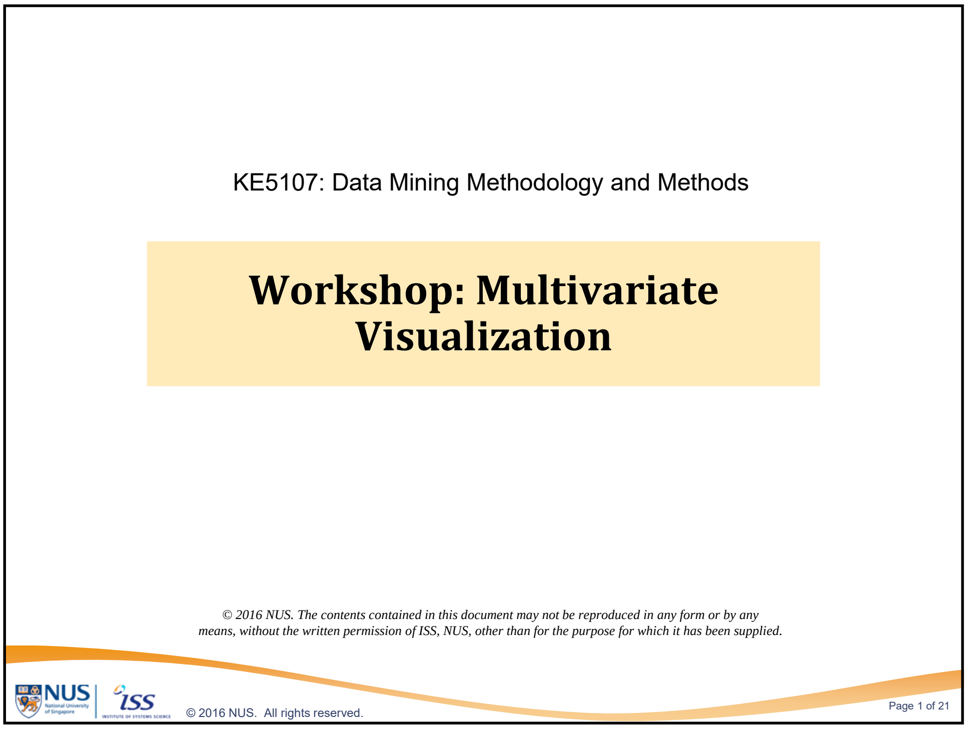

KE5107: Data Mining Methodology and Methods

Workshop: Multivariate Visualization

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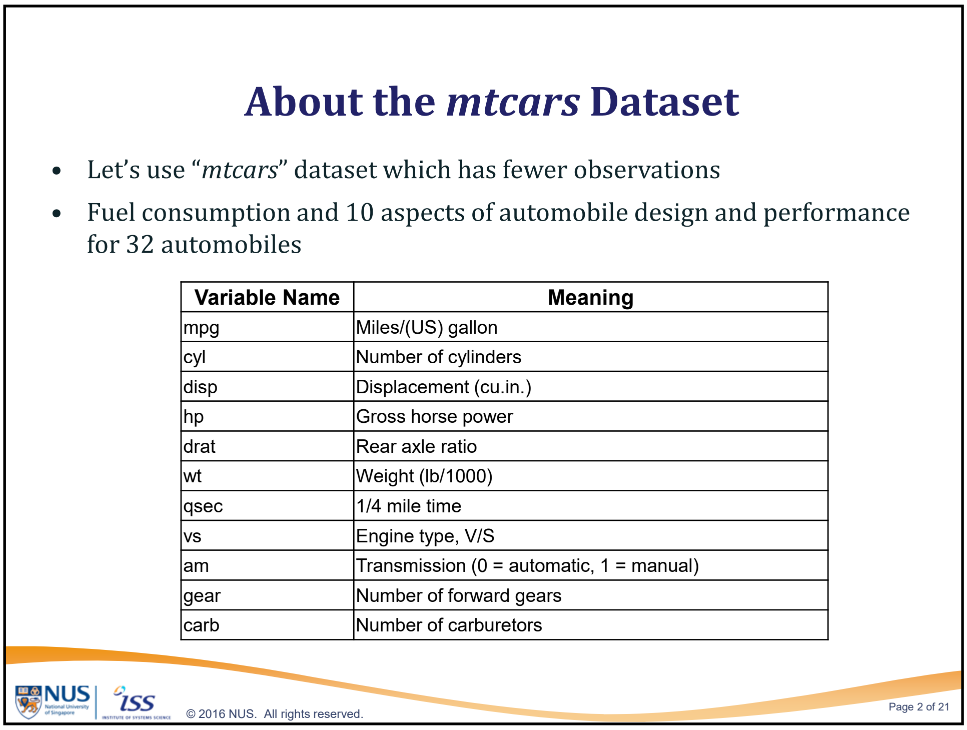


About the *mtcars* Dataset

- Let’s use “*mtcars*” dataset which has fewer observations
- Fuel consumption and 10 aspects of automobile design and performance for 32 automobiles

Variable Name	Meaning
mpg	Miles/(US) gallon
cyl	Number of cylinders
disp	Displacement (cu.in.)
hp	Gross horse power
drat	Rear axle ratio
wt	Weight (lb/1000)
qsec	1/4 mile time
vs	Engine type, V/S
am	Transmission (0 = automatic, 1 = manual)
gear	Number of forward gears
carb	Number of carburetors

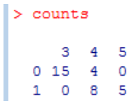
Overlay with Color: Stacked Bar Plot

- First get the counts

  counts <- table(mtcars$am, mtcars$gear)

