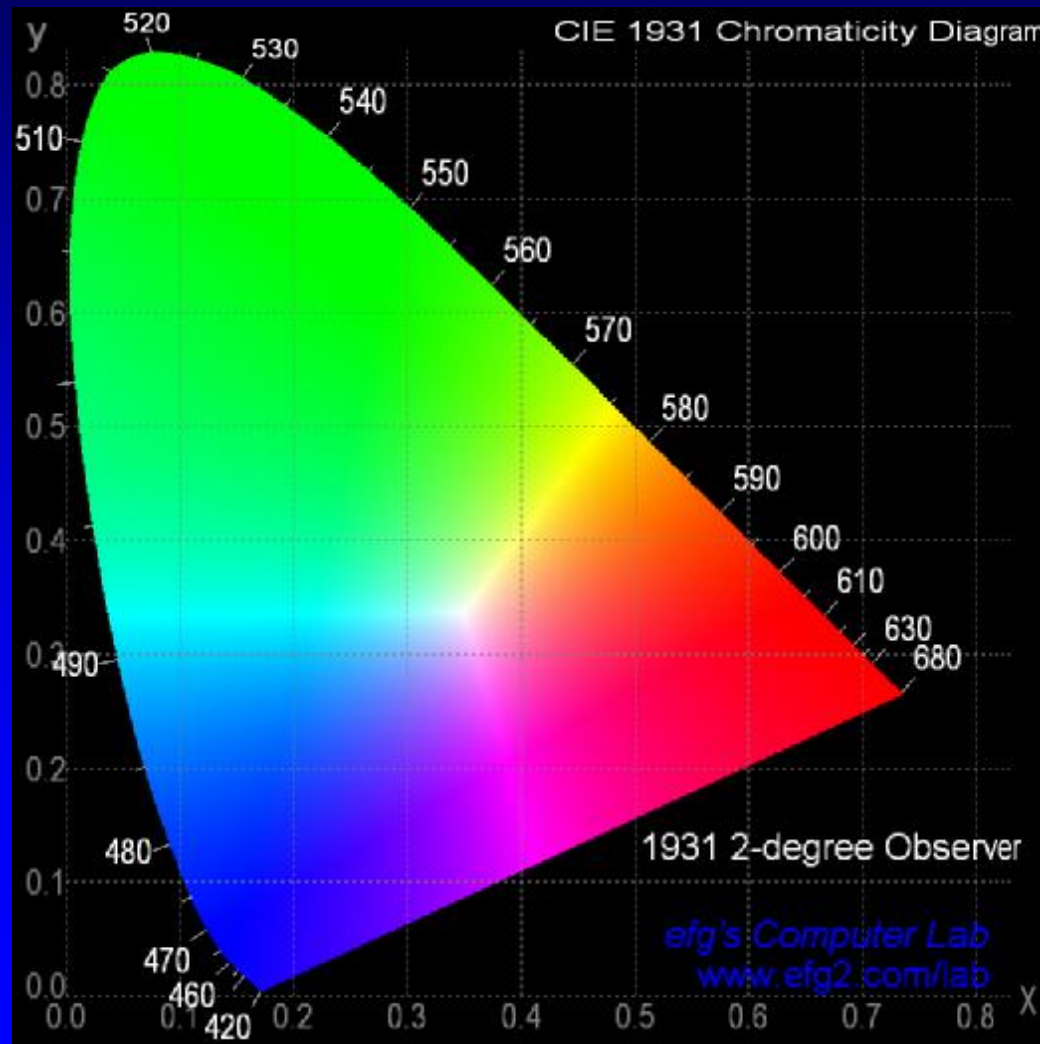


Using Color in R

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- Color Blindness
- Why Don't Screen Colors Match Printout?
- Colors Tips

