RStudio

250 Northern Ave, Boston, MA 02210
Phone: 844-448-1212

Email: info@rstudio.com
Web: http://www.rstudio.com

All Training materials are provided "as is" and without warranty and RStudio disclaims any and all express and implied warranties including without limitation the implied warranties of title, fitness for a particular purpose, merchantability and noninfringement.

Prereqs

```
install.packages("reportsWS",
repos = c(
  "http://cran.rstudio.com",
  "http://training.rstudio.com"
))
library(reportsWS)
```

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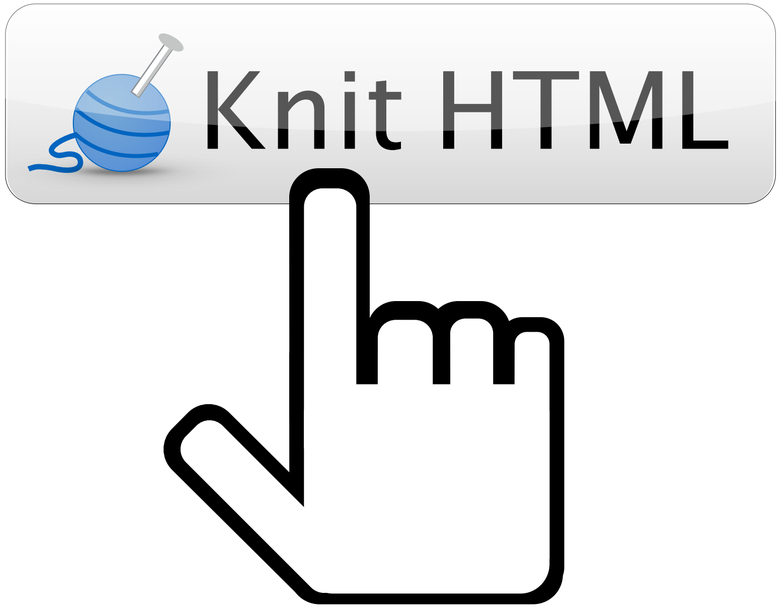
Reproducible reports with R Markdown

One format to rule them all

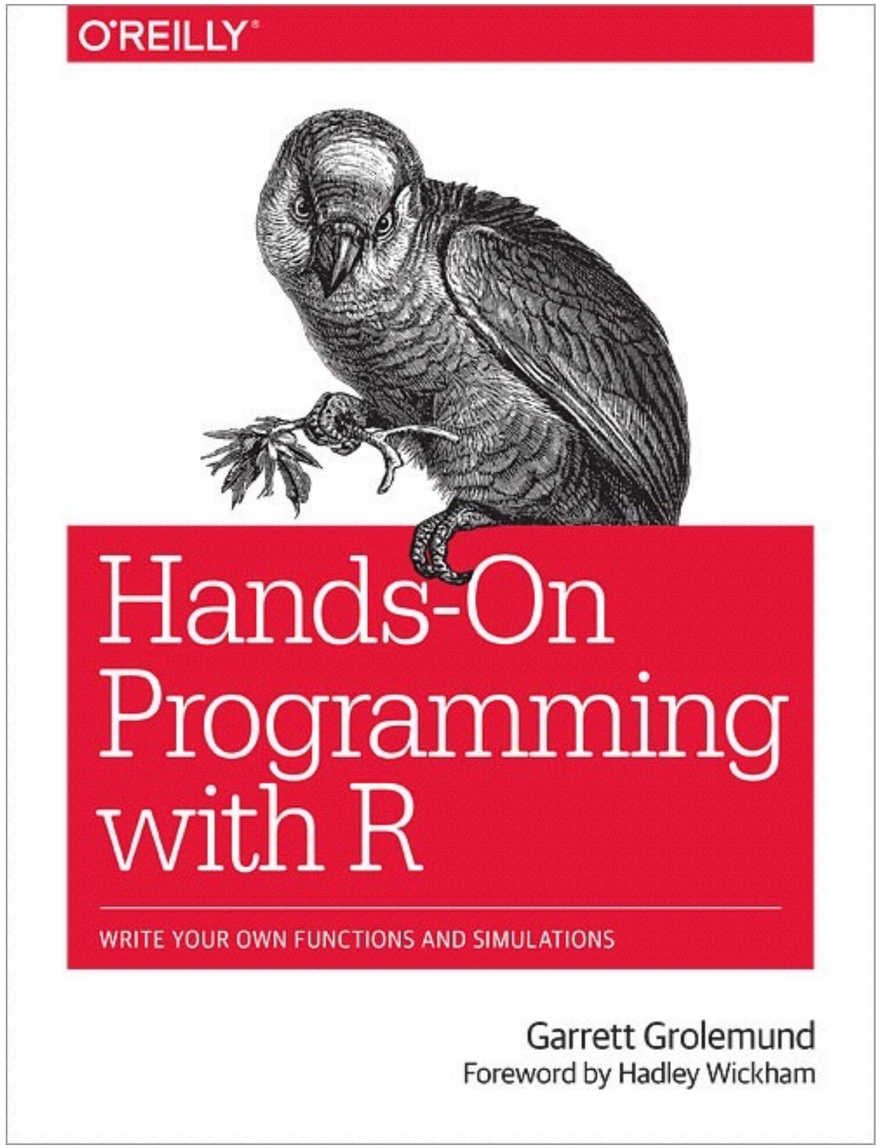


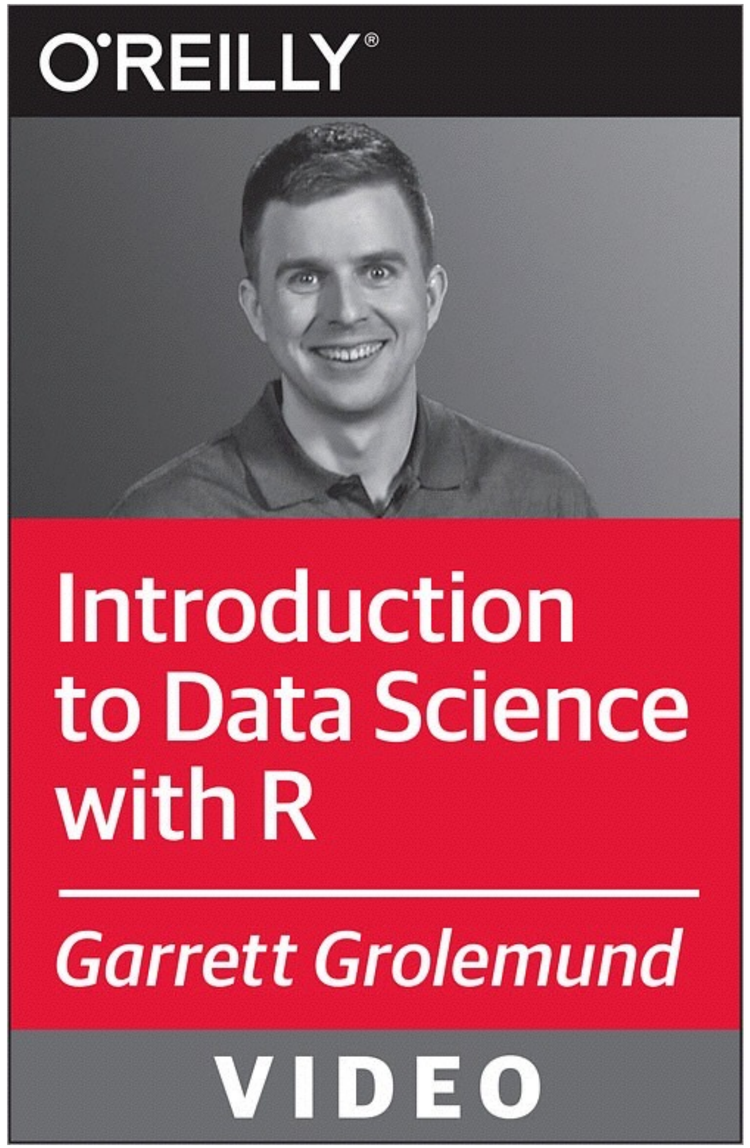
Joe Cheng
Software Engineer
September 2015
Email: joe@rstudio.com