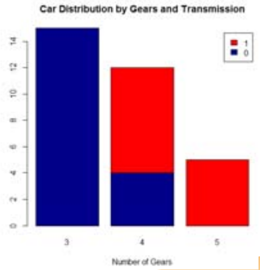
- Then plot

  barplot(counts, main="Car Distribution by Gears and Transmission",
  xlab="Number of Gears", col=c("darkblue","red"),
  legend.text = rownames(counts), names.arg=colnames(counts))



```
> counts

     3  4  5
  0 15  4  0
  1  0  8  5
```



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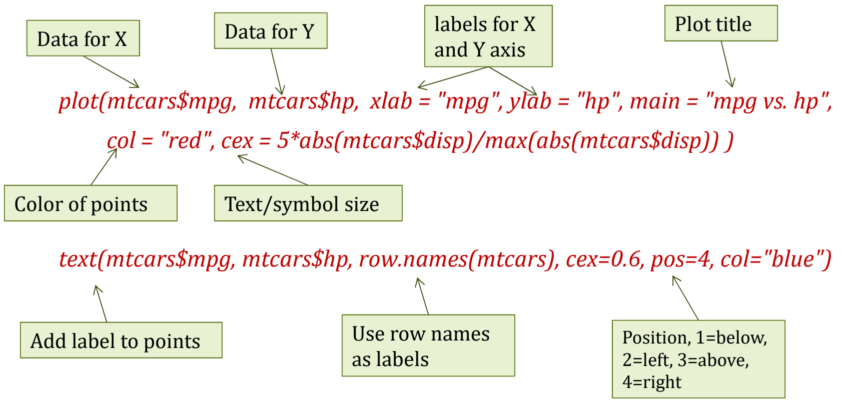
Overlay with Size: Bubble Plot

- Add a third dimension "disp" to the size of the points in a scatter plot



plot(mtcars$mpg, mtcars$hp, xlab = "mpg", ylab = "hp", main = "mpg vs. hp",
*col = "red", cex = 5*abs(mtcars$disp)/max(abs(mtcars$disp)))*

Data for X

Data for Y

labels for X and Y axis

Plot title

Color of points

Text/symbol size

text(mtcars$mpg, mtcars$hp, row.names(mtcars), cex=0.6, pos=4, col="blue")

Add label to points

Use row names as labels

Position, 1=below, 2=left, 3=above, 4=right

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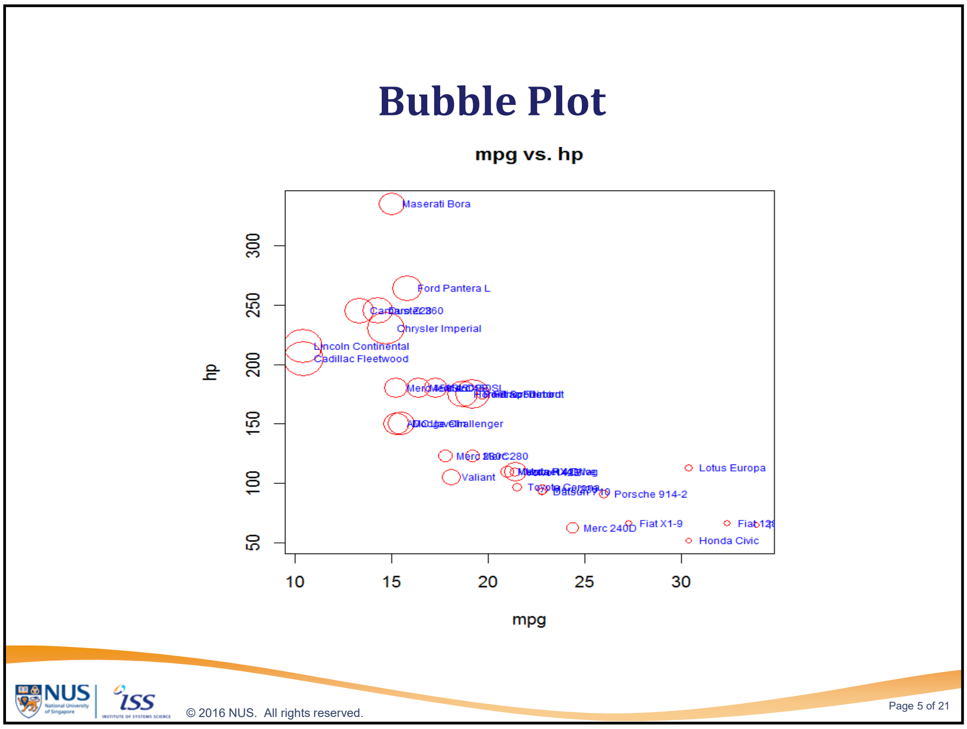

Bubble Plot

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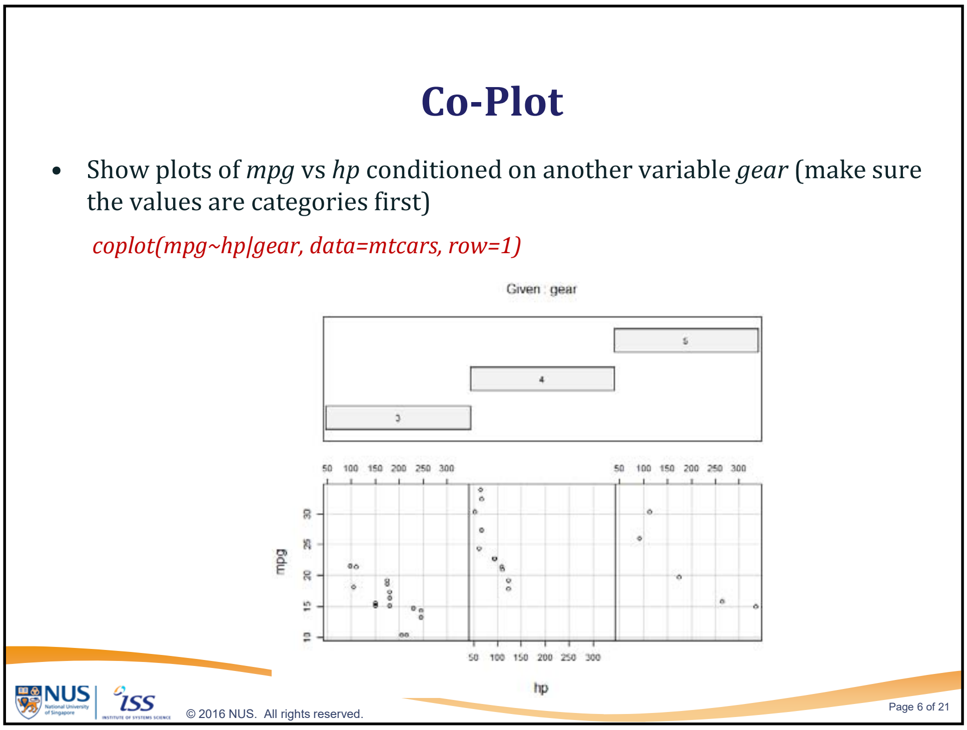

