

Editing graphics in R: a generic approach using TikZ

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Graphics in R

R is great for graphics and produces a wide variety of plots and graphs from a number of different libraries.

I use a lot of graphics in my research and teaching which have been implemented in a number of libraries, some of those I have used are shown below...

An example graphic using ggplot2

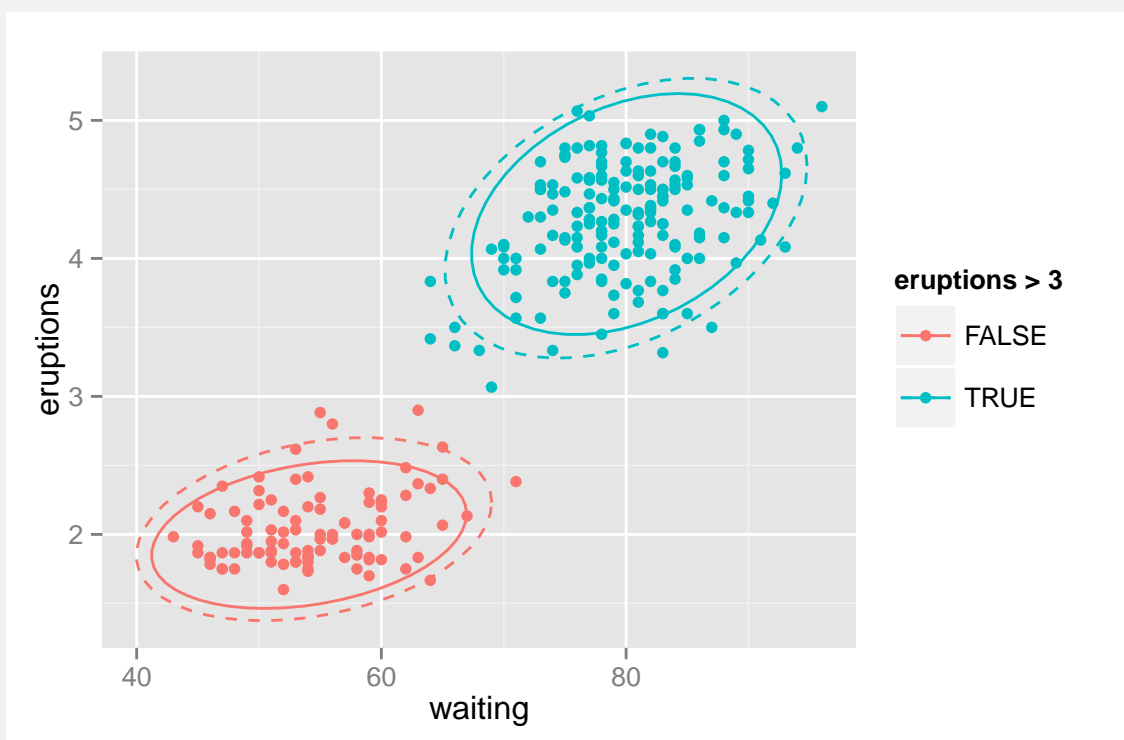
Title: An implementation of the Grammar of Graphics

Author: Hadley Wickham and Winston Chang

An example graphic from ggplot2 help pages...

```
ggplot(faithful,  
  aes(waiting, eruptions,  
    color = eruptions > 3)) +  
  geom_point() +  
  stat_ellipse(type = "norm", linetype = 2) +  
  stat_ellipse(type = "t")
```

An example graphic using ggplot2



An example graphic using lattice

Title: Lattice Graphics

Author: Deepayan Sarkar

An example graphic from lattice help pages...

