R Today

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Outline

R Today

Tidyverse

Documentation

Web Apps

Miscellaneous

R Community

Summary

R Today

R Today

R Core Team has built a **great** product

Base R is very **reliable** and **well tested**

It has a **strong foundation** and is easily **extendable**

It develops **fast**!

Where is **R Today**?

Tidyverse

Tidyverse

Importing Data

Tidy & Transform

Data Visualisation

Modelling

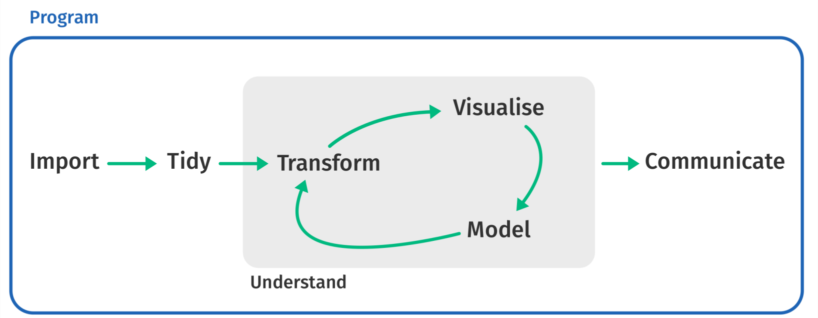
Programming

Tidyverse

“The packages in the tidyverse share a common philosophy of data and R programming, and are designed to work together naturally.” [1]

[1] http://tidyverse.org

Tidyverse



http://r4ds.had.co.nz/introduction.html

Importing Data

Packages

- Text files & CSVs
  - `readr`
- Excel Spreadsheets
  - `readxl`
- SAS, Stata, SPSS
  - `haven`
- Web (e.g. HTML, XML, json)
  - `rvest`, `xml2`, `httr` and `jsonlite`
- Databases
  - `DBI`, `RMySQL`, `RSQLite`, `RPostgreSQL`

Importing Data – CSV with Base R

```r
read.csv(text="subjid , country , gender, age, score
'1001', 'BE', 'Male' , 63, 15.3
'1002', 'NL', 'Female', 63, 18.9
'1003', 'FR', 'Female', 46, 9.1")
```

```
##   subjid country    gender age score
## 1 '1001'    'BE'   'Male'   63  15.3
## 2 '1002'    'NL'  'Female'  63  18.9
## 3 '1003'    'FR'  'Female'  46   9.1
```

Importing Data – CSV with Base R

```r
str(read.csv(text="subjid , country , gender, age, score
'1001', 'BE', 'Male' , 63, 15.3
'1002', 'NL', 'Female', 63, 18.9
'1003', 'FR', 'Female', 46, 9.1"))
```

```
## 'data.frame':    3 obs. of  5 variables:
##  $ subjid : Factor w/ 3 levels "'1001'","'1002'",..: 1 2
##  $ country: Factor w/ 3 levels " 'BE'"," 'FR'",..: 1 3 2
##  $ gender : Factor w/ 2 levels " 'Female'"," 'Male' ": 2
##  $ age    : int  63 63 46
##  $ score  : num  15.3 18.9 9.1
```

Importing Data – CSV with readr

```r
read_csv("subjid , country , gender, age, score
'1001', 'BE', 'Male' , 63, 15.3
'1002', 'NL', 'Female', 63, 18.9
'1003', 'FR', 'Female', 46, 9.1")
```

```
## # A tibble: 3 × 5
##   subjid country   gender   age score
##    <chr>   <chr>    <chr> <int> <dbl>
## 1 '1001'    'BE'   'Male'    63  15.3
## 2 '1002'    'NL' 'Female'    63  18.9
## 3 '1003'    'FR' 'Female'    46   9.1
```

Importing Data – Web with xml2

```r
# Cast of Lion (2017)
read_html("http://www.imdb.com/title/tt3741834") %>%
  html_nodes("#titleCast .itemprop span") %>%
  html_text()
```

```
##  [1] "Sunny Pawar"            "Abhishek Bharate"
##  [3] "Priyanka Bose"          "Khushi Solanki"
##  [5] "Shankar Nisode"         "Tannishtha Chatterjee"
##  [7] "Nawazuddin Siddiqui"    "Riddhi Sen"
##  [9] "Koushik Sen"            "Rita Boy"
## [11] "Udayshankar Pal"        "Surojit Das"
## [13] "Deepti Naval"           "Menik Gooneratne"
## [15] "David Wenham"
```

