Introduction to R and RStudio

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Overview and History of R

- R is a dialect of the S language.
- S is a language that was developed by John Chambers and others at Bell Labs. S was initiated in 1976
- R was created in 1991 – by Rose Ihaka and Robert Gentleman
- In 1993 R was released to the public. 1997: R core group was formed 2000: R 1.0.0 was released
- We are using R version 3.1.2 (2014-10-31)

Features of R

- Runs on almost any standard computing platform/OS (even on the PlayStation 3)
- Frequent releases (annual + bug_x releases); active development.
- Useful for interactive work, but contains a powerful programming language for developing new tools (user –> programmer)

Feature of R

- Very active and vibrant user community; R-help and R-devel mailing lists and Stack Overflow – look at them on when at R help
- It's free! (Both in the sense of beer and in the sense of speech.)

How to setup Environment

- Download R from - The Comprehensive R Archive Network -http://cran.r-project.org/ and R Studio
- Available for the key OS

R-studio? -RStudio is the premier integrated development environment for R. - Download and install from http://www.rstudio.com/

Why R-studio? - RStudio's source editor includes a variety of productivity enhancing features including syntax highlighting, code completion, multiple-file editing, and find/replace, retrieving prev commands

Types of people in the world

- *There are **10 types of people** in this world, those who understand binary and those who dont*

The Terms

- **Object** R is an object oriented language and everything in R is an object.
  - We store using <- or = operator ie x <- 3 | x=3
- **Vector** A collection of one or more objects of the same type . We use c() or vector()
- **Function** A set of instructions carried out on one or more objects.
  - function *mean()* is used to calculate the arithmetic mean
- **Operator** Is a symbol that has a pre-defined meaning. +*-/
- **Parameter** The kind of information that can be passed to a function – mean(age)

Packages

- A set of functions designed to perform more specific statistical or graphical tasks examples and documentation.
- 4000+ packages found on the CRAN
- To use packages in R, we must first install them using the install.packages()

Data Types / Classes

Data Types	Stores
real	floating point numbers
integer	integers
complex	Complex numbers
factor	categorical data
character	strings
logical	TRUE or FALSe
NA	Missing
NULL	Empty
Function	Function type