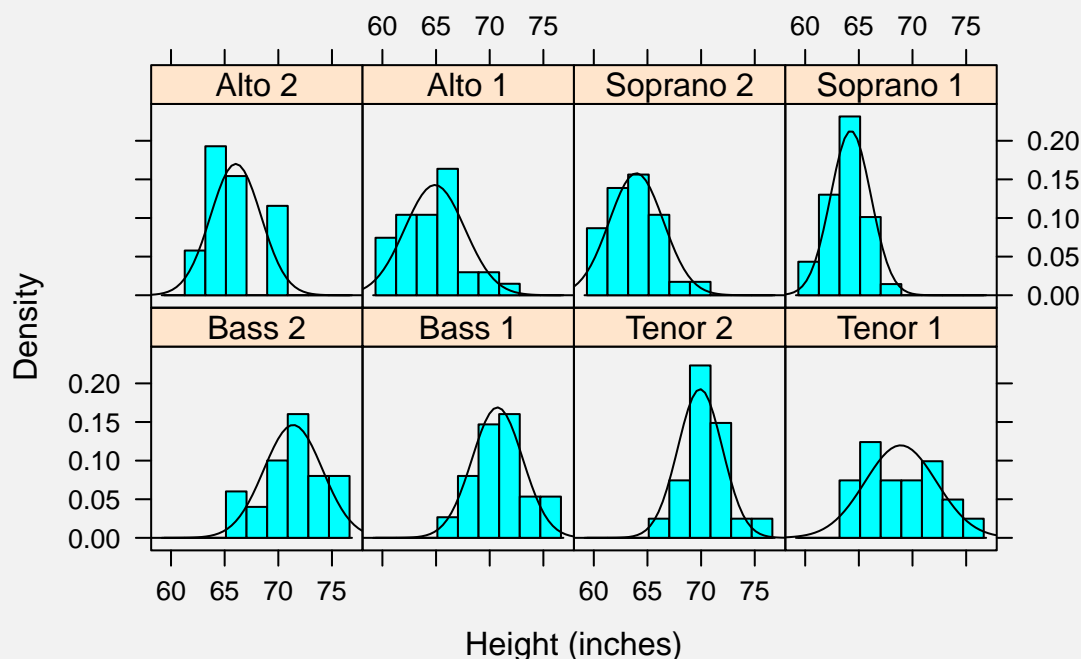
```
require(lattice)
require(stats)

histogram( ~ height | voice.part, data = singer,
           xlab = "Height (inches)", type = "density",
           panel = function(x, ...)
           { panel.histogram(x, ...)
             panel.mathdensity(dmath = dnorm,
                               col = "black",
                               args = list(mean=mean(x),sd=sd(x)))
           } )
```

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An example graphic using lattice



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An example graphic using amelia

Title: Amelia II: A Program for Missing Data

Author: James Honaker, Gary King and Matthew Blackwell

An example graphic from amelia help pages...