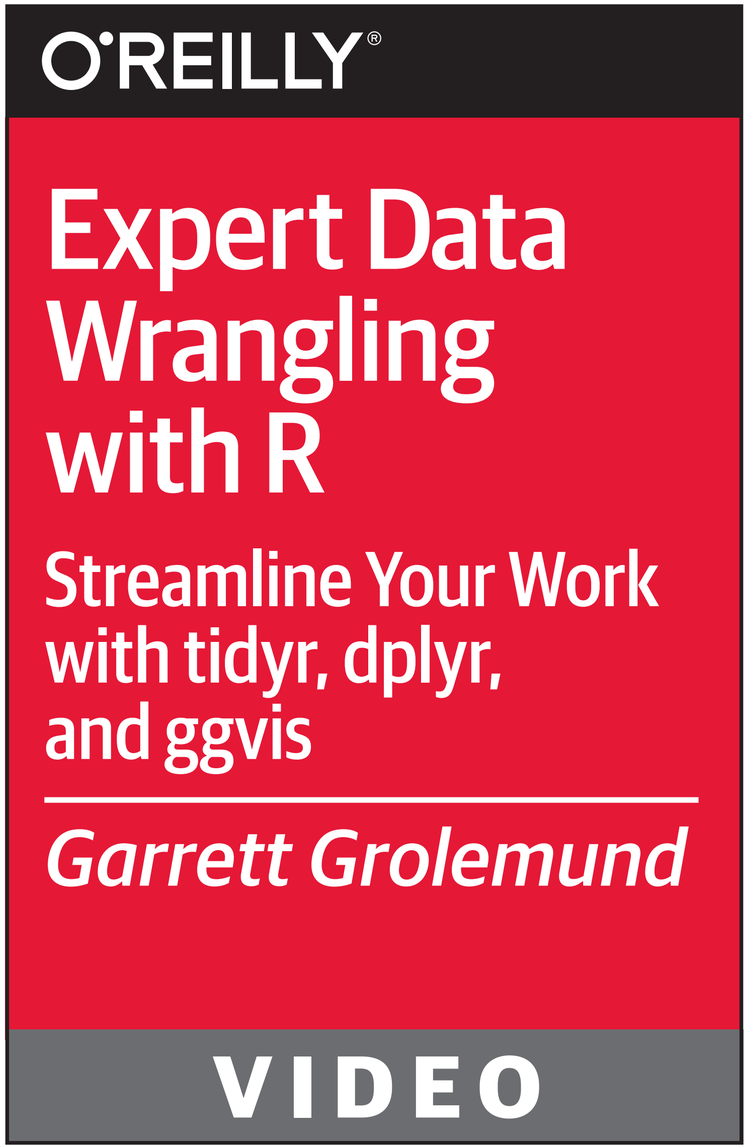
RStudio IDE
RPubs
httpuv
Shiny
Shiny Server
packrat
htmlwidgets
leaflet
d3heatmap

@jcheng

Slides at: bit.ly/EARL2015-Reports







Slides at: bit.ly/EARL2015-Reports

DataCamp

www.datacamp.com

Data Visualization in R with ggvis

Reporting with R Markdown

Data Manipulation in R with dplyr

How to use the RStudio IDE

Why is RStudio IDE greyed out?

Slides at: bit.ly/EARL2015-Reports

Today's assistants:

Tareef Kawaf - RStudio
Aimee Gott - Mango Solutions
Steph Locke - Mango Solutions

Slides at: bit.ly/EARL2015-Reports

Warm Up

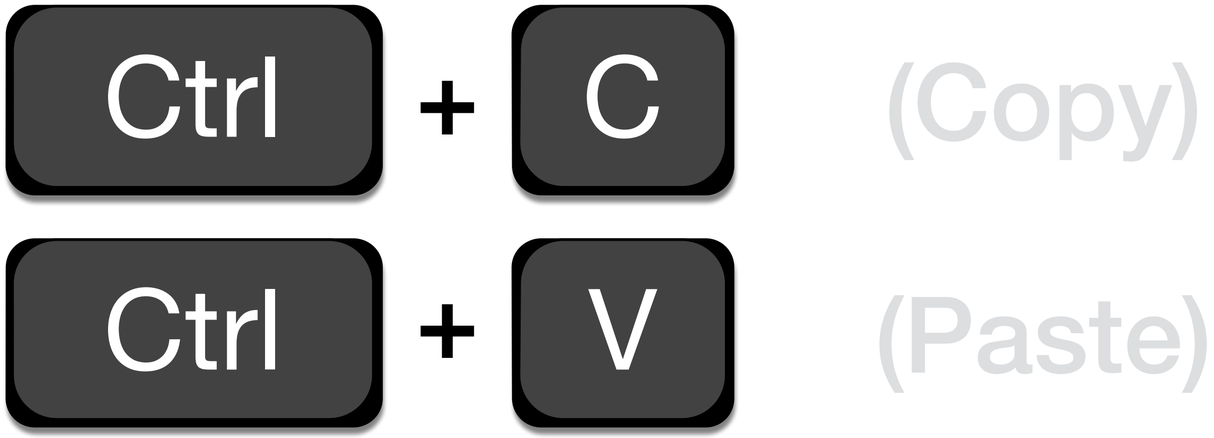
TALK. Introduce yourself to the person on your left and the person on your right.

1. Where do you work?
2. What do you do with data?

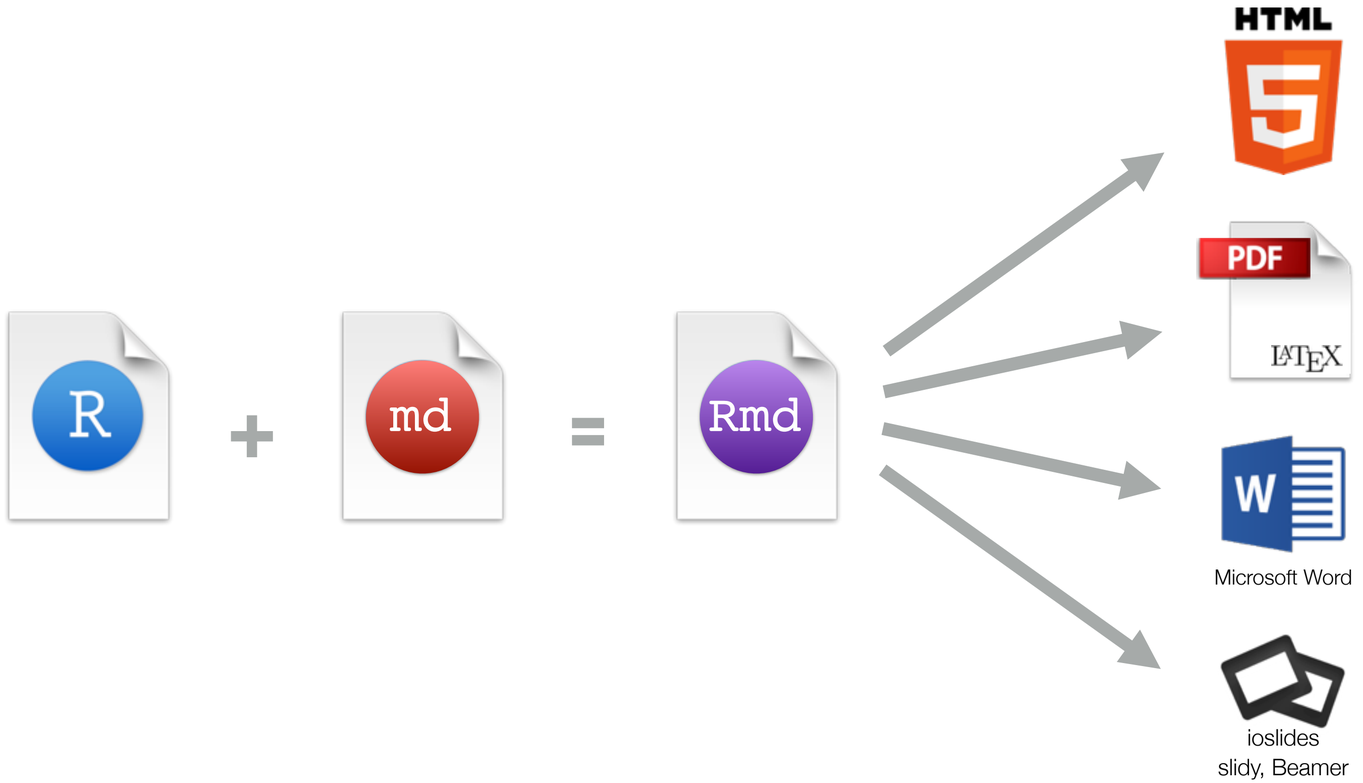
1. Reproduce reports (R Markdown)
2. ~~Reproduce computing environment (Packrat)~~
3. Reproduce R expertise (Shiny)