RStudio Server Platform - Login

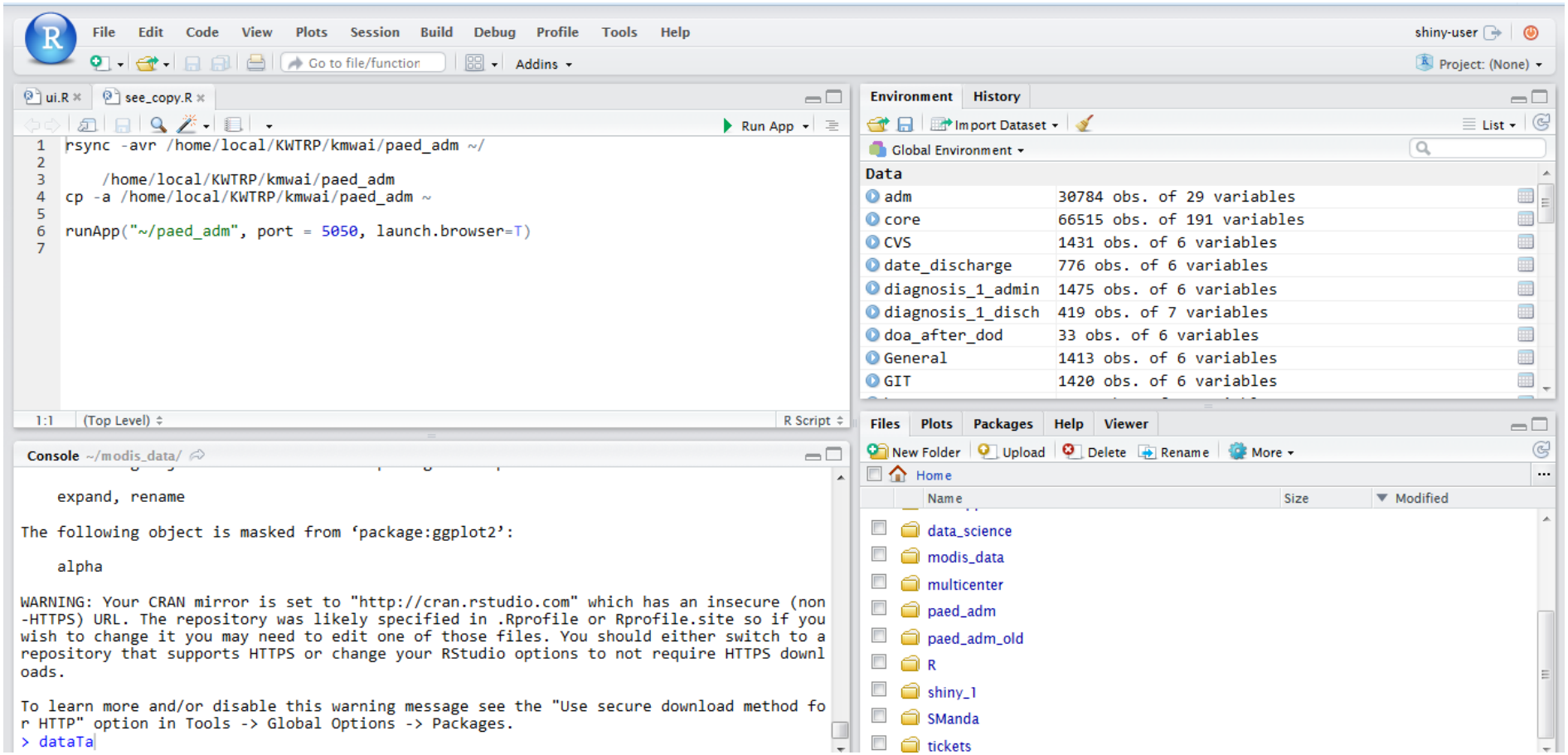


Figure 1: RSTUDIO

Vector

- A vector can only contain objects of the same class

```
a <- c(1, 2, 5.3, 6, -2, 4)  # numeric vector
b <- c("one", "two", "three")  # character vector
c <- c(TRUE, TRUE, TRUE, FALSE, TRUE, FALSE)  #logical vector
```

Matrices

- All columns in a matrix must have the same class(numeric, character, etc.) and the same length. The general format is

```
# mymatrix <- matrix(vector, nrow=r, ncol=c, byrow=FALSE,
# dimnames=list(char_vector_rownames, char_vector_colnames))
# byrow=TRUE indicates that the matrix should be filled by
# rows
```

Factors

- Used to represent categorical data.
- Can be unordered or ordered. -A factor is like an integer vector where each integer has a label.

```
x <- factor(c("yes", "yes", "no", "yes", "no"))
x
```

```
## [1] yes yes no  yes no
## Levels: no yes
```

Missing Values

- Missing values are represented by the symbol **NA** (not available)
- Impossible values (e.g., dividing by zero) are represented by the symbol NaN (not a number)
- Can be unordered or ordered. -A factor is like an integer vector where each integer has a label.

```
x <- NA
# is.na(x) # returns TRUE of x is missing mean(x, na.rm=TRUE)
# # exclude missing in functions complete.cases() #returns
# the number of complete cases
```

Data Frames

- More general than a matrix, has different columns and can have different modes (numeric, character, factor, etc.)
- Used to store tabular data
- Can store data of different classes
- *read.table()* or *read.csv()* – used to load dataframes

Create Data Frames

```
data.frame(foo = 1:4, bar = c(T, T, F, F))
```

```
##   foo   bar
## 1   1  TRUE
## 2   2  TRUE
## 3   3 FALSE
## 4   4 FALSE
```

```
x <- c(1, 2, 3, 4, 5, 6, 7, 8, 9)
y <- c("a", "b", "c", "d", "e", "f", "g", "h", "i")
df <- data.frame(x = x, y = y)
```

```r
print(df)
```

```
##   x y
## 1 1 a
## 2 2 b
## 3 3 c
## 4 4 d
## 5 5 e
## 6 6 f
## 7 7 g
## 8 8 h
## 9 9 i
```

```r
class(df)
```

```
## [1] "data.frame"
```

Subset and filter data

- We use the **subset** function to get a set of data
- We can use the **square brackets** [ROW,COLUMN]
- We can also select by **column names** i.e

```r
# using subset
df_sub1 <- subset(x = df, x > 3, select = c(x, y))
df_sub1
# using square brackets
df_sub2 <- df[1:3, ]
df_sub2
# using column names
df_sub3 <- df[c("x")]
df_sub3
```

- My favourite data subset tool is **dplyr**
- pipes in R - powerful tool for clearly expressing a sequence of multiple operations
- Importance is this pipe **%>%** (ctrl-shift-m)
- check - http://r4ds.had.co.nz/pipes.html

```
install.packages("dplyr")
library("dplyr")
# Example Pipe
1:10 %>% mean

years <- factor(2008:2012)
# nesting
as.numeric(as.character(years))
# piping
years %>% as.character %>% as.numeric
```

Example of subset with dplyr

- filter values of *x* greater than 3 then keep only the *y* variable and rename to *yes*

```
library(dplyr)
df_sub4 <- df %>% filter(x > 3) %>% select(yes = y)
```

