Research Issues and Practices in Psychology

Week 1: Gentle R Introduction

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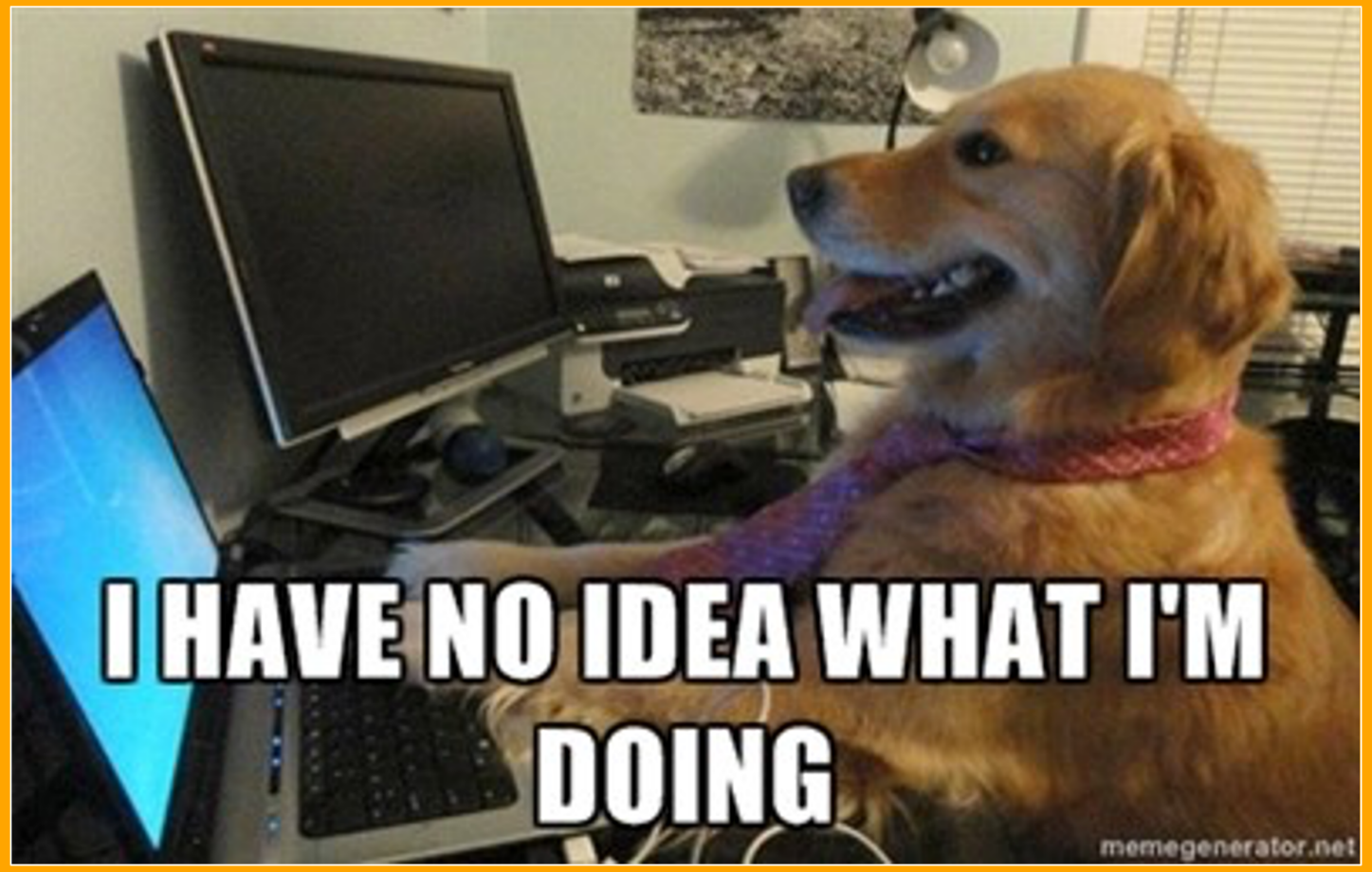
Objective

- Get you started with R
- Load your first dataset in R
- Explain some basic terminology and concepts

- Explain how to structure any data analysis project
- Learn how to run commands and save scripts

I know it is scary



Outline

- `Why R`
- IDE
- R commands & functions
  - Tidyverse & the Pipe Operator
- Multiple Functions
- Reading in data
- Saving R scripts