Reproducible reports

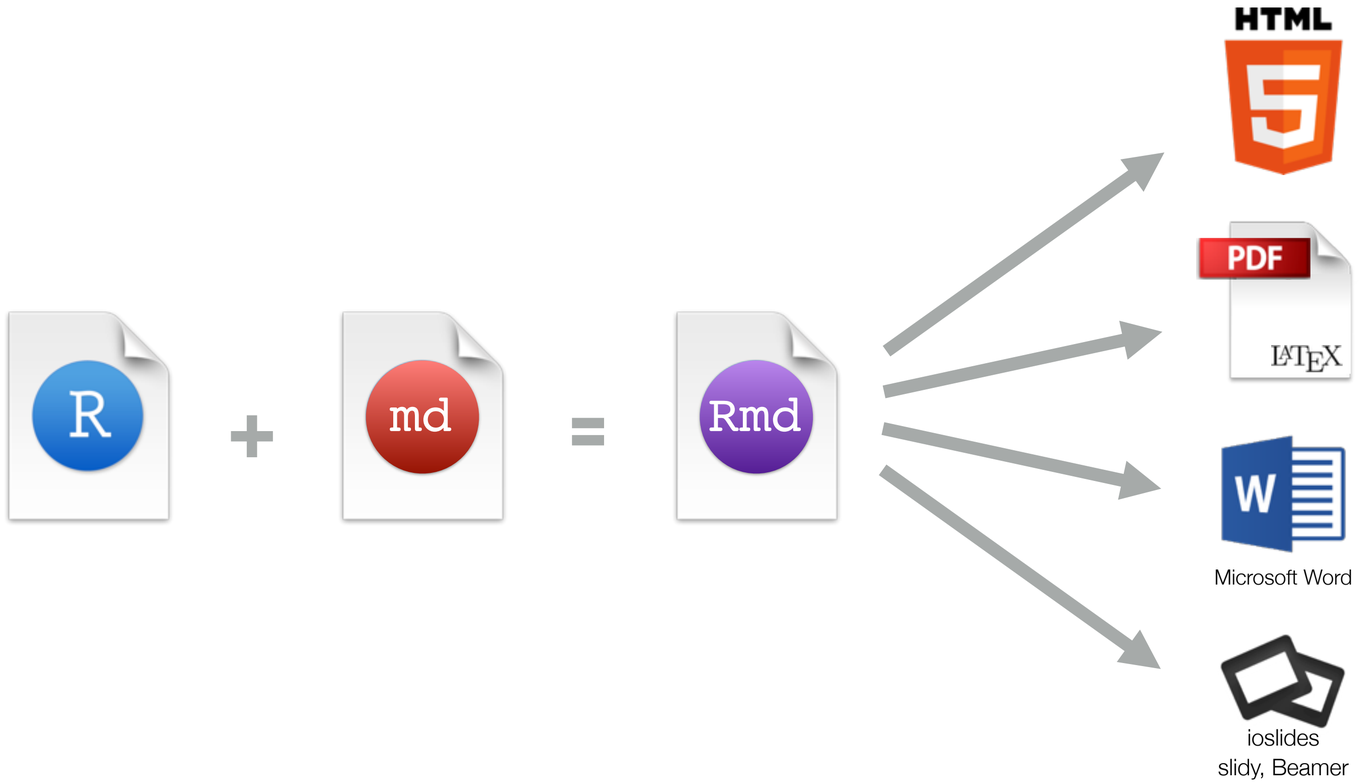
How can you update results?



R Markdown



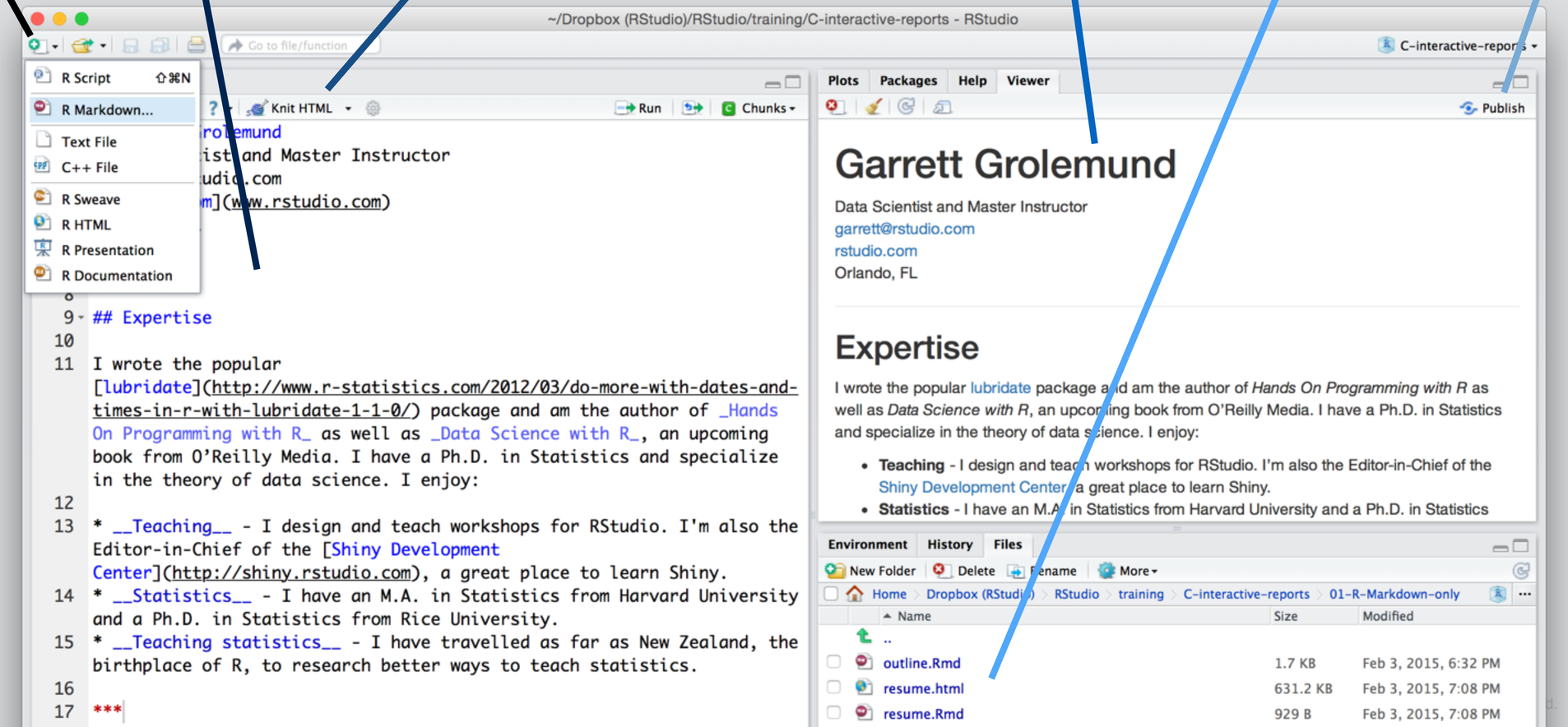
R Markdown



Slides at: bit.ly/EARL2015-Reports

demo

1. Open a new `.Rmd` file
2. Edit text
3. Click "Knit HTML"
4. Preview output
5. Access output file
6. Publish



Markdown

Markdown

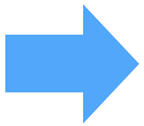
A simple way to write HTML.
Mostly plain english (like an email)

```
# Say Hello

To my little
friend, markdown.


Markdown is

* _easy_ to use
* __simple__
* fun?
```