Co-Plot

- Show plots of *mpg* vs *hp* conditioned on another variable *gear* (make sure the values are categories first)

coplot(mpg~hp|gear, data=mtcars, row=1)

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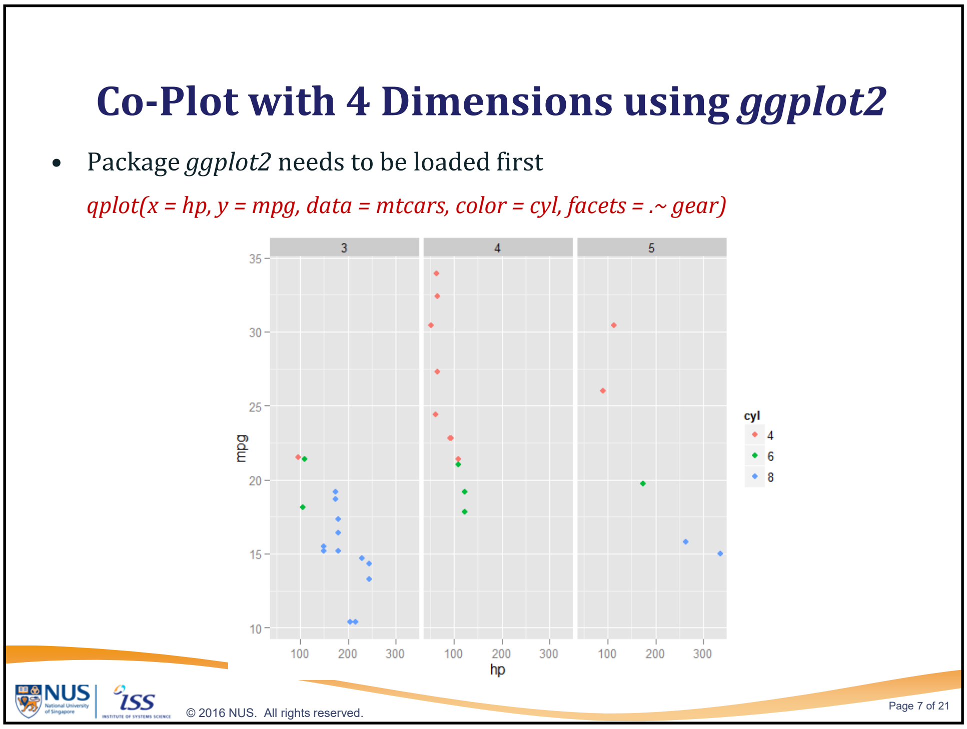

Co-Plot with 4 Dimensions using *ggplot2*

- Package *ggplot2* needs to be loaded first

  qplot(x = hp, y = mpg, data = mtcars, color = cyl, facets = .~ gear)

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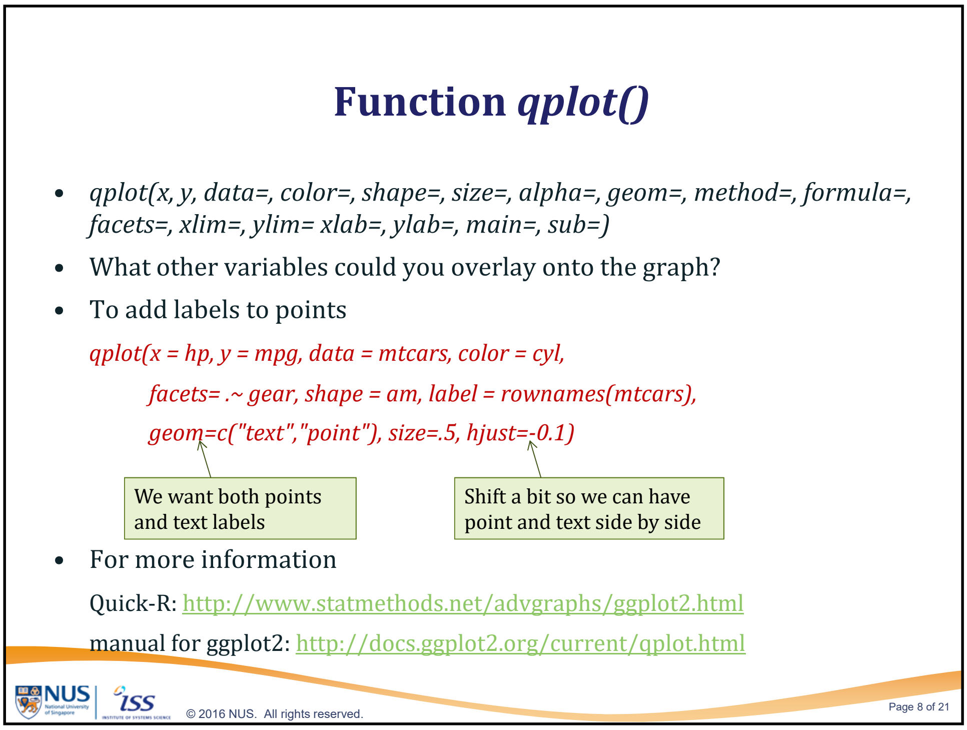

