

# Developing Data Products Notes

Coursera Course by John Hopkins University

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## Intro

### Github Link for Lectures

### Developing Data Products' lectures on GitHub

### Course Book

The book for this course is available on [leanpub](#)

### Instructor's Note

*"This course is about building tools for improving the data analysis process, making data driven decisions, or for other infrastructure that supports other data products. . .*

*To preview some of the topics we'll be covering. With the R Markdown package you can create websites, PDFs, presentations, and even e-books from a single file in R in a way that you're very comfortable and familiar with. We'll teach the latest features of the Shiny package which you can use to create interactive web applications in R. We'll talk about interactive graphics using Plotly and Leaflet which allows you to create beautiful maps that you can share online. We'll do similar things with the package GoogleViz which allows you to create maps and interactive graphics and tables. We've also added how to use swirl and swirlify to design courses in R so that you can share your knowledge. . .*

*- Brian Caffo and the Data Science Track Team"*

## Shiny, GoogleVis, and Plotly

### Shiny Part 1

#### Shiny Overview (1.1)

#### What is Shiny?

- Shiny is a web development framework in R, meaning one only needs to know R to use it.
  - Helps one get around a possible lack of resources or knowledge in JavaScript, HTML, etc.
- Shiny needs a server to run on
  - One can use their own, RStudio's limited free hosting service, or something like Amazon AWS. RStudio also has a paid version of their service.
- Shiny application vs. Shiny server
  - Apps a ran locally and use RStudio's service for hosting the app on their servers, on a platform called shinyapps.io
    - \* the free version only allows one to run 5 apps for a certain amount of time per month
    - \* RStudio will send one a message if the limit is reached
    - \* Should one hit the 25-hour per month limit they can send an email to [shinyapps-support@rstudio.com](mailto:shinyapps-support@rstudio.com) to request an increase in their limit so one can continue working on thier project (for this course)
  - A Shiny server is required such that one can host a shiny app for the world

- \* It requires understanding a little linux server administration and won't be covered in this course.
- Although everything is done in R it is helpful to have some knowledge of HTML to know what the commands in R are actually doing.
- Shiny uses **Bootstrap** (no relation to the statistical method) style, which suffices for aesthetics, rendering, and resizing to fit different screens.

## HTML, CSS, and Javascript Tutorials

- **Mozilla Developer Network Tutorials**
- **HTML & CSS from Khan Academy**
- **Tutorials from Free Code Camp**

## A Shiny Project

- There is **a tutorial for shiny on RStudio**, however these notes will sort of walk through that tutorial anyway.
- A computer interfaces with the app to generate new plots/results based on the users' input on the app.
- A shiny project consists of a directory with at least two files:
  - `ui.R` (for user interface) controls how your app looks.
  - `server.R` that controls what your app does, held on the server.
  - NOTE: The app doesn't actually need these two files but rather the functions they contain, as such it's also an option to just have a `app.R` file.
- **RStudio has some examples of shiny apps too**
- I also found someone **made a game using Shiny**. The game's app also contains **a link to the GitHub repo**.

## Shiny Code Demos (1.2)

A demo is located in `./helloShiny`

## Set-Up

### `ui.R`

- requires the function `shinyUI`
  - `fluidPage()` by default has a main panel, `mainPanel()` and a sidebar panel, `sidebarLayout(sidebarPanel()`