Say Hello

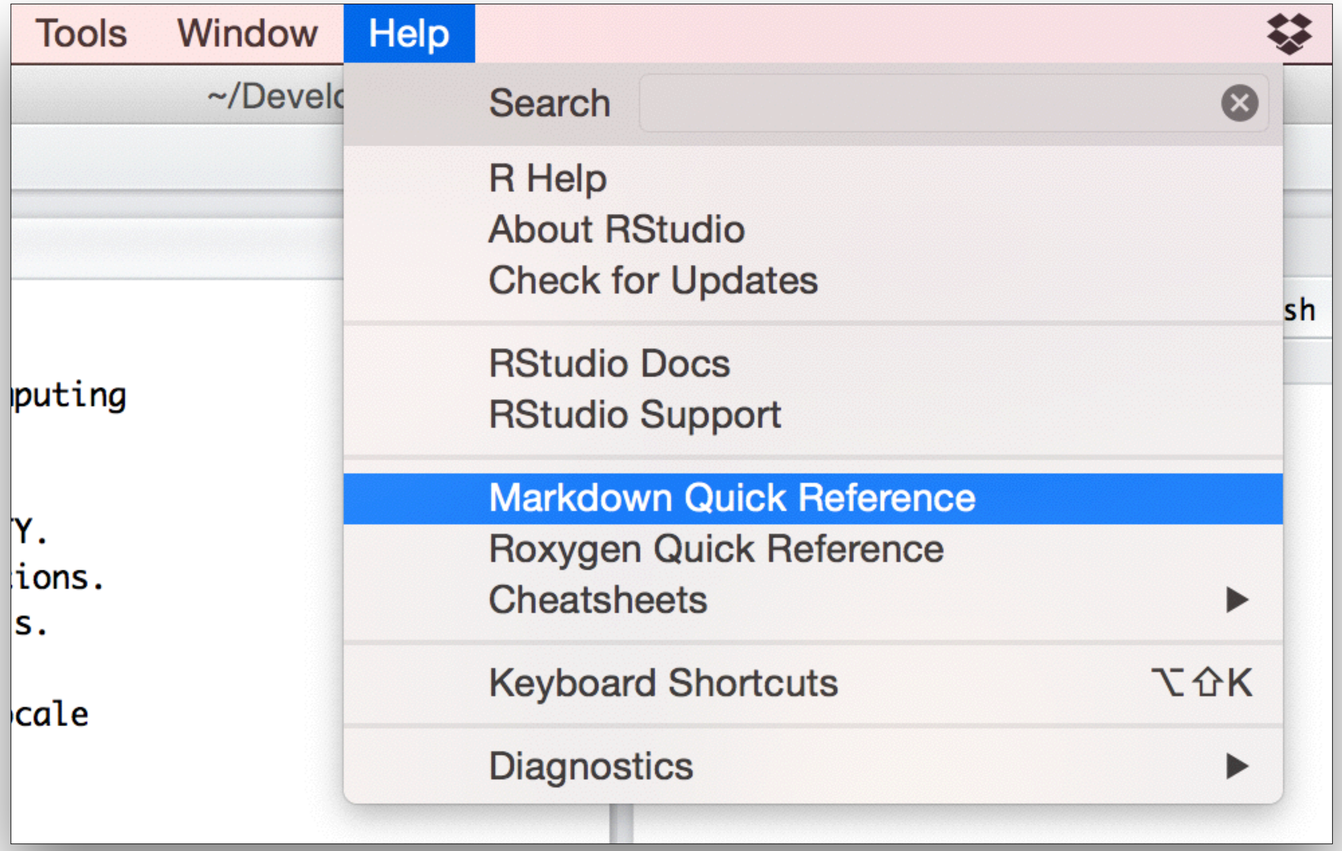
To my little friend, markdown.
Markdown is

- *easy* to use
- **simple**
- fun?

Web sites that use markdown

* **GitHub** www.github.com
* **StackOverflow** www.stackoverflow.com
* **Reddit** www.reddit.com
* **Meteor** www.meteor.com
* many more

Markdown Quick Reference



A* Markdown Cheatsheet

** incomplete*

```
library(reportsWS)
exercise(2)
```

Your Turn

```
exercise(2)
```

Pair up with your neighbor. Choose a writer.

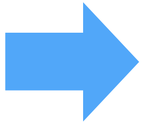
1. Choose a line in the cheatsheet.
2. Rewrite it to display the Markdown formatting that it describes.
3. Re-render the file to see if it worked.

How many can you do?

Headers

Use # to create headers.
Multiple #'s create lower level headers.

```
# Header 1
## Header 2
### Header 3
#### Header 4
##### Header 5
###### Header 6
```



Header 1

Header 2

Header 3

Header 4

Header 5

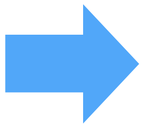
Header 6

Text

Add two spaces at the end of a line to start a new line

Text is rendered as plain text. Use underscores (_) to make italics, two underscores (__) to make bold, back ticks to make code.

```
Text
_italics_
__bold__
`code`
```



Text

italics

bold

`code`

Lists

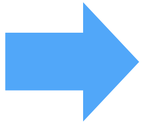
Use asterisks to make bullet points.
Use numbers to make numbered lists.

```
Bullets

* bullet 1
* bullet 2

Numbered list

1. item 1
2. item 2
```



Bullets

- bullet 1
- bullet 2

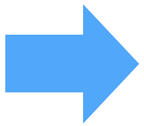
Numbered list

1. item 1
2. item 2

Hyperlinks

Use brackets to denote a link. Place the URL in parentheses.

```
This is a
[link](http://vw.com).
```

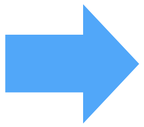


This is a link.

Equations

Write equations with latex math commands and surround them in $'s.

```
According to
Einstein,
$E=mc^{2}$
```



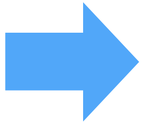
According to Einstein, $E = mc^2$

Equation blocks

Use two $'s to make centered equation blocks.

```
According to
Einstein,

$$E=mc^{2}$$
```



According to
Einstein,

$$E = mc^2$$

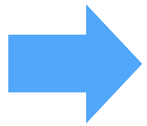
Images

Use a link preceded by an ! to insert an image.