Function *qplot()*

- *qplot(x, y, data=, color=, shape=, size=, alpha=, geom=, method=, formula=, facets=, xlim=, ylim= xlab=, ylab=, main=, sub=)*
- What other variables could you overlay onto the graph?
- To add labels to points

  qplot(x = hp, y = mpg, data = mtcars, color = cyl,

  facets= .~ gear, shape = am, label = rownames(mtcars),

  geom=c("text","point"), size=.5, hjust=-0.1)

  We want both points and text labels

  Shift a bit so we can have point and text side by side

- For more information

  Quick-R: http://www.statmethods.net/advgraphs/ggplot2.html

  manual for ggplot2: http://docs.ggplot2.org/current/qplot.html

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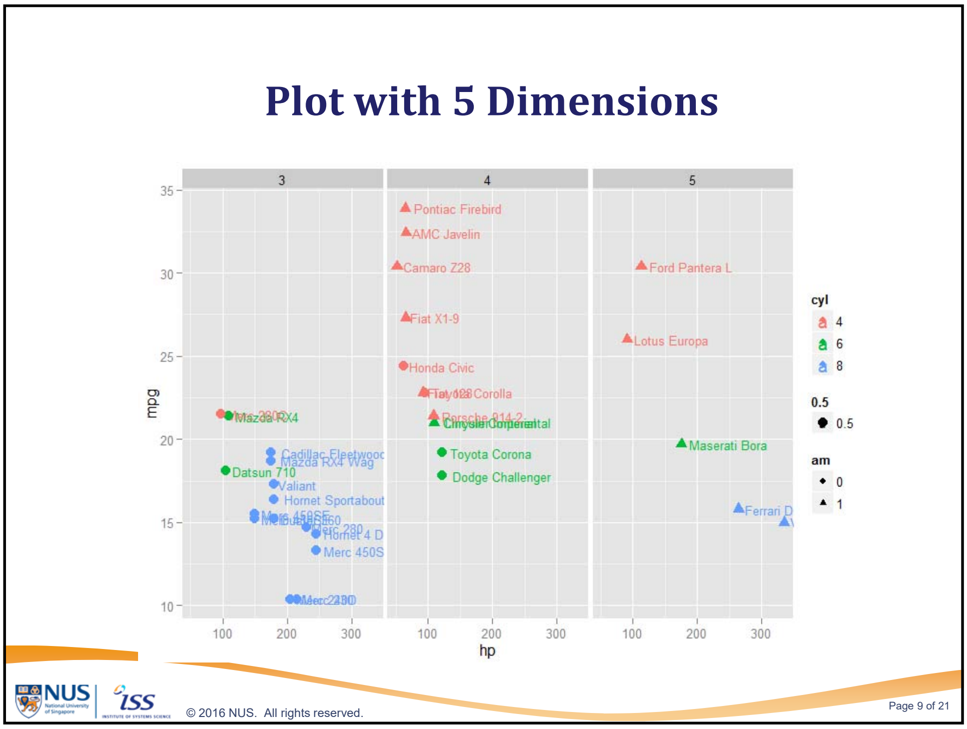

Plot with 5 Dimensions

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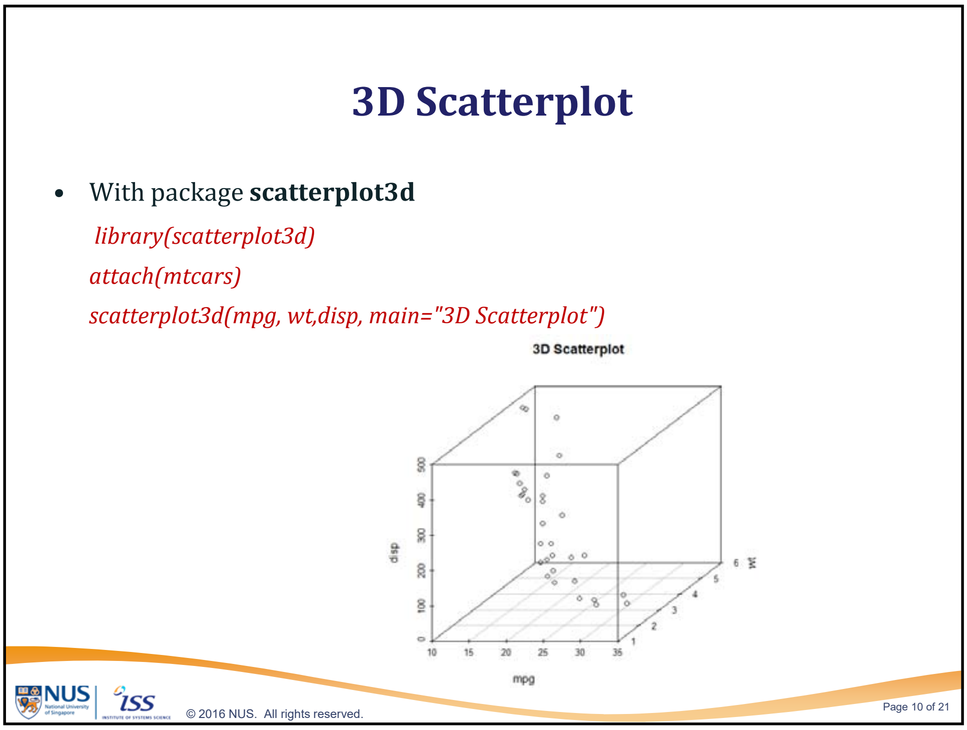