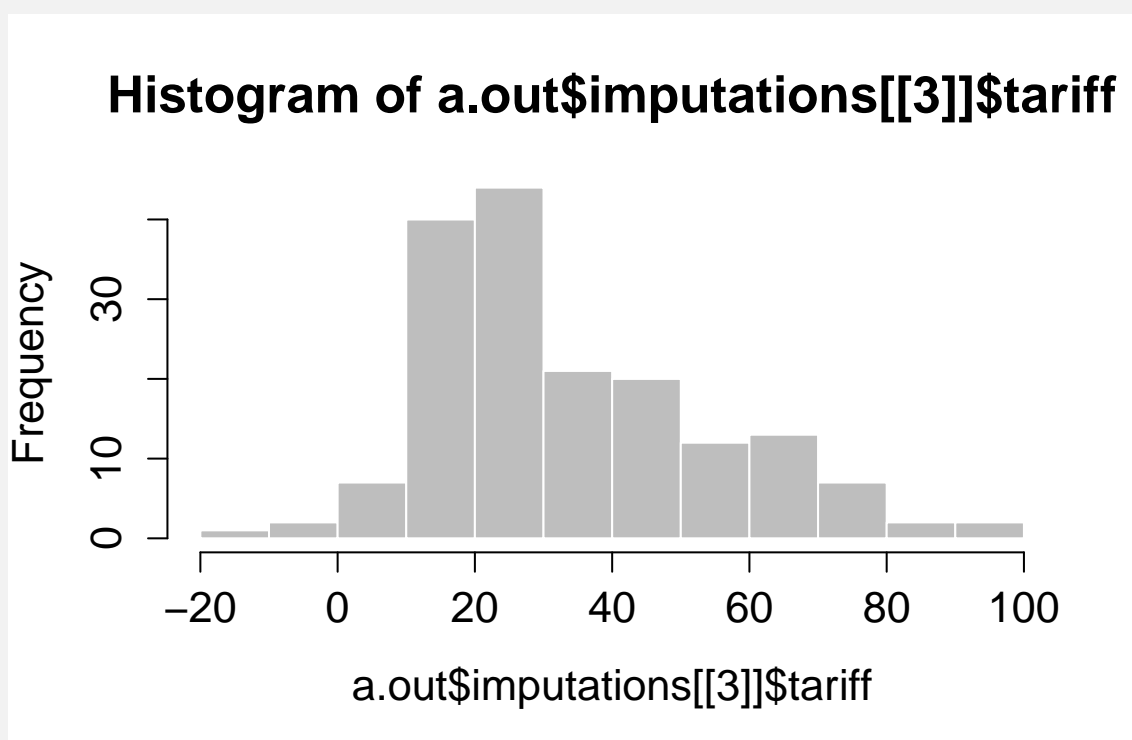
```
require(Amelia)
data(freetrade)

# impute the missing data
a.out <- amelia(freetrade, m = 5, ts = "year",
               cs = "country")

# plot a histogram
hist(a.out$imputations[[3]]$tariff,
     col="grey", border="white")
```

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An example graphic using vcd

Title: Visualizing Categorical Data

Author: David Meyer

An example graphic from vcd help pages...

```
require(vcd)
```

```
data("HairEyeColor")
```

```
# construct table  
(x <- margin.table(HairEyeColor, c(1, 2)))
```

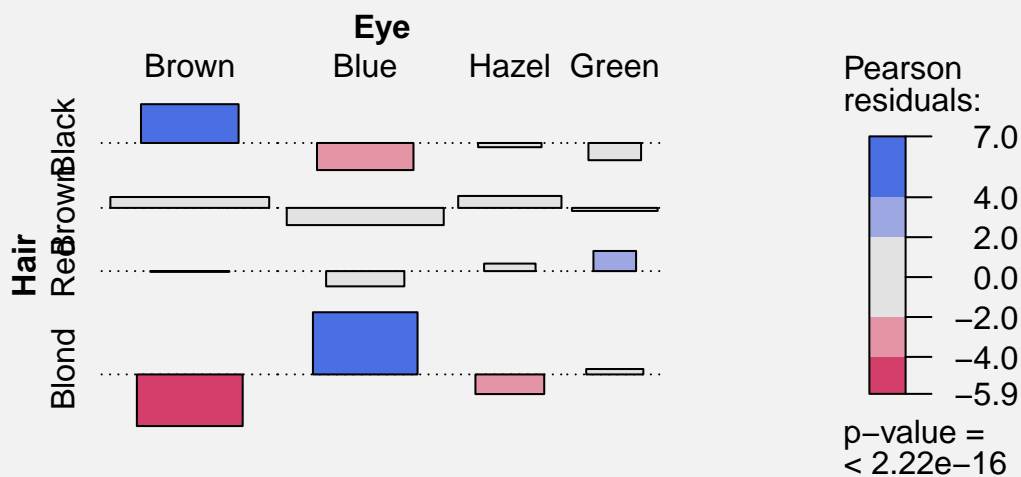
```
# draw association plot  
assoc(x, main = "Relation between hair and eye color",  
      shade = TRUE)
```

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An example graphic using vcd

Relation between hair and eye color



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An example graphic using effects

Title: Effect Displays for Linear, Generalized Linear, Multinomial-Logit, Proportional-Odds Logit Models and Mixed-Effects Models

