Introduction to Shiny

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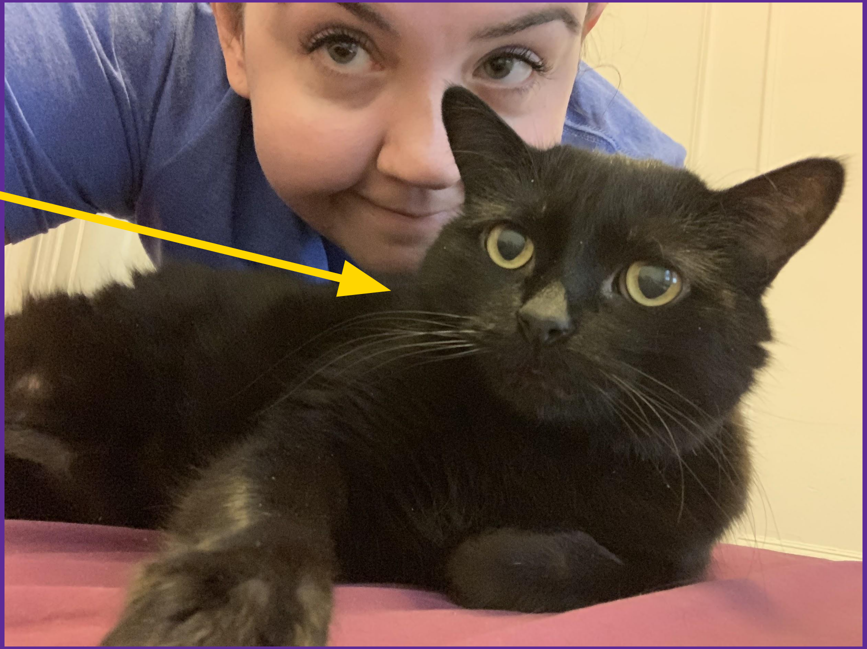
bit.ly/klm-rladiesSTL-introshiny-dec2020

I’m Kaelen!!!!! (That’s Scully)



- Lives in Astoria, Queens (NYC, USA)
- Data scientist on the microservices DS/DE team @ [Medidata Solutions]
- MS in Biostatistics
- Loves R, data, aliens, cats, and podcasts

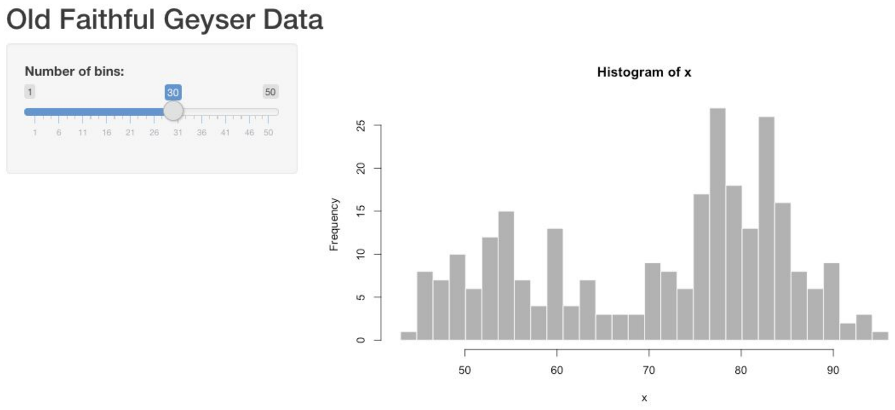
Outline

- Shiny????
- Hello, world! I’m a Shiny app
    - UI
    - Server
    - Basic Reactivity
- Our App
    - We’ll cover:
        - Inputs & Outputs
        - Layouts
        - Interactivity

Shiny???

What is Shiny?

- Shiny is "an R package that makes it easy to build interactive web apps straight from R," says RStudio (who have so graciously brought Shiny to the world)
- Allows us to use R code to build these web apps without having to know HTML, CSS, or JavaScript (though some knowledge can help!)



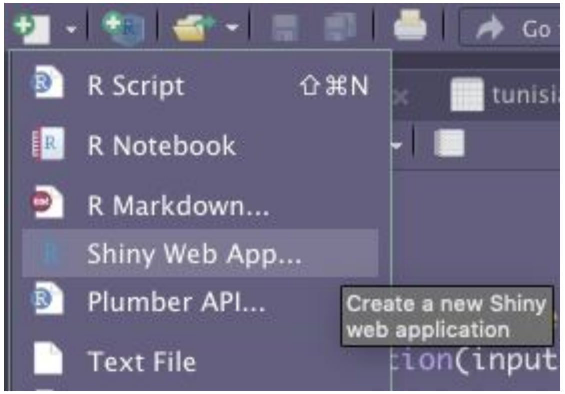
Speaking of that link to the Shiny website...