3D Scatterplot

- With package **scatterplot3d**

library(scatterplot3d)

attach(mtcars)

scatterplot3d(mpg, wt,disp, main="3D Scatterplot")

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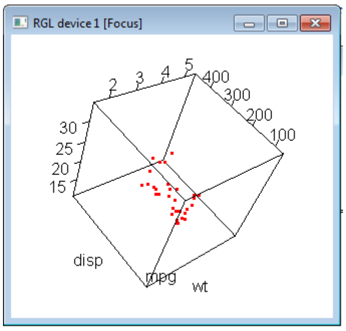
Interactive 3D Scatterplot

- With package **rgl**

  library(rgl)

  plot3d(wt, disp, mpg, col="red", size=3)

- Use mouse to rotate the graph



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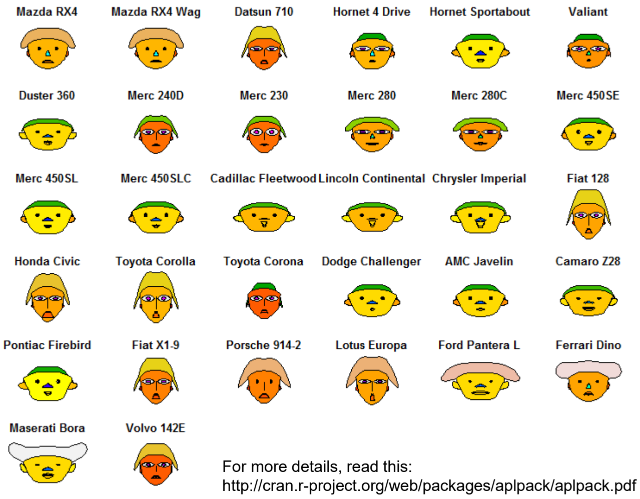
Chernoff Faces

install.packages("aplpack")

library(aplpack)

faces(mtcars)

```
modified item       Var
"height of face   " "mpg"
"width of face    " "cyl"
"structure of face" "disp"
"height of mouth  " "hp"
"width of mouth   " "drat"
"smiling          " "wt"
"height of eyes   " "qsec"
"width of eyes    " "vs"
"height of hair   " "am"
"width of hair   "  "gear"
"style of hair   "  "carb"
"height of nose  "  "mpg"
"width of nose   "  "cyl"
"width of ear    "  "disp"
"height of ear   "  "hp"
```



For more details, read this:
http://cran.r-project.org/web/packages/aplpack/aplpack.pdf

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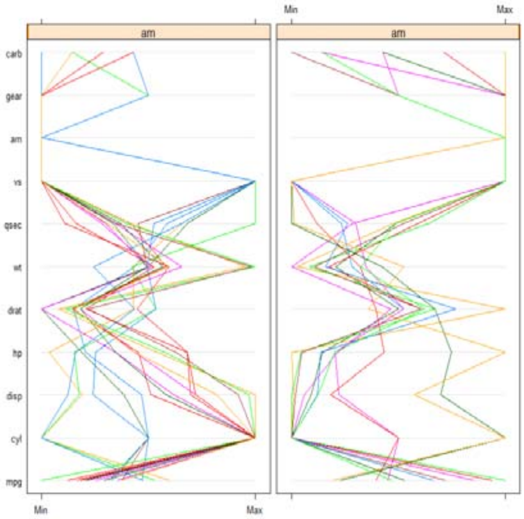
Parallel Coordinates Plot

- With package **lattice**

  library(lattice)

  parallelplot(~mtcars | am, mtcars)



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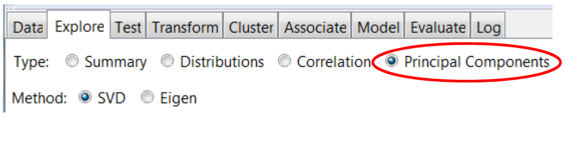
Principal Component Analysis

- Let's use *rattle* to do this. Load *mtcars*. Use all variables as numeric and input
- Select "Principal Components" from *Explore* Tab for PCA of numerical variables
- Two methods:
  - SVD – prcomp()
  - Eigen – princomp()



Type: ○ Summary ○ Distributions ○ Correlation ● Principal Components

Method: ● SVD ○ Eigen

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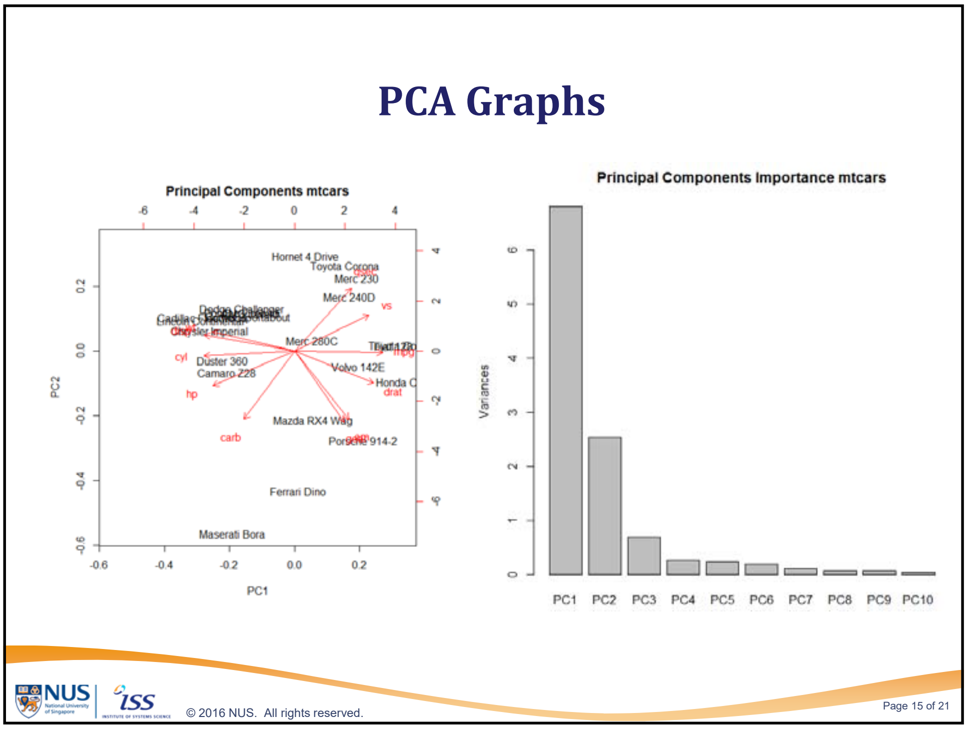