Author: John Fox, Sanford Weisberg, Michael Friendly and Jangman Hong

An example graphic from effects help pages...

```
require(effects)

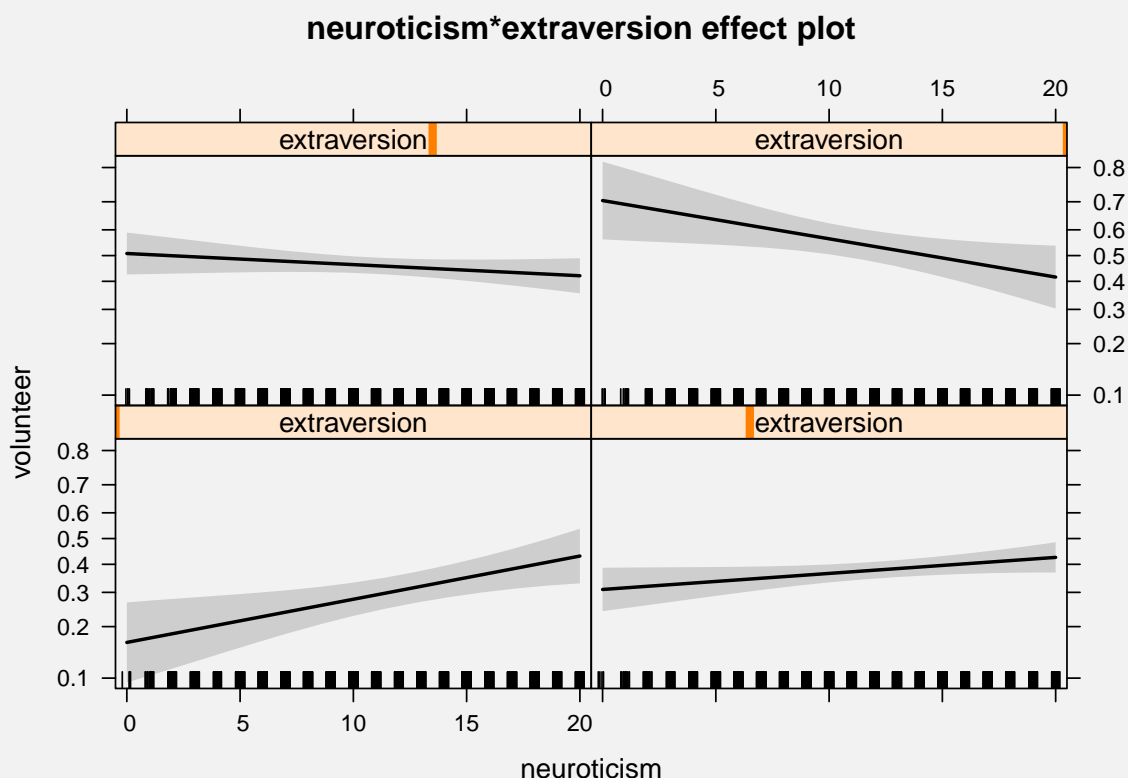
# run the model
mod.cowles <- glm(volunteer ~
  sex + neuroticism*extraversion,
  data=Cowles, family=binomial)

# draw the effect plots for the interaction
plot(allEffects(mod.cowles), selection=2)
```

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Editing graphics in R

An example graphic using effects



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Editing graphics in R

Editing graphics

I often want to edit the graphic output and...

- ▶ change the labels...
- ▶ change the colours...
- ▶ emphasise parts of the plot...
- ▶ change relative sizes of text, lines and plotting characters...
- ▶ alter the positioning of graphical elements...
- ▶ add text, arrows etc...
- ▶ change the resolution/format...

Editing graphics: the options

I can achieve these goals by editing each graphic using the 'basic' plotting commands provided with the package...

Many packages do not have detailed editing options. When they are available, the commands can be quite difficult and what works with one device, may not work with another.

I can edit each graphic using programmes such as GIMP or Photoshop...

This is very time consuming, runs into problems with consistency and problems with resolution and size of graphic file.

I could just learn and use one graphic device...