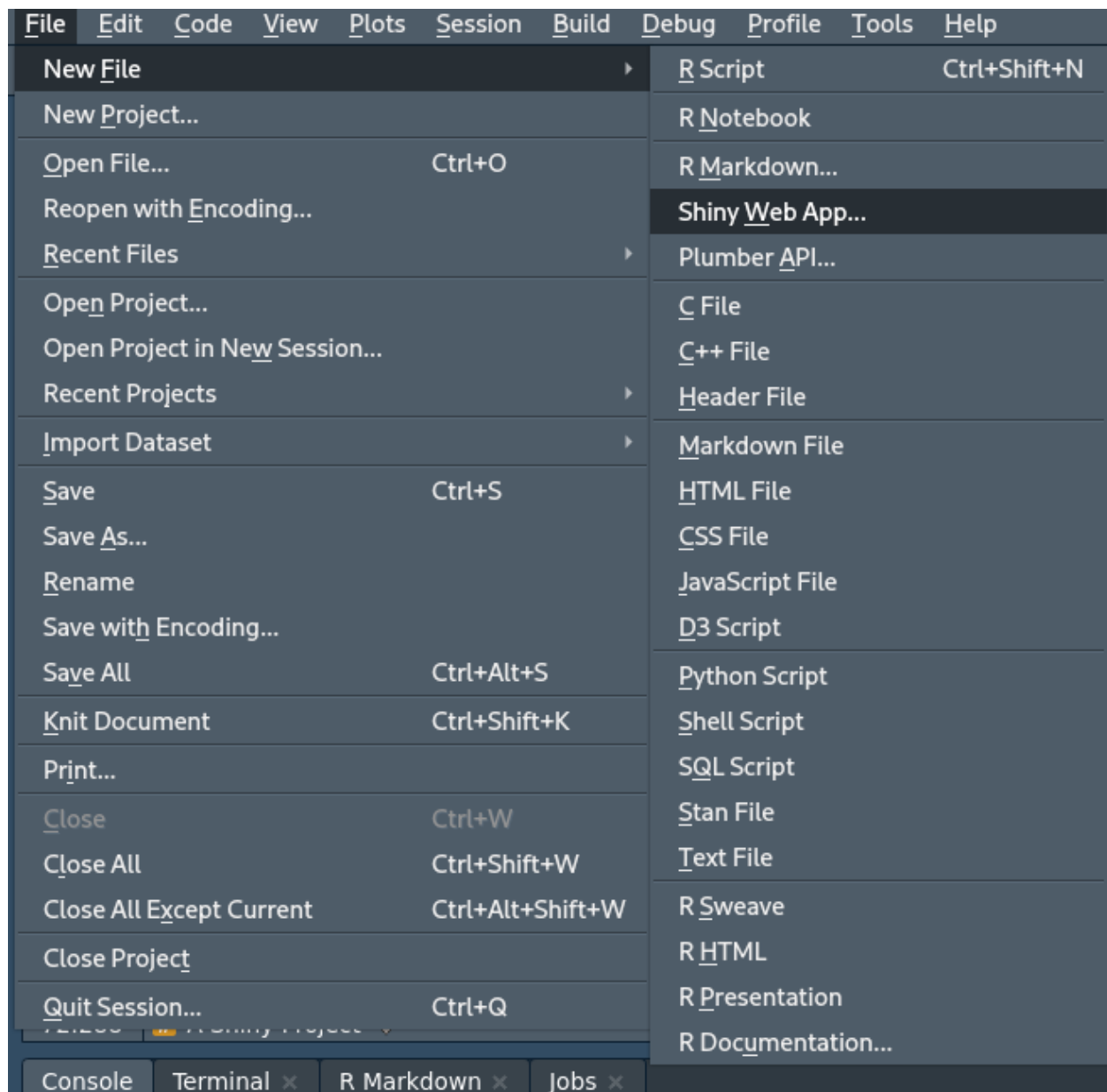


Figure 1: New File

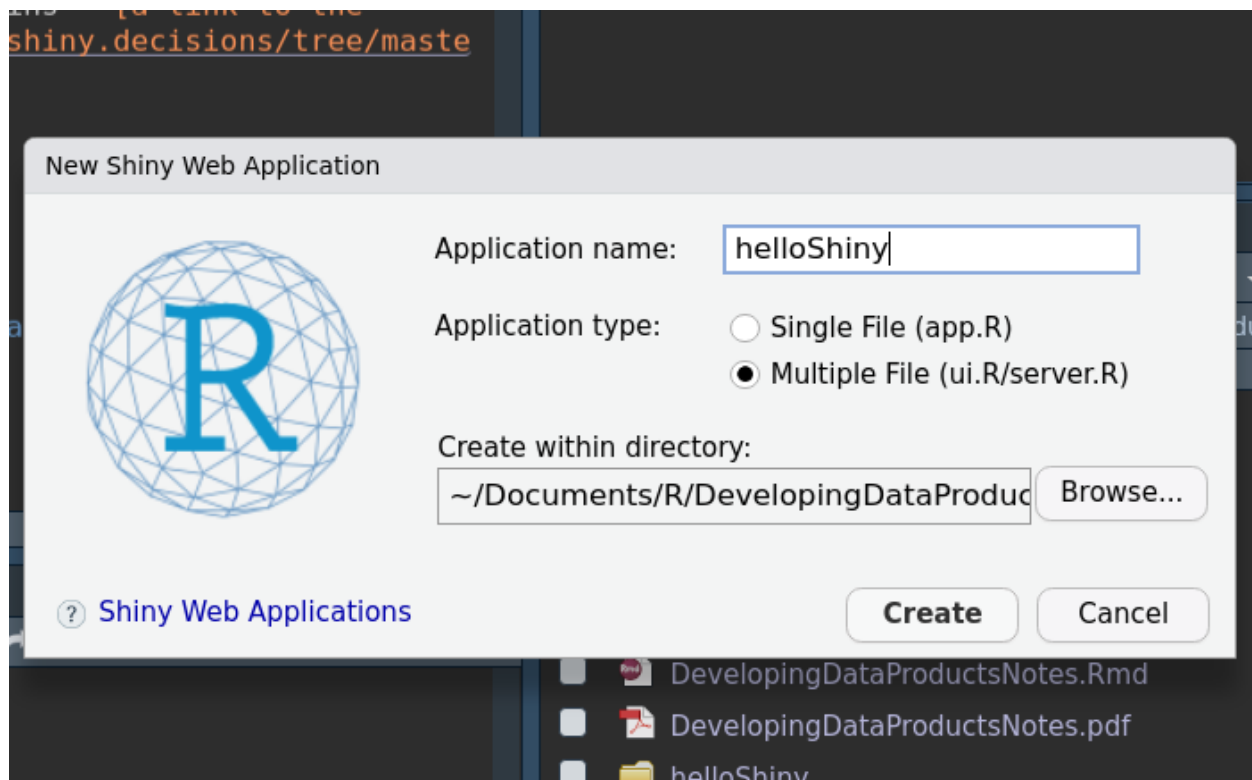


Figure 2: Create app in GUI

## server.R

- requires the function `shinyServer`
  - Any logical computations are done here

## Shiny HTML Tags (1.3)

- Shiny provides several wrapper functions for using standard HTML tags in your `ui.R`, including:
  - `h1()` through `h6()` for headlines
  - `p()` for paragraphs
  - `br()` for line-breaks
  - `a()` for inserting hyperlinks
  - `div()` denotes a section styled with CSS
  - `span()` to color a part of the text
  - See the help page, `?builder` for more details.
  - A guide of HTML tags **can be found on this site**
- Some of these tags are tested in `./helloShiny/`

## Shiny Apps with I/O (1.4)

- In this first demo we'll be looking at a slider input, which will just show the value to the user. This demo is found in `./helloSlider/`

## Shiny Apps with Plots (1.5)

- Allowing users to manipulate data and see the results of their manipulations as a plot can be very useful
- Shiny provides the `plotOutput()` function for `ui.R`
- ...and the `renderPlot()` function for `server.R`
- The demo of this is in `./helloPlot/`
- Also contains:
  - in/de-crementing arrows for a textbox
  - checkboxes for a logical if labels are present

**Reminder to Commit (01), Delete this line *AFTER* Committing**

## Shiny Part 2

### Reactivity (2.1)

- A reactive expression manipulates inputs from Shiny and returns a value.
- Reactivity provides a way for your app to respond, as inputs will change depending on how users interact with your UI
- Expressions that are subject to change should be wrapped with the function `reactive()`
  - Because of the syntax of Shiny this may look a bit “unorthodox” for R code (Having `{...}`)
- Creating a reactive expression is like creating a function:

```
calc_sum <- reactive({  
  input$box1 + input$box2  
})  
  
# ...  
  
calc_sum()
```

- Later we'll look at having the user push a button to have the app react, which is helpful for more computational heavy computations.

## reactive Example (2.2)

- An example that uses the `reactive` function can be found in `./helloReactive/`

## Delayed Reactivity (2.3)

- One may not want an app to immediately react to changes in user input, such as in cases of long-running calculation
- In order to prevent reactive expressions from reacting one can include a submit button in the app.
- An example of this can be found in `./helloSubmit/`, which is a “fork” of `./helloReactive/` but with the submit button (only comments about the submit button are present in this document).

## Tabs (2.4)

- There are several other kinds of UI components that one can add to an app, such as tabs
  - `tabs` - gives app multiple views
  - `navbars` - to click around multiple tabs, like a top menu