PCA Graphs

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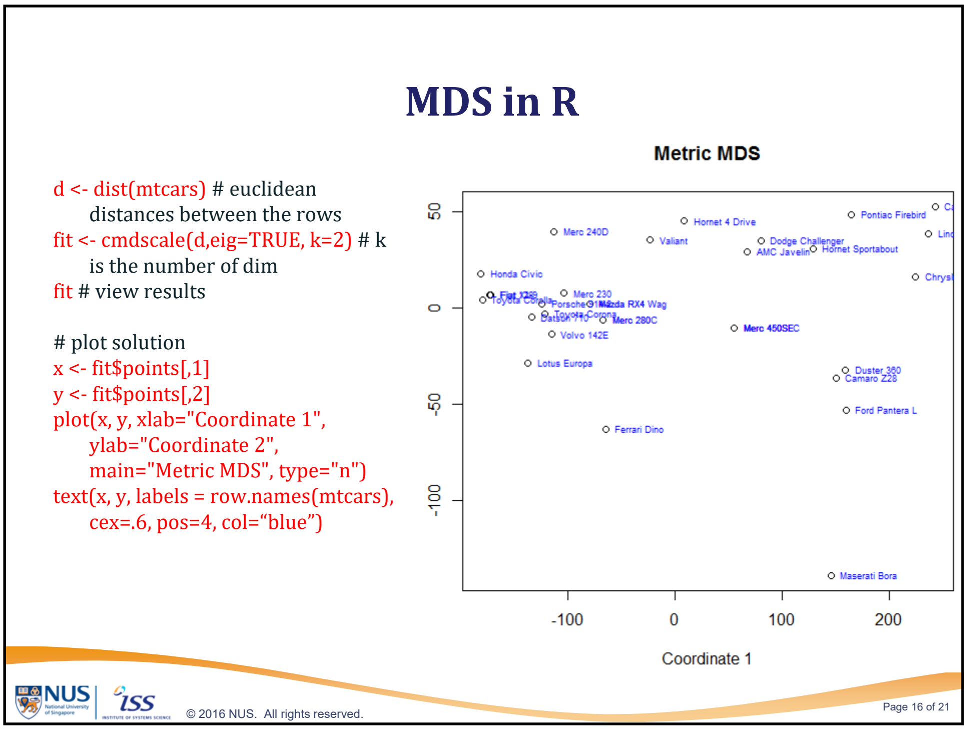

MDS in R

```
d <- dist(mtcars) # euclidean
    distances between the rows
fit <- cmdscale(d,eig=TRUE, k=2) # k
    is the number of dim
fit # view results

# plot solution
x <- fit$points[,1]
y <- fit$points[,2]
plot(x, y, xlab="Coordinate 1",
    ylab="Coordinate 2",
    main="Metric MDS", type="n")
text(x, y, labels = row.names(mtcars),
    cex=.6, pos=4, col="blue")
```

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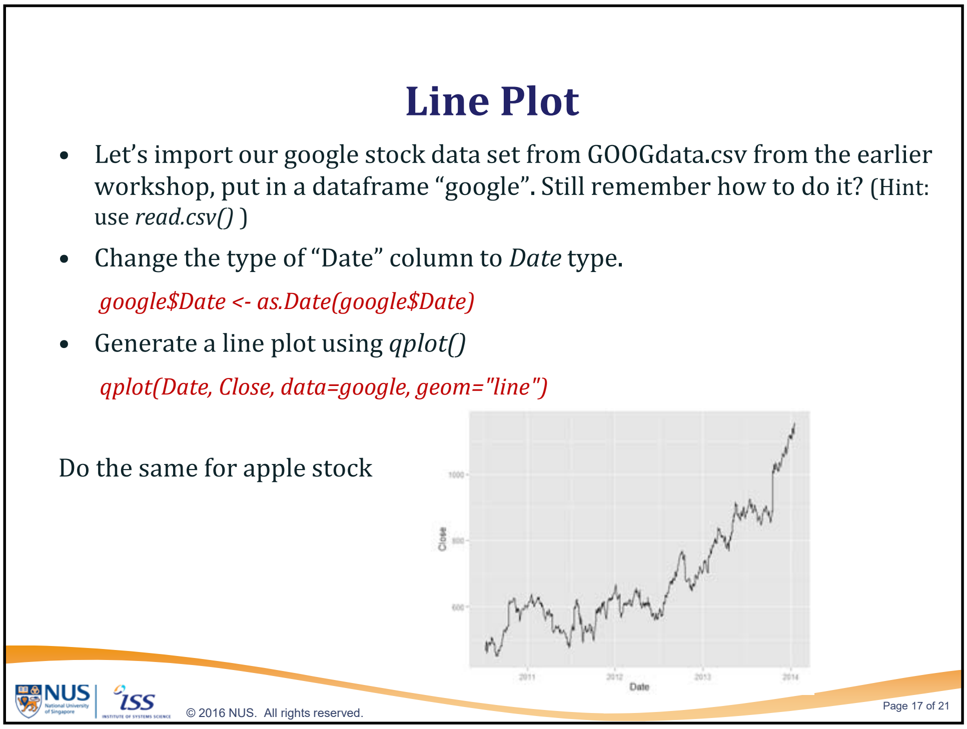