The link text should be

- *a URL (if the image is hosted online)*
- *a file path (if the image is saved as a file)*

```
![](images/1.png)
The RStudio logo.
```



Note: You must save your .Rmd file before the preview will find the image

R Markdown Reference Guide

www.rstudio.com/resources/cheatsheets/

R Markdown Reference Guide

Learn more about R Markdown at rmarkdown.rstudio.com
Learn more about Interactive Docs at shiny.rstudio.com/articles

Contents:

Syntax	Becomes
`Plain text`	Plain text
`End a line with two spaces` `to start a new paragraph.`	End a line with two spaces to start a new paragraph.
`*italics* and _italics_`	*italics* and *italics*
`**bold** and __bold__`	**bold** and **bold**
`superscript^2^`	superscript^2
`~~strikethrough~~`	~~strikethrough~~
`[link](www.rstudio.com)`	link
`# Header 1`	**Header 1**
`## Header 2`	**Header 2**
`### Header 3`	**Header 3**
`#### Header 4`	**Header 4**
`##### Header 5`	**Header 5**
`###### Header 6`	**Header 6**
`endash: --`	endash: –
`emdash: ---`	emdash: —
`ellipsis: ...`	ellipsis: …
`inline equation: $A = \pi*r^{2}$`	inline equation: $A = \pi * r^2$
`image: ![](path/to/smallorb.png)`	image: 
`horizontal rule (or slide break):`	horizontal rule (or slide break):
`***`	

knitr

code chunks

Embed code

Insert a chunk of R code with

````
```{r}
# some code

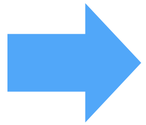
```
````

When you compile, R markdown will run the code and include its results. R markdown will also remove the ```{r} and ```.

inline code

Place code in a sentence with `r #code`. R Markdown will replace the code with its results.

```
Today is
`r Sys.Date()`.
```



Today is 2015-04-16.

You cannot add options to inline code

exercise(19)

```
plot(mtcars$disp, mtcars$mpg)
mod <- lm(mpg ~ disp, data = mtcars)
coef(mod)
```

Your Turn

Write a simple report that embeds the code in `exercise(19)` and explains the results of the code.

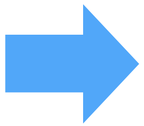
Check your work by knitting the document.

```
solution(19)
```

chunk options

By default, R markdown includes both the code and its results

````
Here's some code
```{r}
dim(iris)
```
````



Here's some code

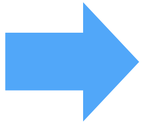
```
dim(iris)
```

```
## [1] 150   5
```

echo

Add options in the brackets after r.
echo = FALSE hides the code.

````
Here's some code
```{r echo=FALSE}
dim(iris)
```
````



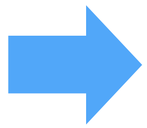
Here's some code

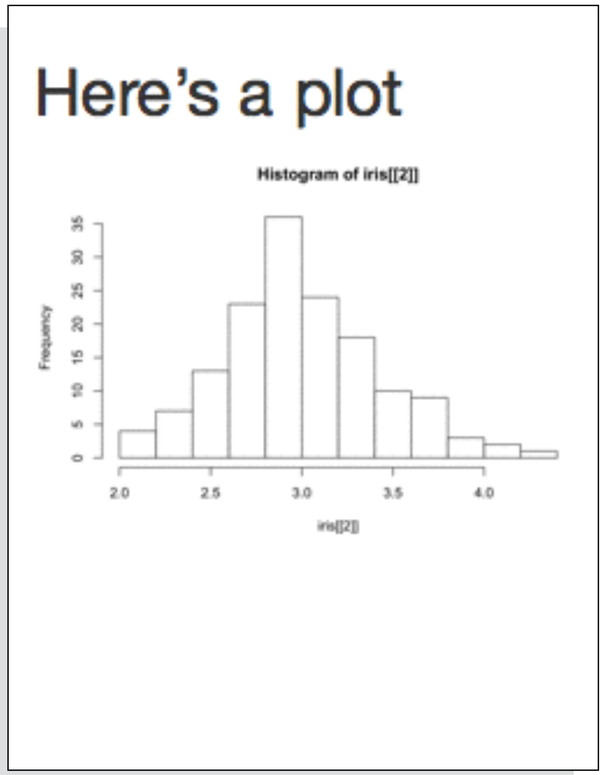
```
## [1] 150   5
```

echo

Add options in the brackets after r.
echo = FALSE hides the code.

````
Here's a plot
```{r echo=FALSE}
hist(iris[[2]])
```
````





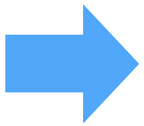
This is very useful for plots

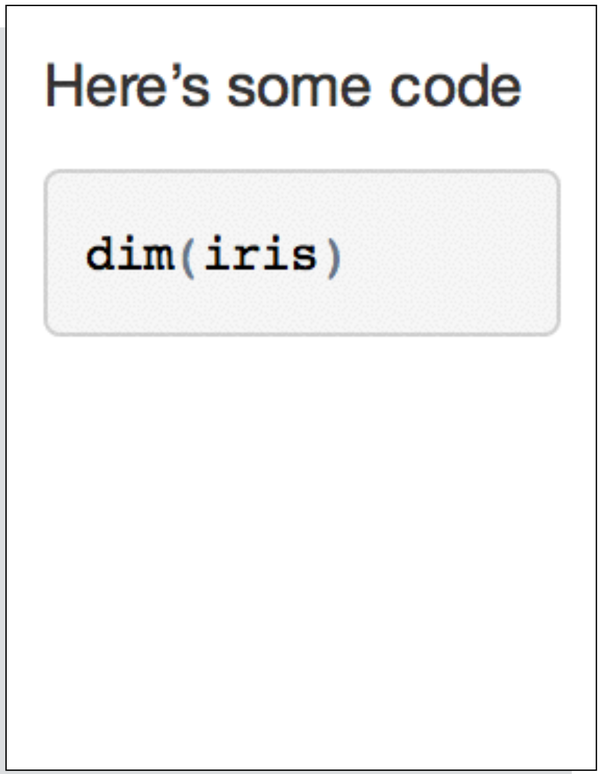
eval

eval = FALSE prevents the code from being run.
As a result, no results will be displayed with the code

````
Here's some code

```{r eval=FALSE}
dim(iris)
```
````



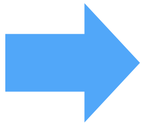


results

results = 'hide' hides the results of the chunk.
However, knitr still evaluates the code.

````
Here's some code

```{r results = 'hide'}
dim(iris)
```
````



Here's some code

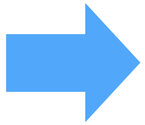
```
dim(iris)
```

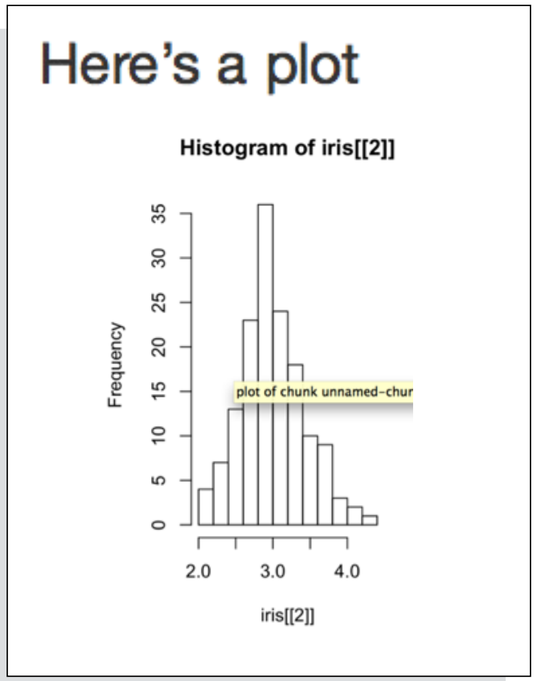
fig.height, fig.width

Specify the dimension of plots (in inches) with fig.width and fig.height. Separate multiple arguments with commas.

````
Here's a plot

```{r echo=FALSE, fig.width=3, fig.height=5}
hist(iris[[2]])
```
````





Your Turn

Return to your report. Separate this line into its own code chunk:

```
plot(mtcars$disp, mtcars$mpg)
```

1. Set a width and a height for the plot, and
2. prevent the code from appearing above the plot

Check your work by knitting the document.

````
```{r echo=FALSE, fig.width=3, fig.height=5}
plot(mtcars$disp, mtcars$mpg)
```
````

engine

To embed non R code, set the engine option to the language you want to embed.

````
Some python code,