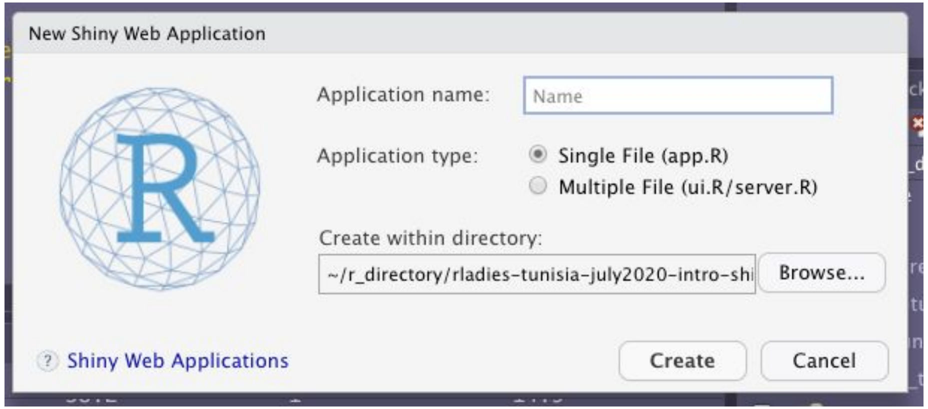
- It’s an amazing resource for getting started with Shiny OR extending your current knowledge!
- Highly recommend using the Gallery, which as both awesome showcase apps and also demos (with code!) to show how certain features work
- But also features articles, reference materials, and help

Hello, world! I’m a Shiny app

Let's dive in!

- To create a new app, go to the "New" button in RStudio and click "Shiny Web App"
- Then you can give your app a name and choose if you want to use a single file (called app.R) or separate files (one for the UI, one for the server)
- For now, select single file and call your app something meaningful to you
    - example_app, hello_world




New Shiny Web Application

Application name: Name

Application type: (●) Single File (app.R) ( ) Multiple File (ui.R/server.R)

Create within directory: ~/r_directory/rladies-tunisia-july2020-intro-shi

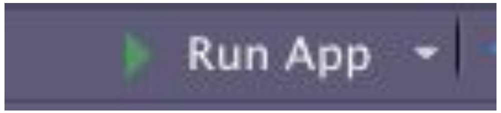
Browse...