Tidy Data

Data can be presented in different ways

> *“Tidy datasets are all alike; every messy dataset is messy in its own way”*
>
> *Hadley Wickham (paraphrasing Leo Tolstoy)*

Tidy Data

Packages

- “Modern” dataframe (made easy)
  - `tibble`
- Easily go from long to wide datasets and vice versa
  - `tidyr`

Data Transformations

Packages

- Manipulate, process, merge, … data
    - `dplyr` – *"A grammar of data manipulation"*
- String manipulation
    - `stringr`
- Handling dates & time
    - `lubridate` & `hms`
- Factor variables
    - `forcats`

Chick Weight Data

Four variables: weight (g), time (days), chick ID and diet (four)

Twelve weight measurments per chick over 21 days

```
## # A tibble: 578 × 4
##   weight  Time Chick   Diet
## *  <dbl> <dbl> <ord> <fctr>
## 1     42     0     1      1
## 2     51     2     1      1
## 3     59     4     1      1
## 4     64     6     1      1
## # ... with 574 more rows
```

Pipe – %>%

Pipes are a powerful tool to do multiple steps in “one” go

```r
ChickWeight %>% as_tibble() %>%
  filter(Diet==2 & Time %in% c(0, 21)) %>%
  group_by(Time) %>%
  summarise(N=n(), mean=mean(weight))
```

```
## # A tibble: 2 × 3
##    Time     N  mean
##   <dbl> <int> <dbl>
## 1     0    10  40.7
## 2    21    10 214.7
```

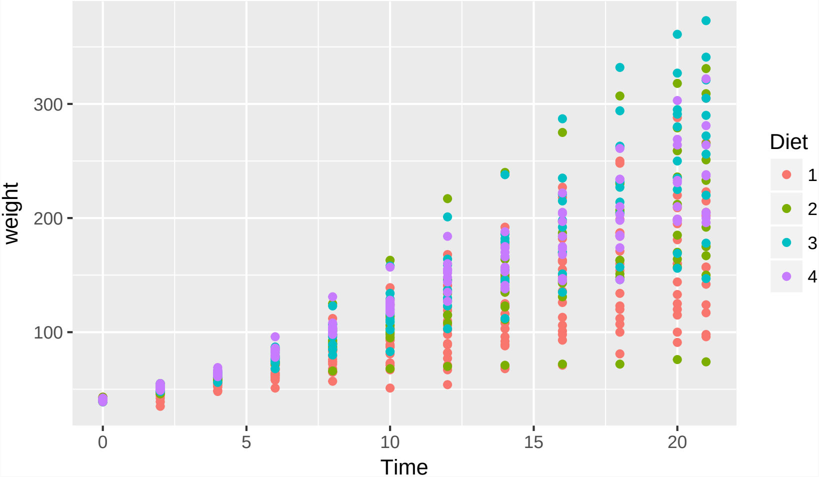
Data Visualisation

Packages

- Implementation of “Grammar of Graphics”
  - `ggplot2`
- Interactive graphics
  - `plotly`
- Scalable Vector Graphics
  - `svglite`

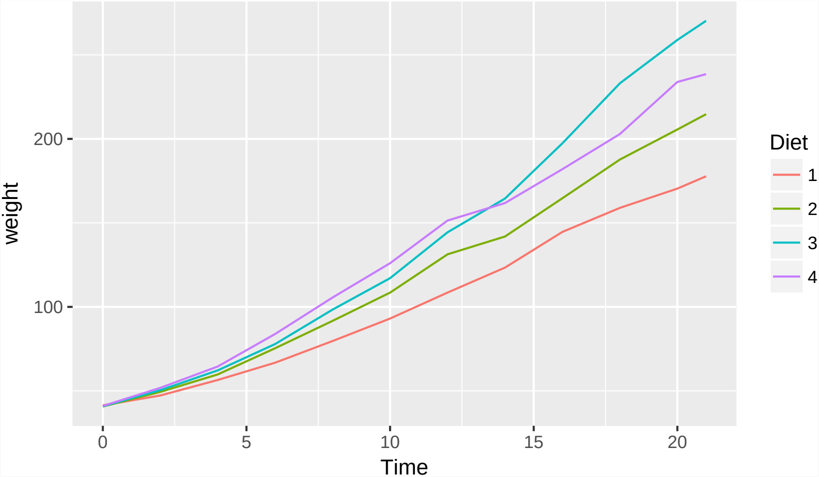
Chick Weight (i)

```
ggplot(ChickWeight, aes(Time, weight, colour = Diet)) +
  geom_point()
```