Line Plot

- Let's import our google stock data set from GOOGdata.csv from the earlier workshop, put in a dataframe "google". Still remember how to do it? (Hint: use *read.csv()*)
- Change the type of "Date" column to *Date* type.

  google$Date <- as.Date(google$Date)
- Generate a line plot using *qplot()*

  qplot(Date, Close, data=google, geom="line")

Do the same for apple stock

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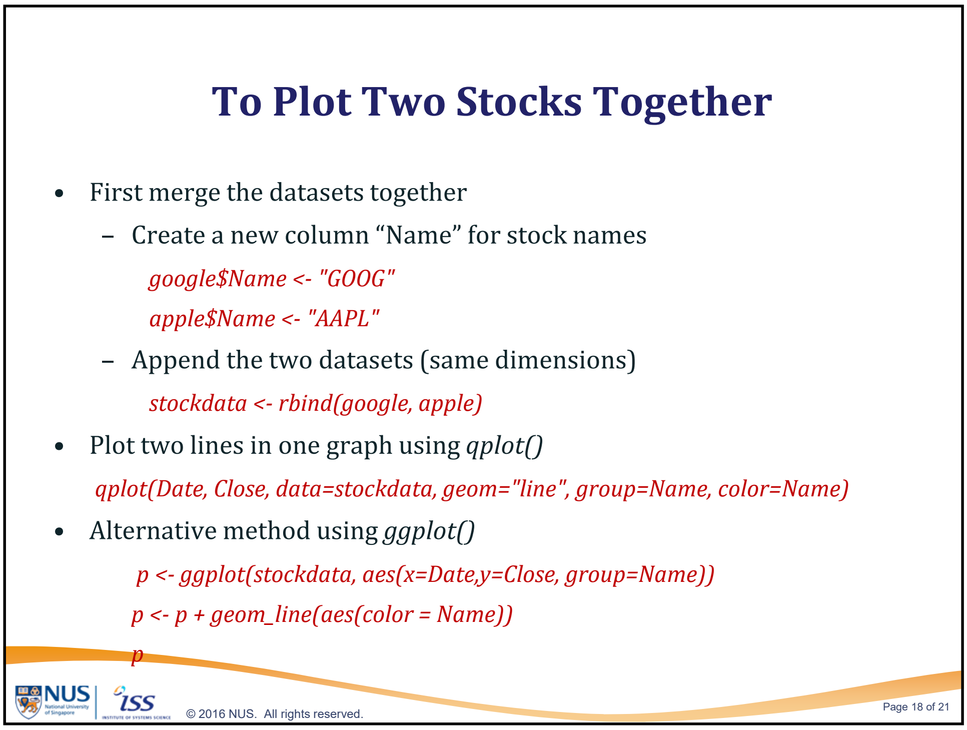

To Plot Two Stocks Together

- First merge the datasets together
  - Create a new column "Name" for stock names

    google$Name <- "GOOG"

    apple$Name <- "AAPL"
  - Append the two datasets (same dimensions)

    stockdata <- rbind(google, apple)
- Plot two lines in one graph using *qplot()*

  qplot(Date, Close, data=stockdata, geom="line", group=Name, color=Name)
- Alternative method using *ggplot()*

```
 p <- ggplot(stockdata, aes(x=Date,y=Close, group=Name))
p <- p + geom_line(aes(color = Name))
p
```

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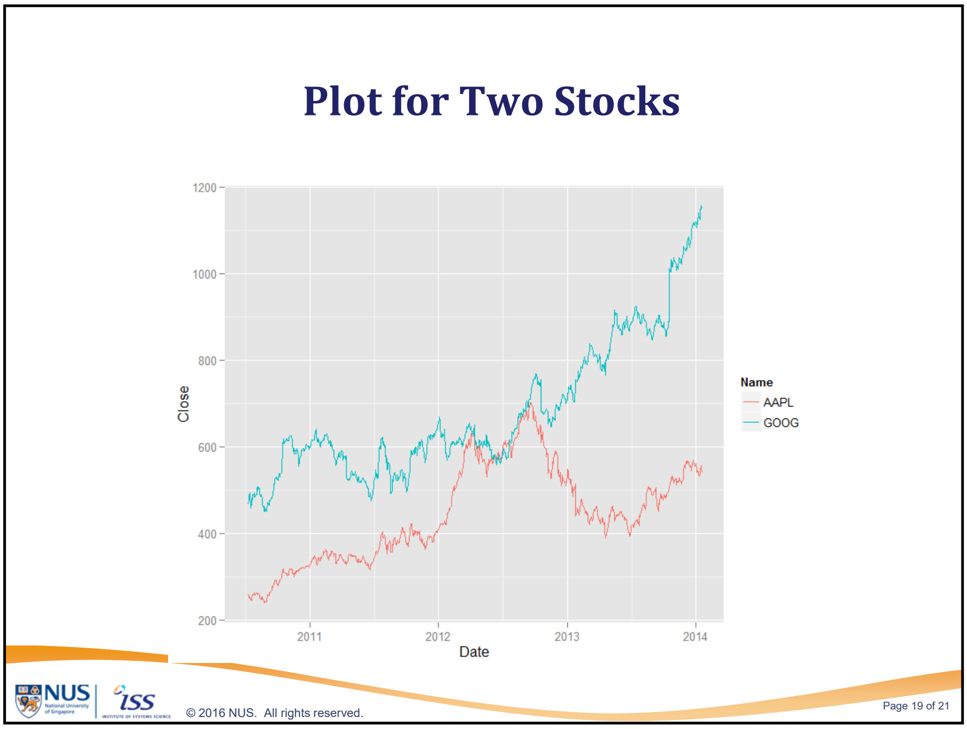