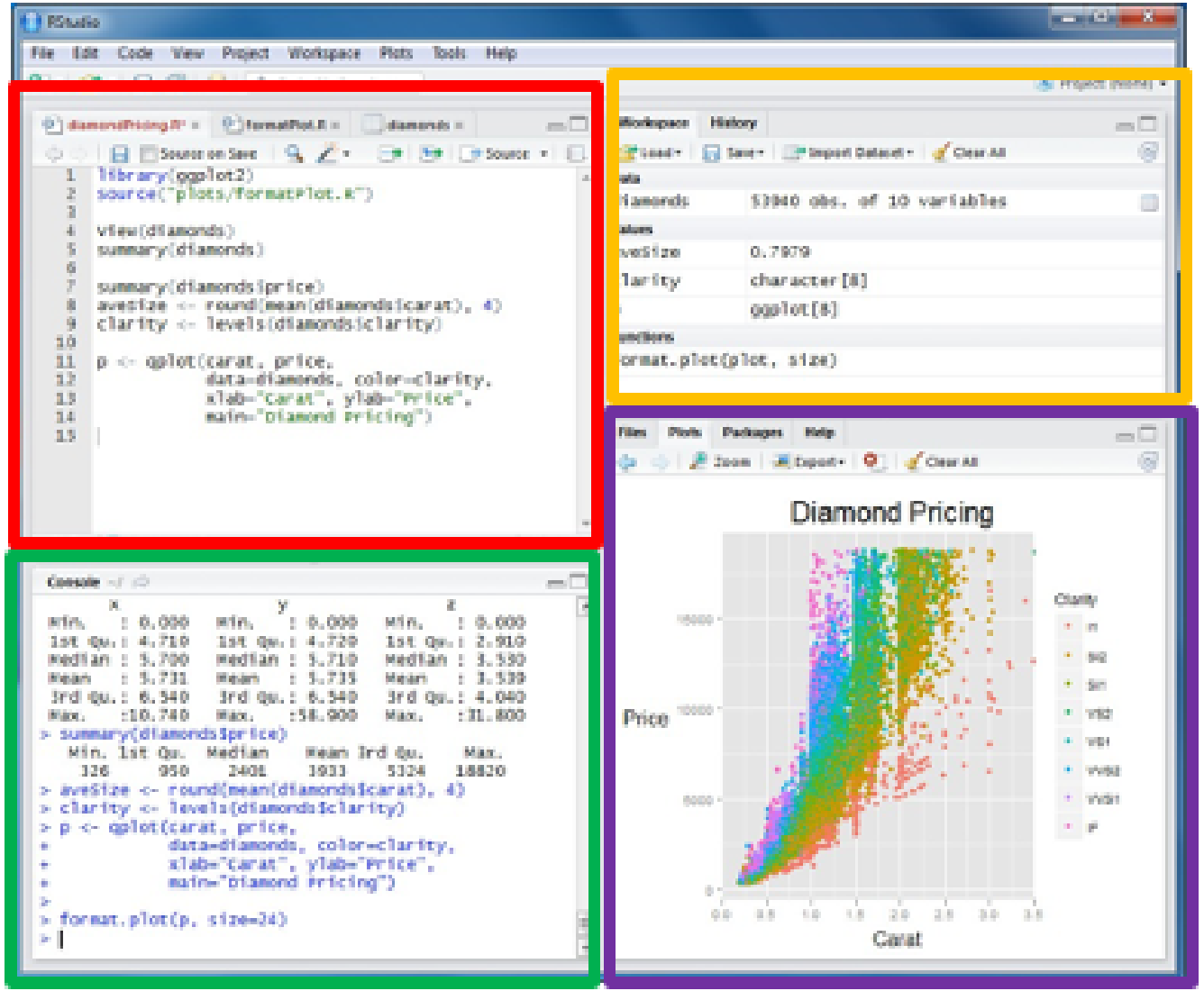
Why R?

- Free and open-source
- Flexibility
- Programming language (not point-and-click)
- Excellent graphics (via `ggplot2`)
- Easy to generate with reproducible reports
- Easy to integrate with other tool
- Inclusive Community

Rstudio Integrated Development Environment (IDE)

Source: edit file that you can run again later.

Console: type/paste commands to get output from R



Workspace: see list of variables and previous commands

Files/Plots/Packages/Help

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Assignment of Variables

- A variable is a symbol that stands for another value (just like “X” in algebra)

```
x <- 4

x
```

```
## [1] 4
```

- The arrow <- is called an ASSIGNMENT OPERATOR, and tells R to save an object called x that has the value of 6. This is similar to saving a value in a graphing calculator.