Shiny Web Applications

Create Cancel

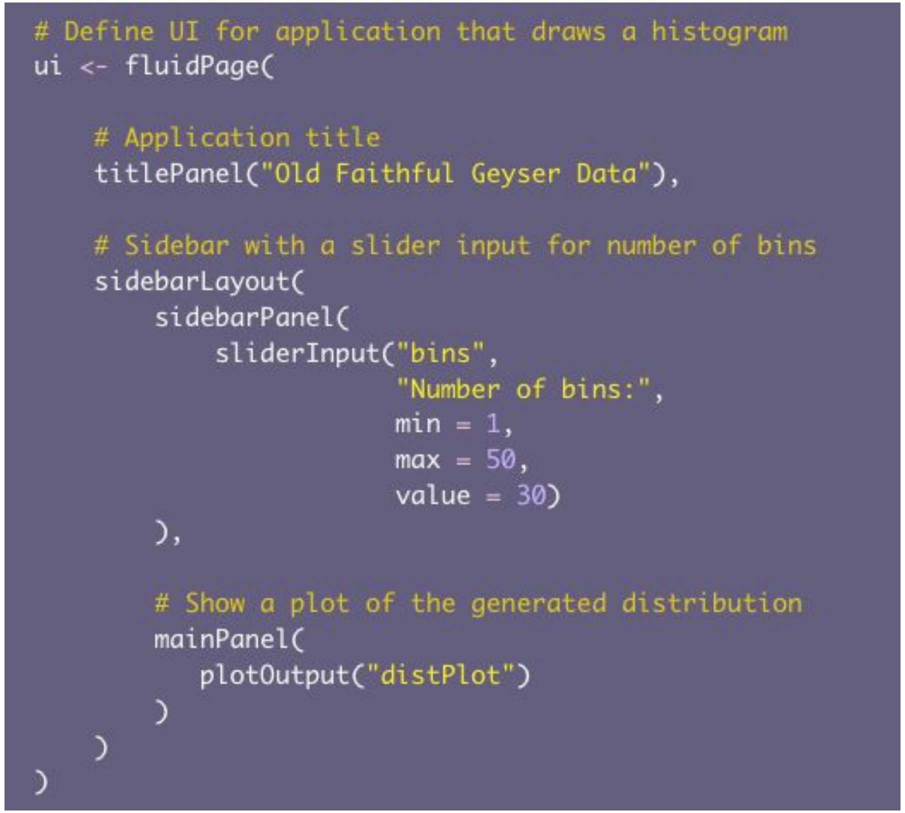
Default app

- The same default app is always created when you make an app this way
- Let’s run it by hitting “Run App” or Cmd + Shift + Enter (Mac) or Window + Shift + Enter (Windows, probably)
    - “Run App” should be in the upper right of your app.R script pane
- Example app uses the Old Faithful geyser data and allows users to slide to select the number of bins in the histogram, between 1-50



Let’s look at some of the code

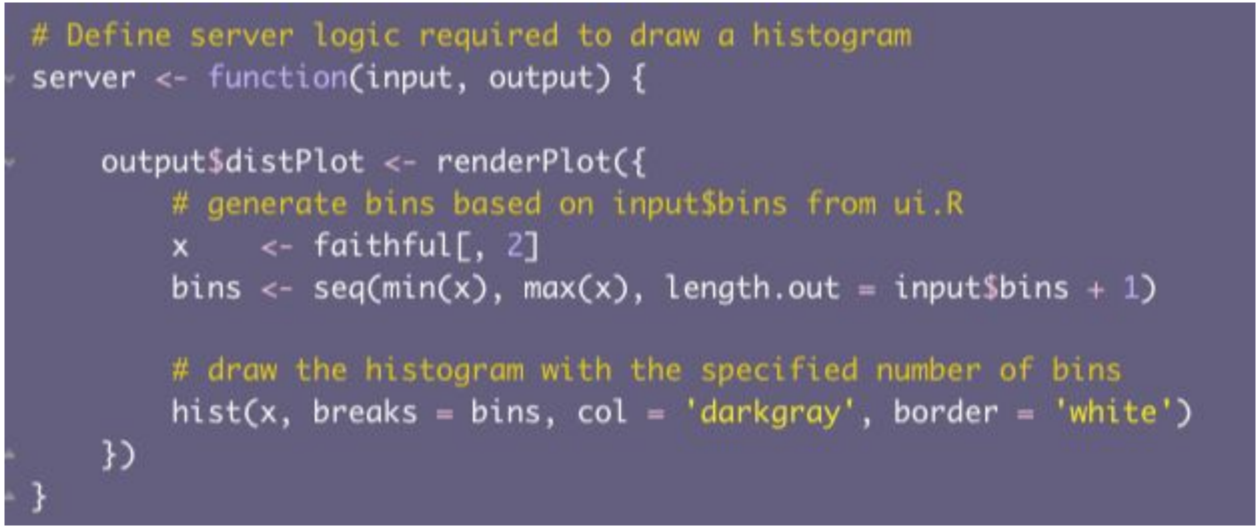
- App has…
  - A UI



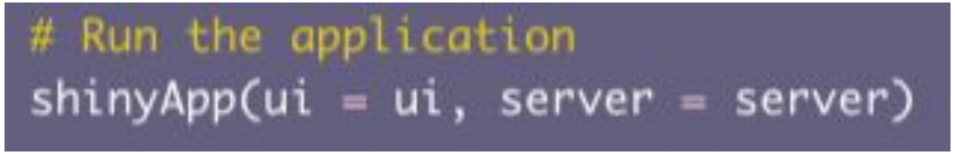
```
# Define UI for application that draws a histogram
ui <- fluidPage(

    # Application title
    titlePanel("Old Faithful Geyser Data"),

    # Sidebar with a slider input for number of bins
    sidebarLayout(
        sidebarPanel(
            sliderInput("bins",
                        "Number of bins:",
                        min = 1,
                        max = 50,
                        value = 30)
        ),

        # Show a plot of the generated distribution
        mainPanel(
           plotOutput("distPlot")
        )
    )
)
```

Let’s look at some of the code

- App has…
  - A UI
  - A server
  - A call to shinyApp() to actually run the application
- Those are the basic building blocks of an app!



```r
# Define server logic required to draw a histogram
server <- function(input, output) {

    output$distPlot <- renderPlot({
        # generate bins based on input$bins from ui.R
        x    <- faithful[, 2]
        bins <- seq(min(x), max(x), length.out = input$bins + 1)

        # draw the histogram with the specified number of bins
        hist(x, breaks = bins, col = 'darkgray', border = 'white')
    })
}
```



```r
# Run the application
shinyApp(ui = ui, server = server)
```