Chick Weight (ii)

```
ggplot(ChickWeight, aes(Time, weight, colour = Diet)) +
  stat_summary(fun.y="mean", geom="line")
```



Base Graphics vs ggplot2

Assume that we have the following datasets

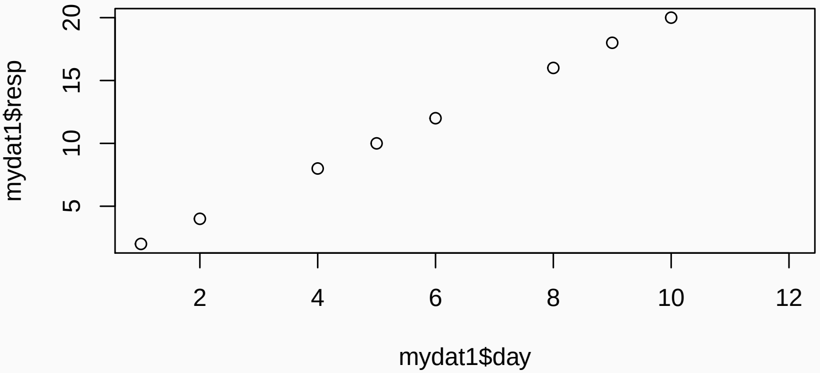
```
mydat1 <- tibble(
  day = c(1:12),
  resp = c(2, 4, NA, 8, 10, 12, NA, 16, 18, 20, NA, NA)
)

mydat2 <- tibble(
  day = c(1:12),
  resp = 0.5 + 3.2*day + rnorm(12)
)
```

Base Graphics – “Painter Model” (i)

Plot the first dataset

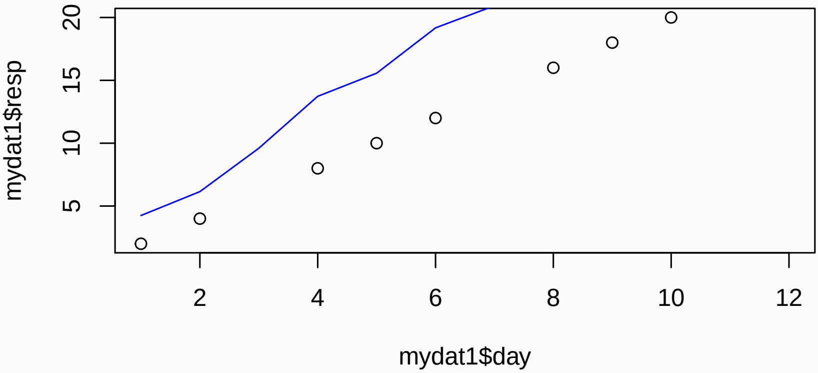
```
plot(mydat1$day, mydat1$resp)
```



Base Graphics – “Painter Model” (ii)

Add a line for the second dataset

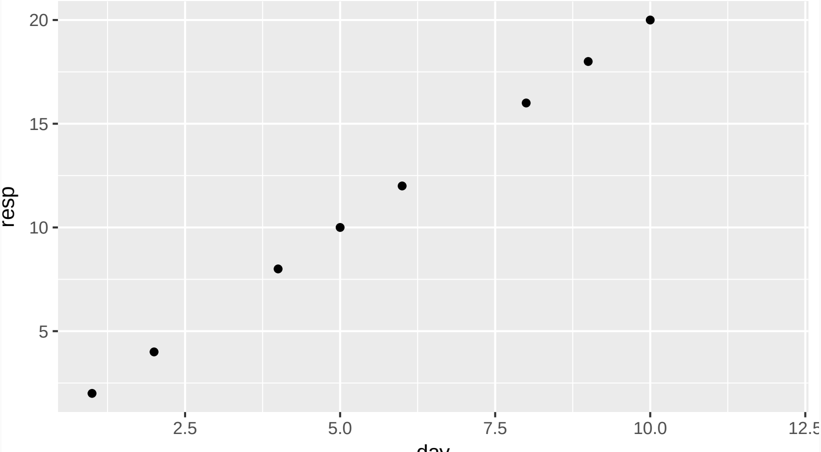
```
plot(mydat1$day, mydat1$resp)
lines(mydat2$day, mydat2$resp, pch=19, col="blue")
```



ggplot2 – "Grammar of Graphics" (i)