```{r engine='python'}
x = 'hello, python world!'
print(x)
print(x.split(' '))
```
````

Some python code:

```
x = 'hello, python world!'
print(x)
print(x.split(' '))
```

```
## hello, python world!
## ['hello,', 'python', 'world!']
```

knitr comes with engines for the following languages, and can be extended to other languages

asis
asy
awk
bash
c
cat
coffee
dot
gawk
haskell
highlight
perl
python
Rcpp
Rscript
ruby
sas
scala
sed
sh
tikz
zsh

Logistics

1 Knitr runs the document in a fresh R session, which means you need to load the libraries that the document uses *in the document*

Logistics

1 Knitr runs the document in a fresh R session, which means you need to load the libraries that the document uses *in the document*

````
```{r}
library(reportsWS)
get_babyname("Ted", "M")[1,3:4]
```
````

```
##    name  n
## 1   Ted 13
```

Logistics

1 Knitr runs the document in a fresh R session, which means you need to load the libraries that the document uses *in the document*

````
```{r}
get_babyname("Ted", "M")[1,3:4]
```
````

```
Error :
  could not find
  function
  "get_babyname"
```

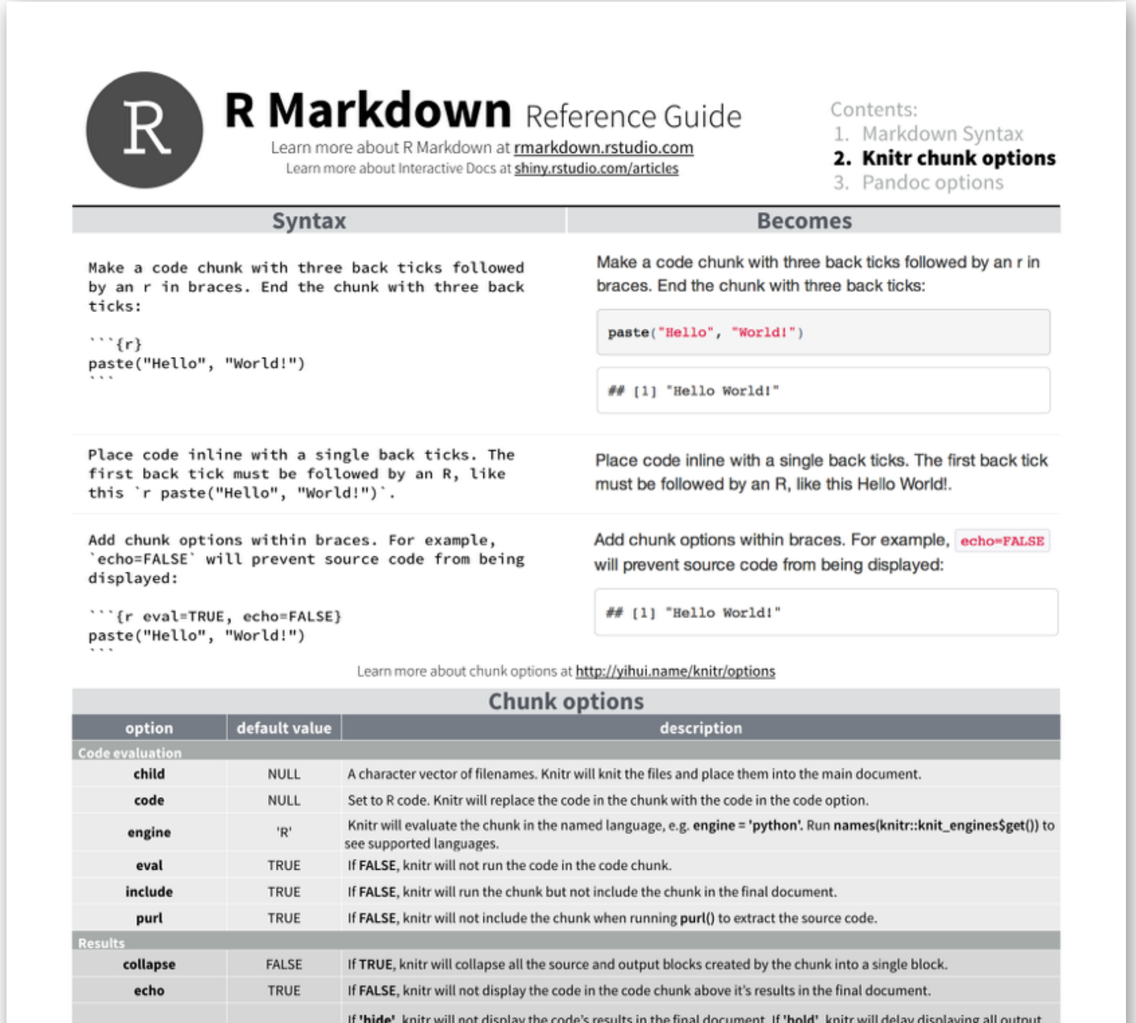
Logistics

1. Knitr runs the document in a fresh R session, which means you need to load the libraries that the document uses *in the document*

2. Objects made in one code chunk will be available to code in later code chunks.

R Markdown Reference Guide

www.rstudio.com/resources/cheatsheets/



R Markdown Reference Guide

Learn more about R Markdown at rmarkdown.rstudio.com
Learn more about Interactive Docs at shiny.rstudio.com/articles

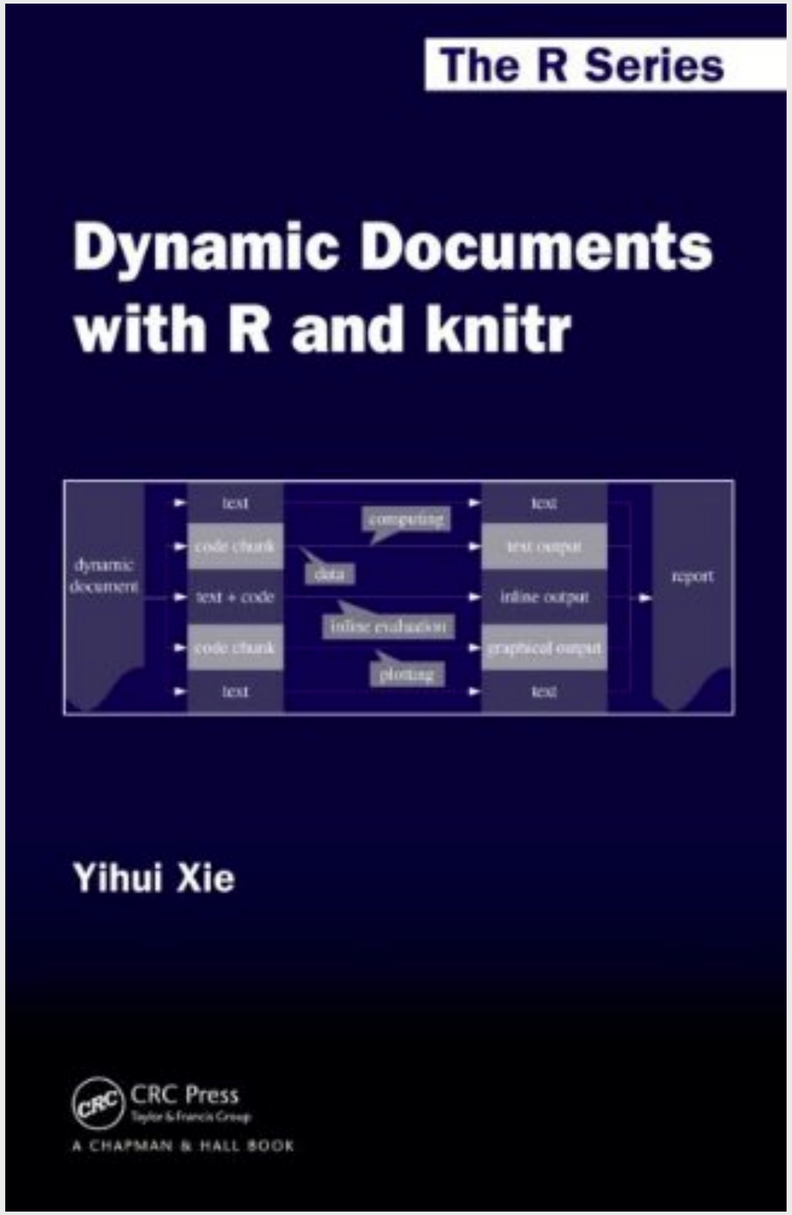
Contents:
1. Markdown Syntax
2. **Knitr chunk options**
3. Pandoc options