  - `sidebars` - just like `navbars` but on the side
- There are functions for managing these tabs:
  - `tabsetPanel()` - specifies a group of tabs
  - `tabPanel()` - specifies the contents of an individual tab
- An example of tabs can be found in `./helloTabs/`

## Using your own HTML (2.5)

- To use custom HTML one would save the code as `index.html` in a directory, named `www`, which is a child of the directory containing the `server.R` file
- Most of the style from Shiny’s bootstrap setup in the header will no longer be needed

## Interactive Graphics (2.6)

- A feature of Shiny is the ability to create graphics that a user can interact with.
- One method that can be used to select multiple data points on a graph is by specifying the `brush` parameter in `plotOutput()` in the `ui.R` file, then using the `brushedPoints()` function in the `server.R` file.
- The `./helloBrush/` directory gives an example that draws a line of best fit, given user selected points.

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Shiny Gadgets

Shiny Gadgets (1.1)

Shiny Gadgets (1.2)

Shiny Gadgets (1.3)

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GoogleVis

GoogleVis (1.1)

GoogleVis(1.2)

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Plotly

Plotly (1.1)

Plotly (1.2)

Plotly (1.3)

Plotly (1.4)

Plotly (1.5)

Plotly (1.6)

Plotly (1.7)

Plotly (1.8)

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Quiz 1

1.

2.

3.

4.

5.

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## R Markdown and Leaflet

### R Markdown

R Markdown (1.1)

R Markdown (1.2)

R Markdown (1.3)

R Markdown (1.4)

R Markdown (1.5)

R Markdown (1.6)

### Sharing R Markdown Documents

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### Leaflet

Leaflet (1.1)

Leaflet (1.2)

Leaflet (1.3)

Leaflet (1.4)

Leaflet (1.5)

Leaflet (1.6)

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### Quiz 2

1.

2.

3.

4.

5.

6.

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### Course Project 1

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## Building R Packages

### R Packages

#### R Packages Overview

#### R Packages (1.1)

#### R Packages (1.2)

#### Building R Packages Demo

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### R Classes and Methods

#### R Classes and Methods (1.1)

#### R Classes and Methods (1.2)

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### Quiz 3

- 1.
- 2.
- 3.
- 4.

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### Course Project 2

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## Swirl

### Swirl

#### Swirl (1.1)

#### Swirl (1.2)

#### Swirl (1.3)

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### Course Project 3

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