UI

- UI = User Interface
- Part of the app where you control the things the user is going to see & interact with
- Here's where you'll put the code to **display**…
  - Inputs
  - Outputs
  - Layout changes
    - Tabs
    - Colors
  - Anything that affects how the app will **LOOK**

Server

- Creates a new environment each time you start the app
- The server() function requires 3 arguments:
  - Input
  - Output
  - Session
- In the server, you’ll use the inputs (as needed) to create the things you want to display
  - Plots
  - Tables
  - Maps
  - Value Boxes
  - And more!

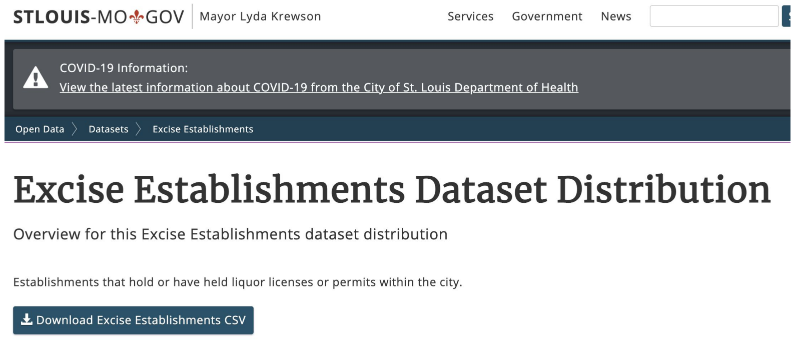
(The Most) Basic Reactivity

- Reactivity fundamentally means that when your inputs are updated, they automatically update any connected outputs
- **Reactive sources** are the inputs themselves
- **Reactive endpoints** are the things that are updated by the reactive sources (inputs) and will appear to your user (updated!)
- You can use these ideas to build reactive expressions, functions that are:
  - Only evaluated when called by a reactive endpoint (inside a render**() function!)
  - Evaluated ONLY when some reactive source changes (an input!)

Our app

The data

- St. Louis Excise Establisments dataset
    - “Establishments that hold or have held liquor licenses or permits within the city.”
- We’ll create a few graphs + a datatable of this data in our app.
- Columns:
    - business_name
    - case_number
    - dba
    - location
    - neighborhood_name
    - police_district_when_last_updated
    - status_code
    - ward



COVID-19 Information:
View the latest information about COVID-19 from the City of St. Louis Department of Health

Excise Establishments Dataset Distribution

Overview for this Excise Establishments dataset distribution

Establishments that hold or have held liquor licenses or permits within the city.

Inputs

- Inputs allow your user to input a value that will control the outputs in some way
- Shiny Widgets Gallery displays a bunch of possible inputs…
    - Checkboxes
    - Date/date range selectors
    - Numeric input
    - Select box
    - Sliders
    - Text input
- Created in your UI with a *Input() function
    - textInput(), numericInput(), etc.