Syntax	Becomes
Make a code chunk with three back ticks followed by an r in braces. End the chunk with three back ticks: ```{r} paste("Hello", "World!") ```	Make a code chunk with three back ticks followed by an r in braces. End the chunk with three back ticks: `paste("Hello", "World!")` `## [1] "Hello World!"`
Place code inline with a single back ticks. The first back tick must be followed by an R, like this `r paste("Hello", "World!")`.	Place code inline with a single back ticks. The first back tick must be followed by an R, like this Hello World!.
Add chunk options within braces. For example, `echo=FALSE` will prevent source code from being displayed: ```{r eval=TRUE, echo=FALSE} paste("Hello", "World!") ```	Add chunk options within braces. For example, `echo=FALSE` will prevent source code from being displayed: `## [1] "Hello World!"`

Learn more about chunk options at http://yihui.name/knitr/options

Chunk options

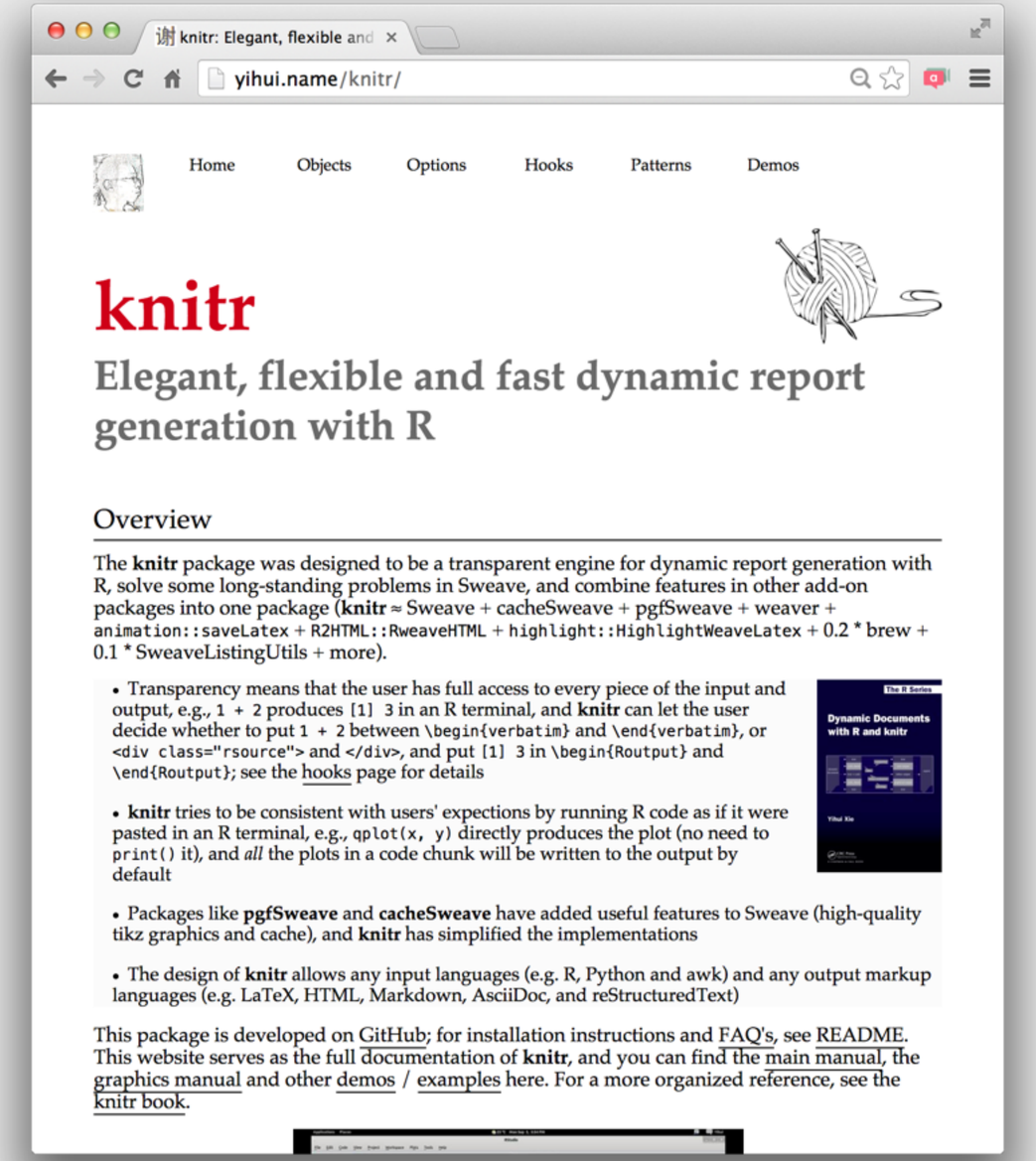
option	default value	description
Code evaluation		
child	NULL	A character vector of filenames. Knitr will knit the files and place them into the main document.
code	NULL	Set to R code. Knitr will replace the code in the chunk with the code in the code option.
engine	'R'	Knitr will evaluate the chunk in the named language, e.g. **engine = 'python'**. Run **names(knitr::knit_engines$get())** to see supported languages.
eval	TRUE	If **FALSE**, knitr will not run the code in the code chunk.
include	TRUE	If **FALSE**, knitr will run the chunk but not include the chunk in the final document.
purl	TRUE	If **FALSE**, knitr will not include the chunk when running **purl()** to extract the source code.
Results		
collapse	FALSE	If **TRUE**, knitr will collapse all the source and output blocks created by the chunk into a single block.
echo	TRUE	If **FALSE**, knitr will not display the code in the code chunk above it's results in the final document.
		If **'hide'**, knitr will not display the code's results in the final document. If **'hold'**, knitr will delay displaying all output



Dynamic Documents with R and knitr by Yihui Xie

Explains knitr and literate programming. Demonstrates how to extend knitr to other languages (e.g., python) and other formats (e.g. latex)

amzn.com/1482203537



http://yihui.name/knitr/

Demonstrates every knitr chunk option and has a gallery of example knitr projects

output formats

/var/folders/c3/z24wjmw525710y8yxqtyplxw0000gn/T/Rtmp8bxdqu/Preview-1a1e4ca208.html

Preview-1a1e4ca208.html | Open in Browser | Publish | Find

Untitled

RStudio

April 16, 2015

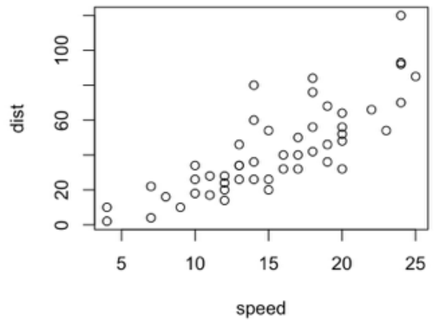
This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see http://rmarkdown.rstudio.com.

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

```
summary(cars)
```

```
##      speed           dist
##  Min.   : 4.0   Min.   :  2.00
##  1st Qu.:12.0   1st Qu.: 26.00
##  Median :15.0   Median : 36.00
##  Mean   :15.4   Mean   : 42.98
##  3rd Qu.:19.0   3rd Qu.: 56.00
##  Max.   :25.0   Max.   :120.00
```

You can also embed plots, for example:



Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.