I use many different libraries and want to use new libraries in the future.

or...

I can use `tikZ`, which is a format based on \LaTeX that transforms all graphics into text that can be easily manipulated (TikZ is written by Till Tantau, who also wrote the latex presentation package 'beamer').

The `tikzDevice` package translates graphical output from R into tikZ code.

tikzDevice

Title: R Graphics Output in LaTeX Format

Authors: Charlie Sharpsteen and Cameron Bracken.

```
require(tikzDevice)
```

In order to run this library, \LaTeX must be installed on your local machine.

In order to run and use `tikzDevice` effectively, you do not need to be an expert in tikZ or \LaTeX .

QtikZ: an easy tikz editor

Graphics from `tikzDevice` can be edited using any \LaTeX editor (or directly from the Rstudio). It is easiest, however, to edit them in a dedicated editor such as Qtikz, which is freely available for linux. Editors are available for other platforms - try out a few and see which one best fits your needs.

Using `tikzDevice`

simply put the command for the plot between the commands...

```
tikz("tikzEXAMPLE01.tex")  
  
# input plot command here  
  
dev.off()
```

The plot will be translated into tikZ format and saved to the file `'tikzEXAMPLE01.tex'`.

This file can now be opened up in an editor....

Editing the ggplot graphic

```
tikz("tikzEXAMPLE01.tex")
  ggplot(faithful,
    aes(waiting, eruptions,
      color = eruptions > 3)) +
  geom_point() +
  stat_ellipse(type = "norm", linetype = 2) +
  stat_ellipse(type = "t")
dev.off()
```

This command translates the graphic into text format...

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```
% Created by tikzDevice version 0.7.0 on 2014-10-30 13:17:38
% !TEX encoding = UTF-8 Unicode
\begin{tikzpicture}[x=1pt,y=1pt]
\definecolor[named]{fillColor}{rgb}{1.00,1.00,1.00}
\path[use as bounding box,fill=fillColor,fill opacity=0.00] (0,0)
  rectangle (505.89,505.89);

\begin{scope}
  \path[clip] ( 0.00, 0.00) rectangle (505.89,505.89);
  \definecolor[named]{drawColor}{rgb}{1.00,1.00,1.00}
  \definecolor[named]{fillColor}{rgb}{1.00,1.00,1.00}
  \path[draw=drawColor,line width= 0.6pt,line join=round,
    line cap=round,fill=fillColor] ( 0.00, 0.00)
    rectangle (505.89,505.89);
\end{scope}