- Can use = if you want

```
x + 7
```

```
## [1] 11
```

Vectors

- Allows multiple types of classes to be concatenated together
    - Numeric

```
x <-  c(2,6,16)

x
```

```
## [1]  2  6 16
```

```
- `x` here is called an object
```

- Logical (TRUE/FALSE)

```
x[1]==2
```

```
## [1] TRUE
```

Vectors

- Character

```
x <- c("cat", "bat")

gender <- c("male", "female")
```

- Factors
- Turn character strings into specific categories

```
gender <- as.factor(gender)

gender
```

```
## [1] male   female
## Levels: female male
```

Indexing

- Vectors can be indexed

```
x[1] # retreve first
```

```
## [1] "cat"
```

```
x[2] # retreive second
```

```
## [1] "bat"
```

```
x[-2] # everythin but that numbe
```

```
## [1] "cat"
```

- Change values in vector

```
x[1] <- 7

x
```

Vectors

- Logical vectors

```
x==7
```

```
## [1]  TRUE FALSE
```

R as a Calculator

- Typing in a simple calculation show us the result

```
608+ 28
```

```
## [1] 636
```

```
11527-283
```

```
## [1] 11244
```

```
# divison
400/65
```

```
## [1] 6.153846
```

```
#multiplication
2*4
```

```
## [1] 8
```

Functions

- Take an object, do something to it, and return the result
- More complex calculations can be done with functions:
    - What is square root of 64?

```
# sqrt function
# in parenthesis: what we want to perform function on
sqrt(64)
```

```
## [1] 8
```

```
sr=function(a, b){

  a=x
  b=x

  c=a + b
  return(c)
}

sr(2,3)
```

Arguments

- Some functions have settings ("arguments") that we can adjust:
- `round(3.14)`
  - Rounds off to the nearest integer (zero decimal places)
- `round(3.14, digits=1)`
  - One decimal place

Getting Help

1. Help files

Anatomy of an R help file

Two ways to access:

1. Peruse in Help pane
2. ?<name> in console

Adapted from: https://socviz.co/appendix.html#a-little-more-about-r

Exercises

1. Open a blank new script

1.1 File -> New File > R Script

1.2 Ctrl + Shift + N

1.3 Click on new script icon

1. In one of these scripts type "Hello World"

2. To paste strings together you can use the `paste`() function (e.g., paste("Hello", "World")).

3.1 Use the `paste` function to string together a sentence of your choice. Assign it to a variable or object.

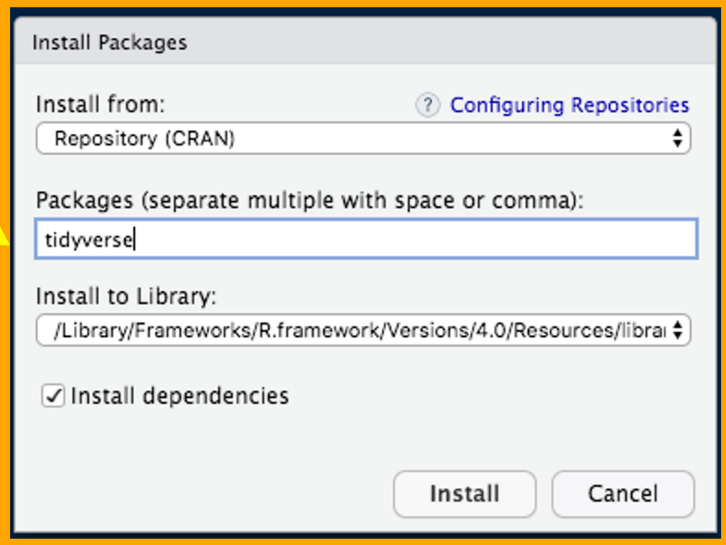
1. Modify the function above and instead of returning the sum return the .

Tidyverse and Pipes

- The `tidyverse` is an ecosystem of R packages designed for data science. All pac
share an underlying design philosophy, grammar, and data structures.


reading data
data visualisation
ggplot2
dplyr
readr
tibble
PSY 505
mod
data frames
data wrangling
tidyverse
data tidying
string manipulation
stringr
forcats
tidyr
purrr
functional programming

Installing Tidyverse




```
install.packages(tidyverse)
```

- Load package

```
library(tidyverse)
```

Pipes

- `tidyverse` provides another interface to functions—the pipe operator
  - Makes code easier to read and follow:
- This:

```
a %>%
  round()
```

- Can be converted into:
  - Start with a and then round
- Become popular is the `|>` pipe

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Multiple Functions

- Pipe operator makes it easy to do multiple functions in a row

```
-16 %>%
  sqrt() %>%
  abs()
```

- What is this doing?

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Reading in Data

- Download the file

function	reads
read_csv()	Comma separatedvalues
read_csv2()	Semi-colon separatedvalues
read_delim()	General delimited files
read_fwf()	Fixed widthfiles
read_table()	Space separated
read_tsv()	Tab delimited values

- General form: dataframe.name <-read.csv('filename')

Data Frames

> A data frame is like an Excel spreadsheet. It is two-dimensional with rows and columns.