RStudio: View PDF

Page: 1 of 1 | Automatic Zoom

Untitled

RStudio

April 16, 2015

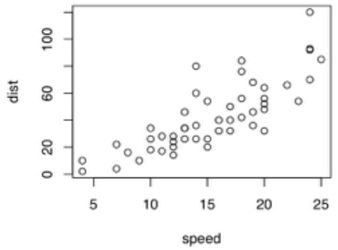
This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see http://rmarkdown.rstudio.com.

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

```
summary(cars)
```

```
##      speed           dist
##  Min.   : 4.0   Min.   :  2.00
##  1st Qu.:12.0   1st Qu.: 26.00
##  Median :15.0   Median : 36.00
##  Mean   :15.4   Mean   : 42.98
##  3rd Qu.:19.0   3rd Qu.: 56.00
##  Max.   :25.0   Max.   :120.00
```

You can also embed plots, for example:



Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.

1

Preview-1a13939b7b8.docx (1 page)

Search

Untitled

RStudio
April 16, 2015

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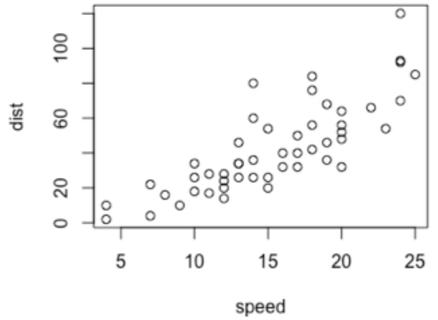
```

You can also embed plots, for example:



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HTML

PDF

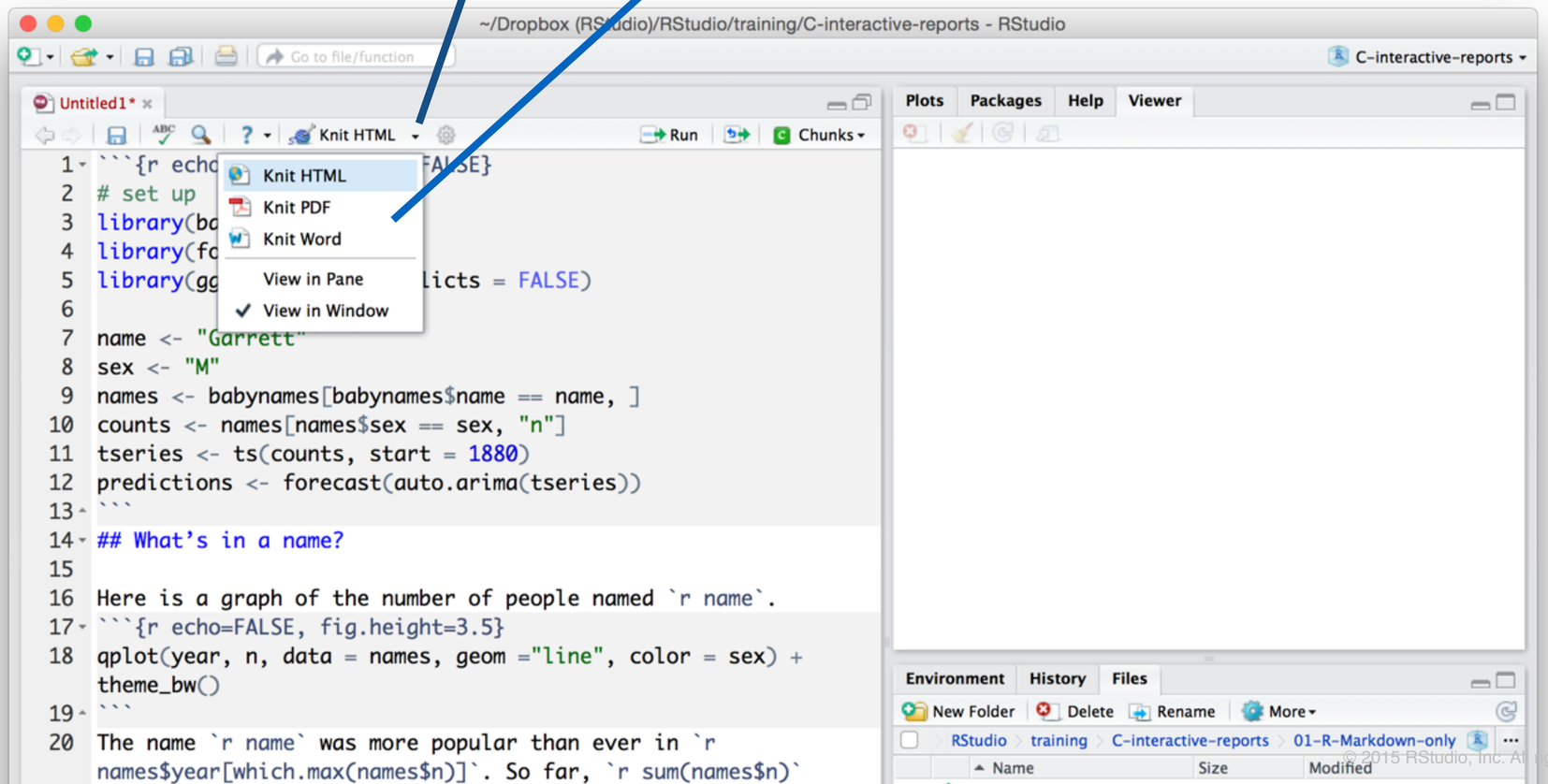
** preview requires tex*

MS Word

** preview requires "Word"*

Output

1. Open drop down menu
2. Select format



YAML

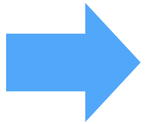
A section of key:value pairs separated by dashed lines ———

```
---
title: "Untitled"
author: "RStudio"
date: "February 4, 2015"
output: html_document
---
Text of document
```

YAML

A section of key:value pairs separated by dashed lines — — —

Most important option



```
---
title: "Untitled"
author: "RStudio"
date: "February 4, 2015"
output: html_document
---
Text of document
```

output templates

`html_document`	HTML document
`pdf_document`	pdf document
`word_document`	Microsoft .docx file
`md_document`	markdown file (converts R output to markdown)
`ioslides_presentation`	ioslides HTML 5 slideshow
`slidy_presentation`	slide HTML 5 slideshow
`beamer_presentation`	beamer pdf slideshow

Slide divisions

R Markdown will start a new slide at each first (and second*) level header, and horizontal rule

** ioslides only*

```
# Slide 1
text

## Slide 2
text

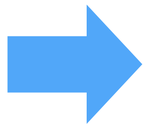
***
Slide 3
```

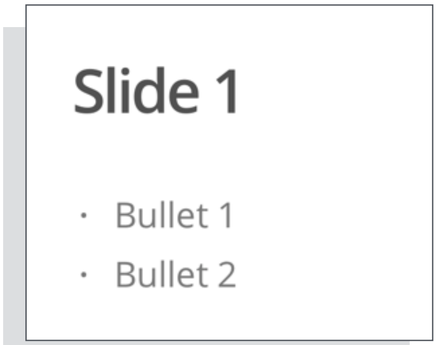
Slide bullets

Start bullets with -
Incremental bullets with >-

```
## Slide 1
- Bullet 1
- Bullet 2

## Slide 2
>- Bullet A
>- Bullet B
```





rmarkdown::**render**

Render at the command line with YAML options

```
> render("doc.Rmd")
```

Render at the command line, override output format.

```
> render("doc.Rmd", "html_document")
```

Render at the command line to multiple formats.

```
> render("doc.Rmd", c("html_document", "pdf_document"))
```

The R Markdown Development Center

rmarkdown.rstudio.com