Plot for Two Stocks

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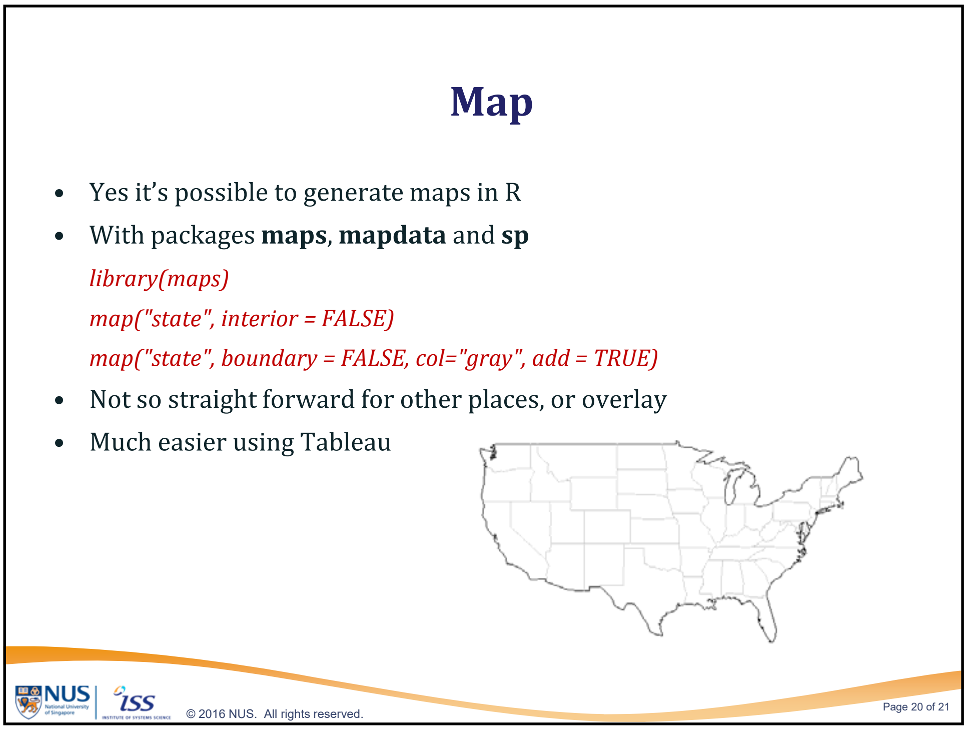

Map

- Yes it's possible to generate maps in R
- With packages **maps**, **mapdata** and **sp**

  library(maps)

  map("state", interior = FALSE)

  map("state", boundary = FALSE, col="gray", add = TRUE)
- Not so straight forward for other places, or overlay
- Much easier using Tableau

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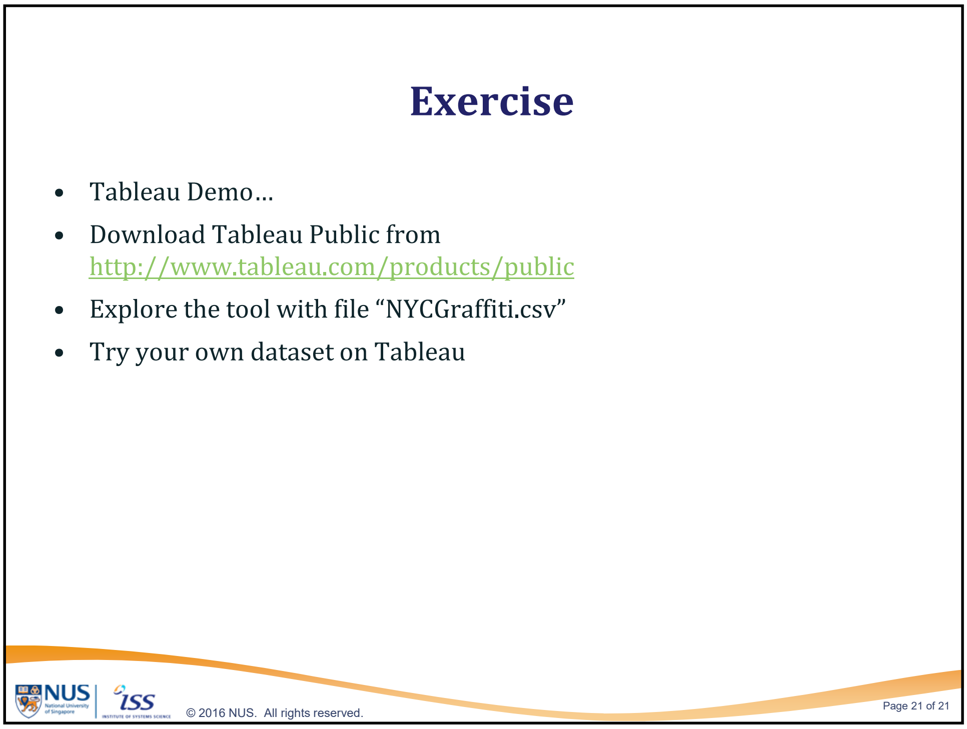

Exercise

- Tableau Demo…
- Download Tableau Public from http://www.tableau.com/products/public
- Explore the tool with file “NYCGraffiti.csv”
- Try your own dataset on Tableau

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