Datasets

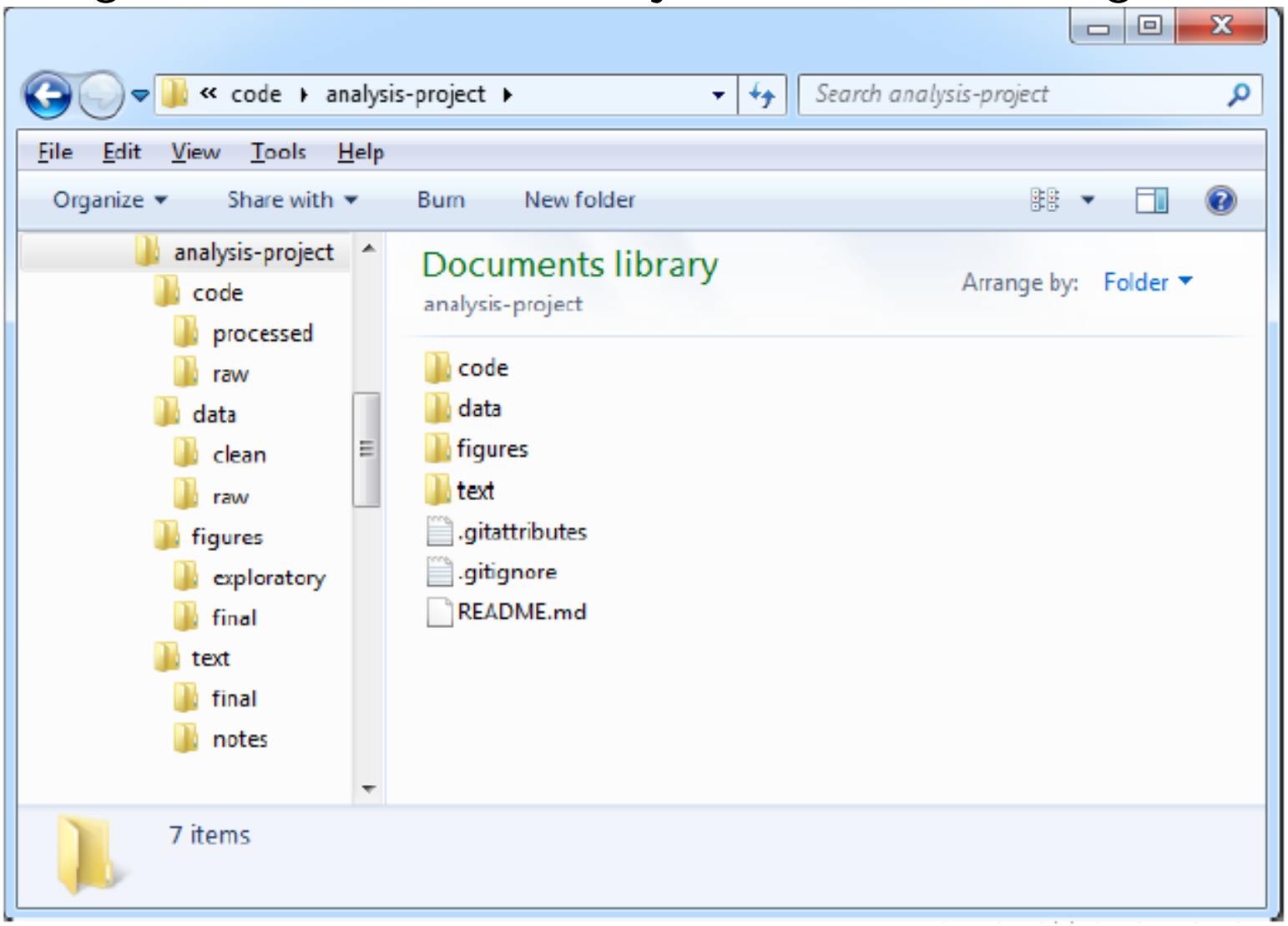
- R works with different types of datasets
- Base R functions *read.table* and *read.csv* can read in data stored as text files, delimited by *almost anything*
- Data from other stat packages can be read using *foreign package?*

- *read.xlsx(file, sheetIndex=1) #excel files*

- *read.dta(file)# stata files*
- *read.gpr(file) # files from genepix*

Creating an analysis project - Ideal Way

- Using R Studio to create a Project - From an existing directory



Reading Dataset

There are a few principal functions reading data into R.

- `read.table`, `read.csv`, for reading tabular data
- `readLines`, for reading lines of a text file
- `source`, for reading in R code files (inverse of `dump`)
- `dget`, for reading in R code files (inverse of `dput`)
- `load`, for reading in saved workspaces
- `unserialize`, for reading single R objects in binary form

Source: Computing for Data Analysis-Roger Peng

- Create the folder structure
- Upload/copy the data *birthweight.csv*
- read.csv the data with object name birthweight
- select females with a birthweight of more than 2500 then keep only *lbw* , *bweight* , *sex*

Help Areas

- R Help Mailing List - https://stat.ethz.ch/mailman/listinfo/r-help
- R Commander - http://socserv.mcmaster.ca/jfox/Misc/Rcmdr/
- Quick R - http://www.statmethods.net/
- R CookBook - http://www.cookbook-r.com/
- R-Bloggers - http://www.r-bloggers.com/
- Inside R- http://www.inside-r.org/blogs
- Try R - http://tryr.codeschool.com/
- Video Tutorials - http://www.twotorials.com/
- Stack overflow About R - http://stackoverflow.com/tags/r/info
- Stack overflow R FAQ - http://stackoverflow.com/tags/r
- R google group - https://groups.google.com/forum/#!forum/r-help-archive
- Pipes - https://stackoverflow.com/documentation/r/652/pipe-operators-and-others#t=20170908130003193933

Questions

```
is.everything("awe-some")
```

FALSE

```
is.everything("R-Some")
```

TRUE