- Instead of creating a number of vectors we store all the vectors into a single DF
- Can store numeric data (phone number, postal code, coordinates, etc.), float data (internet IP address, etc.), logical data (wants to receive ads: FALSE/TRUE, etc.), etc.

```
car_model <- c("Ford Fusion", "Hyundai Accent", "Toyota Corolla")
car_price <- c(25000, 16000, 18000)
car_mileage <- c(27, 36, 32)

cars_df <- data.frame(model=car_model, price=car_price, mileage=car_mileage)

flextable::flextable(cars_df)%>% flextable::autofit()
```

Tibbles

- More modern take on Data frames
  - Never changes input's type
  - Never adjusts the names of variables
  - It evaluates arguments lazily and sequentially
- Differences
  - Printing

```
as.tibble()
```

Here package

- Here helps set relative as opposed to absolute paths
  - Why would this be a problem?

```
#setwd("your path here")
```

```
#install here
library(here)

# here

here::here()
```

```
## [1] "/Users/jgeller1/Desktop/Psy505_issues_application"
```

```
# can use with read.csv
```

Loading the Data

> Disclaimer: `Create new project folder first, open up R second`

The faculty dataset contains aggregated data per faculty:

- faculty: Business, Economics, Political Science, Sociology
- students: number of students
- profs: number of profs
- salary: amount of salary
- costs: amount of costs dataset entails demographic and school-related information on imaginary students, such as

Load the data

CSV

```
fac=read.csv(here::here("static", "slides", "01-R", "datasets", "faculty.csv"))

fac
```

```
##             faculty students profs salary costs
## 1          Business      339    76  57273 33346
## 2         Economics      225    79  83292 33527
## 3 Political Science      264    63  66425 24965
## 4         Sociology      162    77  54246 29640
```

Looking at Data


```
fac%>%
  summary()
```

```
##    faculty            students         profs           salary
##  Length:4           Min.   :162.0   Min.   :63.00   Min.   :54246
##  Class :character   1st Qu.:209.2   1st Qu.:72.75   1st Qu.:56516
##  Mode  :character   Median :244.5   Median :76.50   Median :61849
##                     Mean   :247.5   Mean   :73.75   Mean   :65309
##                     3rd Qu.:282.8   3rd Qu.:77.50   3rd Qu.:70642
##                     Max.   :339.0   Max.   :79.00   Max.   :83292
##      costs
##  Min.   :24965
##  1st Qu.:28471
##  Median :31493
##  Mean   :30370
##  3rd Qu.:33391
##  Max.   :33527
```

Looking at Data


```
library(skimr)

fac%>%
  skim()
```

Table: Data summary

Name	Piped data
Number of rows	4
Number of columns	5
_	
Column type frequency:	
character	1
numeric	4
__	

Looking at the Data

- Select specific columns
  - use $ operator to grab one column

```
fac$column_name %>%
  summary()
```

```
## Length  Class   Mode
##      0   NULL   NULL
```

```
fac%>%
  select(column_name) %>%
  summary()
```

Looking at the Data

- Whole dataset
- First 6 observations
- Last 6 observations

```
fac # whole dataset
```

```
##             faculty students profs salary costs
## 1          Business      339    76  57273 33346
## 2         Economics      225    79  83292 33527
## 3 Political Science      264    63  66425 24965
## 4         Sociology      162    77  54246 29640
```

```
head(fac)
```

```
##             faculty students profs salary costs
## 1          Business      339    76  57273 33346
## 2         Economics      225    79  83292 33527
## 3 Political Science      264    63  66425 24965
## 4         Sociology      162    77  54246 29640
```

```
tail(fac)
```

Looking at Data


```
# look at specific variables
table(fac$students)
```

```
##
## 162 225 264 339
##   1   1   1   1
```

```
# let's try another package
library("janitor")
tabyl(fac$students)
```

```
##  fac$students n percent
##           162 1    0.25
##           225 1    0.25
##           264 1    0.25
##           339 1    0.25
```

Reading in Other File Types

- Excel

```
library(readxl)

fac<-  read_excel('/Users/jg/Desktop/experiment.xlsx', sheet=2)
# excel files can have multiple sheets
```

- SPSS

```
library(haven)

fac<-  read_spss('/Users/jg/Desktop/experiment.spss')
```


PSY 505

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Saving Files


```
write.csv(fac, file="df.csv")

write.table(fac, file="df.txt")
```

Getting help

1. R help files
2. Cheat sheets (https://rstudio.cloud/learn/cheat-sheets)
3. Google!

Exercise

1. Create a variable called y with the value of 7

2. Save the results of 6 + 3 as a variable called a.

3. Create a new project folder for this course entitled "psy_505" (run the .Rproj file)

   3.1 Place the exercise.csv file in the folder

4. Using here assign the file to a name of your choice

5. Explore the data set by running the commands head(data), str(data), glimpse(data) and summary(data) in your R script. You will use these a lot in the future, so have a closer look at the different outputs in the console (lower left). Remember to save your script!