\begin{scope}
  \path[clip] ( 32.22, 34.03) rectangle (400.88,493.85);
  \definecolor[named]{fillColor}{rgb}{0.90,0.90,0.90}
  \path[fill=fillColor] ( 32.22, 34.03)
    rectangle (400.88,493.85);
  \definecolor[named]{drawColor}{rgb}{0.95,0.95,0.95}
  \path[draw=drawColor,line width= 0.3pt,line join=round]
    ( 32.22, 68.26) - (400.88, 68.26);
\end{scope}
\end{tikzpicture}
```

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Editing the graphic...

This file (`tikzEXAMPLE01.tex`) can now be loaded into QtikZ and edited...

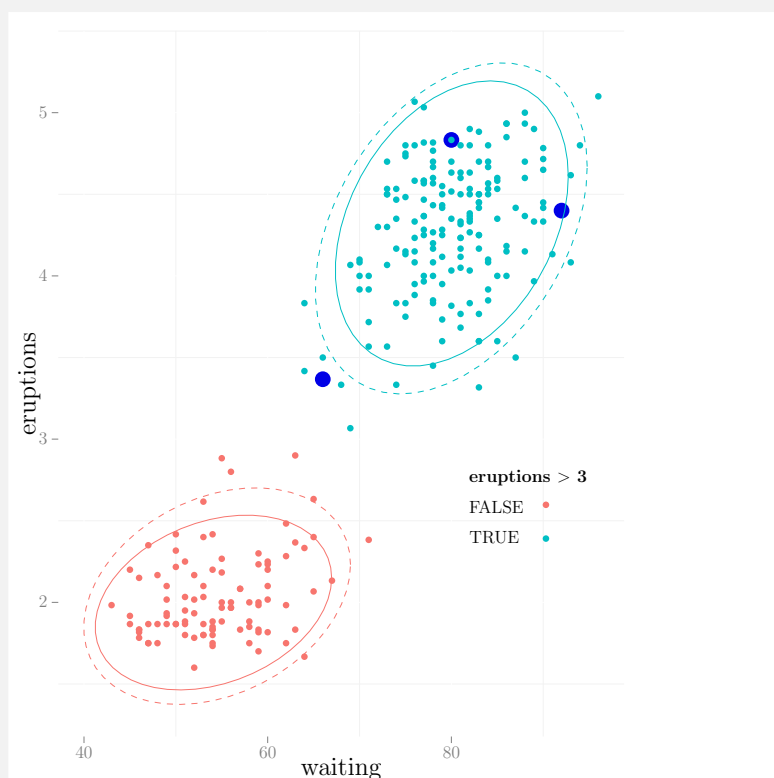
Try deleting each `scope` command and see what effect this has on the graphic (it is automatically updated after each edit).

Once you know what the commands do, it is usually simple to edit.

When finished, save the graphic to whichever format you want (or add the code directly to a \LaTeX document).

The following graphic has been edited to remove the background, change the ellipses, move the key and highlight a few individual cases...

An edited graphic

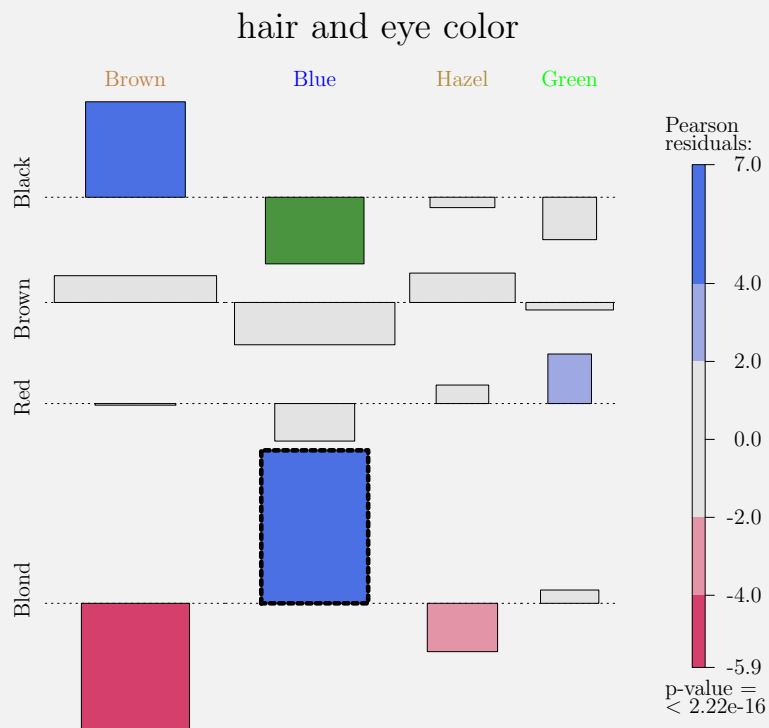


Editing the vcd graphic

```
tikz("tikzEXAMPLE02.tex")
  assoc(x, main = "Relation between hair and
        eye color", shade = TRUE)
dev.off()
```

This file (tikzEXAMPLE02.tex) can now be loaded into QtikZ and edited...

An edited graphic



Further considerations

In addition to editing R output using tikzDevice, this system allows access to the full power of tikZ and allows graphics to be manipulated and augmented in a stunning variety of ways (look at the 1100-page tikZ manual for inspiration and entertainment; it is a very funny manual!).

This system opens the door to true graphic independence and creativity.

It is fast, convenient, powerful and provides a general solution to editing graphics.