Using Color in R

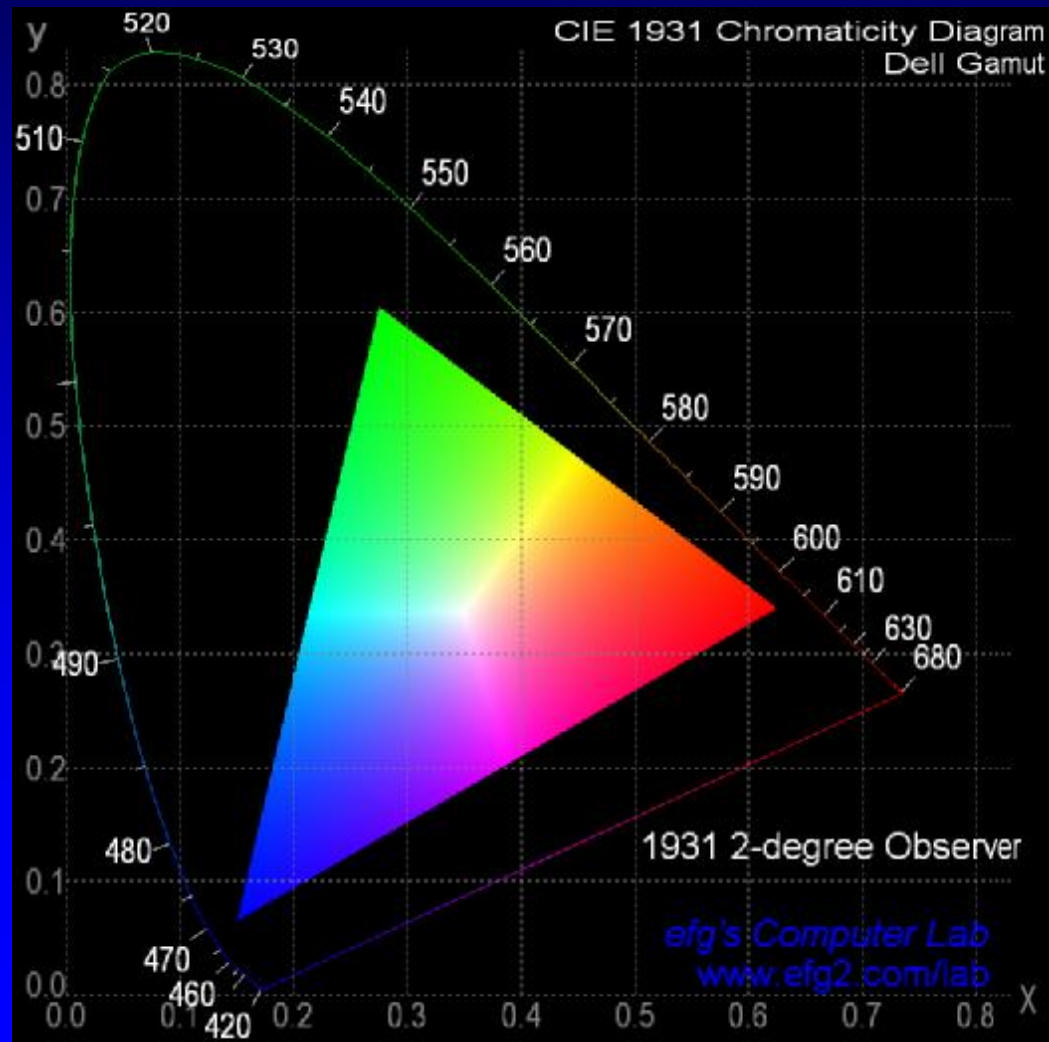
Why Don't Screen Colors Match Printout?



Conceptual
Diagram of
All Colors
(2D Slice)

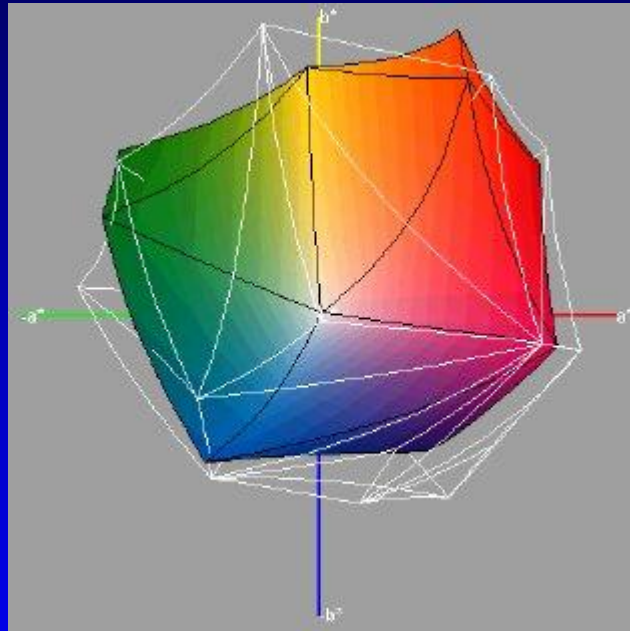
Using Color in R

Why Don't Screen Colors Match Printout?



Each Device
Has Own
Gamut of
Colors

Using Color in R 3D Color Gamut



From “Visualization of Expanded Printing Gamuts Using 3-Dimensional Convex Hulls”
by Karl Guyler, Hallmark Cards, Kansas City

Color calibration can be used to minimize needless differences

Using Color in R

Why Don't Screen Colors Match Printout?

- Different color gamuts between devices:
How should a color be represented if it doesn't exist on a device?
- Imperfect conversions:
CRT screens with RGB (Red-Green-Blue) additive colors must be converted to CMYK (Cyan-Magenta-Yellow-Black) subtractive colors
- Color fidelity may not be accurate
- Paper/ink differences

Using Color in R

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Using Color in R

Color Tips

- Avoid unnecessary use of color.
- Use bright colors with small graphics to make them stand out.
- Be consistent in use of color.
- Don't use color as only attribute to show difference. E.g., consider color and line type.

Also see: Cool Color Commentary, <http://www.public-speaking.org/public-speaking-color-article.htm>

Using Color in R

Color Tips: Palettes

- Qualitative Palette:

- all same perceptual weight/importance
- typical application: bar plot

- Sequential Palette

- for coding numerical information in a range
- typical application: heat map

- Diverging Palette

- Like Sequential Palette but with neutral value

Source: Choosing Color Palettes for Statistical Graphics

http://epub.wu-wien.ac.at/dyn/virlib/wp/mediate/epub-wu-01_abd.pdf?ID=epub-wu-01_abd

Using Color in R

References

Colour for Presentation Graphics

<http://www.stat.auckland.ac.nz/~ihaka/colour/color-talk.pdf>

Why should Engineers and Scientists be worried about color?

<http://www.research.ibm.com/people/l/lloyd/color/color.HTM>