Plot the first dataset

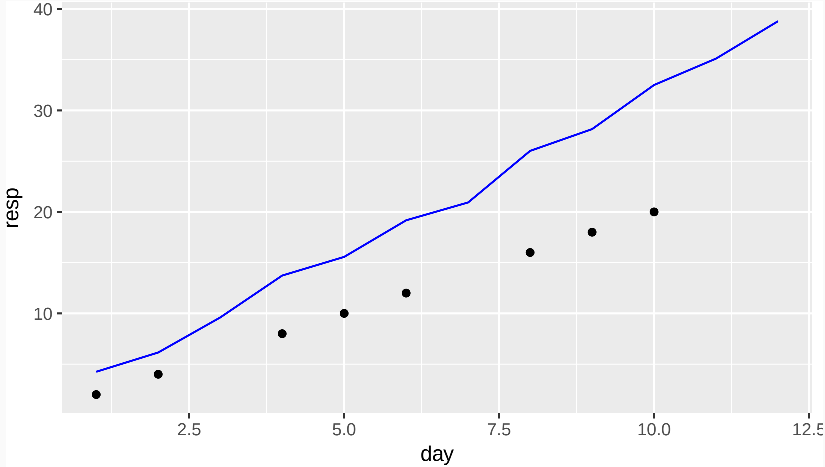
```
mygph <- ggplot(mydat1, aes(day, resp)) + geom_point()
mygph
```



ggplot2 – "Grammar of Graphics" (ii)

Add a line for the second dataset

```
mygph + geom_line(data=mydat2, colour="blue")
```



Base Graphics vs ggplot2

Base graphics plotted the second dataset **without warning** that there were values outside the plot.

ggplot2 **adapted** the plot for the second dataset.

- It also gave a **warning** (not shown) about the 4 missing values.

The Base graphics issue could be programmed out but **ggplot2** takes it away.

Modelling

Packages

- Convert statistical analysis objects from R into tidy data frames
  - `broom`
- Modelling Functions that Work with the Pipe (%>%)
  - `modelr`

Programming

Packages

- Less development time, readable code and easier maintenance
  - `magrittr` (origin of the pipe *like* operator %>%)
- Functional Programming Tools - consistent version of `apply` family of functions
  - `purrr`

Literate Programming

> *“Let us change our traditional attitude to the construction of programs. Instead of imagining that our main task is to instruct a computer what to do, let us concentrate rather on explaining to humans what we want the computer to do.”*
>
> *Donald E. Knuth, Literate Programming, 1984*

Documentation

Documentation

Packages

- Dynamic Documents for R
  - `rmarkdown`, `knitr`, `pander`
- Authoring Books and Technical Documents with R Markdown
  - `bookdown`
  - `blogdown` for blogs (under development)
- Microsoft Word and PowerPoint Documents
  - `ReporteRs`

R Markdown

Rmarkdown is an *authoring framework* for your code, results and commentary.

From data to final report in one document.

- **Great** for reproducible research
- Quality Control workload can be **reduced**
- Can output to **different** formats

R Markdown

Outputs

- Reports
  - HTML
  - PDF
  - Microsoft Word
- Presentations
  - PDF ($\LaTeX$ beamer)[2]
  - HTML 5 (`ioslides`, `slidy`)

[2] Like this presentation :)

Web Apps

Web Apps

Package

- Web Application Framework
    - `shiny`, `opencpu`
- Interactive Web Maps
    - `leaflet` & `rmaps` (under development)
- JavaScript Data Visualization
    - `htmlwidgets`

Miscellaneous

Miscellaneous

Package

- Extension of `data.frame` to reduce programming and compute time *tremendously*
  - `data.table`
- Language agnostic fast, lightweight, and easy-to-use binary file format for storing data frames
  - `feather`

R Community

R Community

R has a **strong community** across the world

R Core Team hosts some long running mailing lists

R Consortium has companies as members

R Ladies Global promotes gender diversity

Various **web** based communities, e.g. GitHub, Twitter, Stackoverflow

How can you keep up?

It can be a full time job to keep up and this presentation just gave some highlights

- **Use R** as much as you can
- **Learn** from one another **by sharing code**
- Don't be afraid to **ask** questions
- Once a week look at **R-weekly.org**
- **Join in by contributing** e.g., packages, documentation, blog posts, giving courses, support on forums, …

Summary

Summary

R Core Team have developed a **high quality** and **reliable product**

Base R is **flexible** and **extendable** by design

Fast development – there are more than 10,000 packages

R Community is diverse and strong

Tidyverse approach lets you think about **what you want to do** and **less about what R is doing**