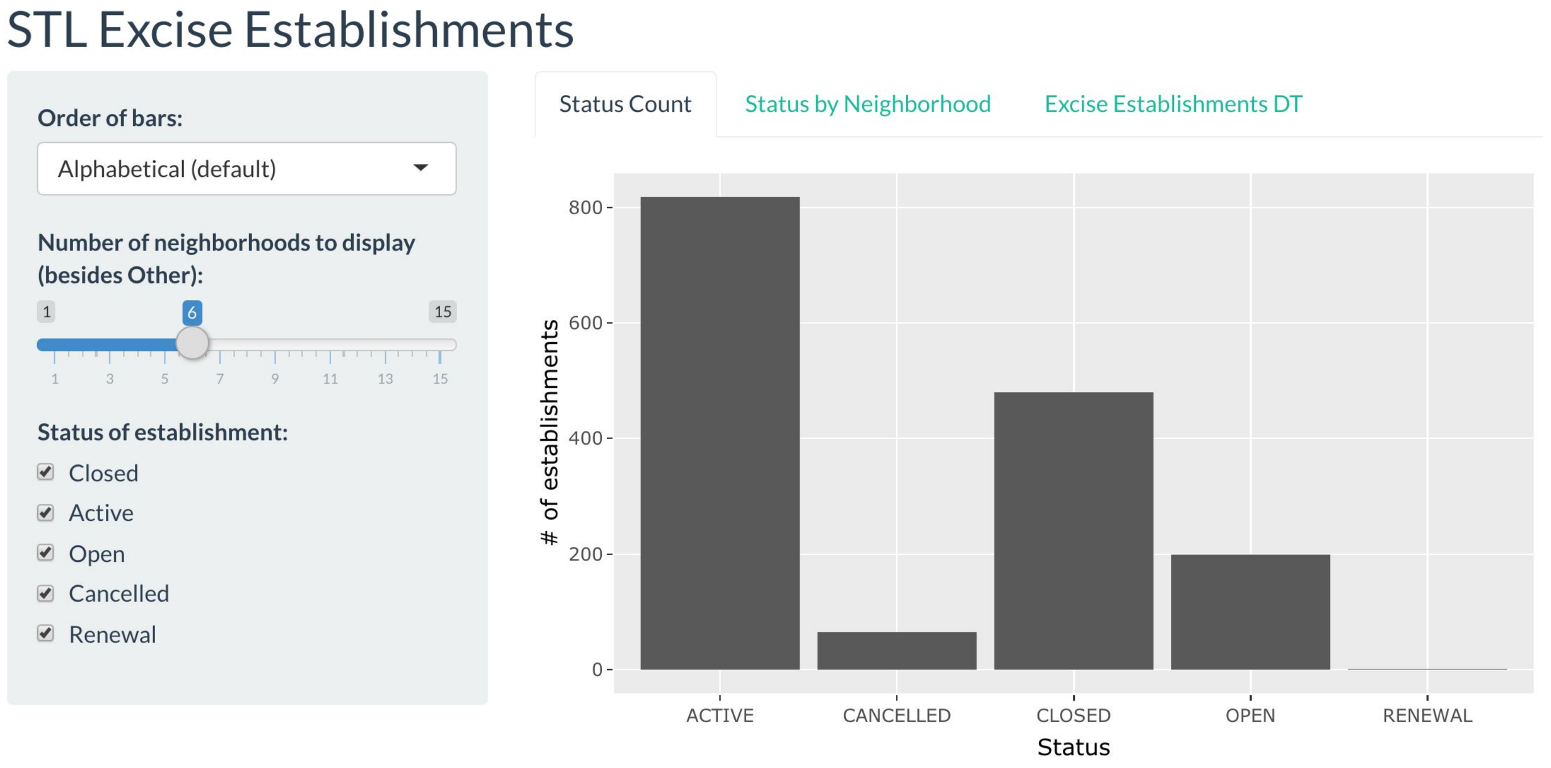
Outputs

- Outputs are created in the server:

```
output$mpgPlot <- renderPlot({

     mtcars %>% ggplot(aes(mpg)) + geom_histogram()

})
```

- Create an output object, use the correct render function, and write R code inside to create what you want to display
- Then, back in the UI, they are displayed with the correct *Output() function:
  - plotOutput(), tableOutput(), textOutput(), etc.

Ultimately, we'll have an app that looks like...



STL Excise Establishments

Order of bars: Alphabetical (default)

Number of neighborhoods to display (besides Other): 6

Status of establishment:

- [x] Closed
- [x] Active
- [x] Open
- [x] Cancelled
- [x] Renewal

Let's begin!

- We'll use the ui.R AND server.R files in the stl_app_static_1 folder on Github (if you just want the code) or you can code along with me
- A note on the arrangement of the Github repo:
  - I made each step of the app we're going to code a separate app so anyone not here can follow along
  - Each folder is labeled at the end with _#
  - Each is a copy of the previous folder (app) with at least one thing added on
- Packages you'll need installed:
  - shiny
  - tidyverse
  - forcats
  - shinythemes
  - DT
  - plotly

stl_app_static_1

- We'll add:
  - App title
  - Dropdown selector for the order of the bars
  - Static bar graph showing the status of the excise establishments
- BONUS!
  - Data manipulation trick with forcats, courtesy of David Robinson

stl_app_tabs_2

- We’ll add:
  - A tab layout
  - Slider input to select number of neighborhoods to show
  - Checkbox group input to select statuses to display
  - A graph of status code by neighborhood name
- MORE BONUS!
  - Even more data manipulation tricks courtesy of David Robinson

stl_app_table_3

- We’ll add:
    - Static table of the entire dataset

stl_app_interactive_4

- We'll:
  - Convert all of our static outputs to interactive outputs
    - plotly for graphs
    - DT for datatables
- We won't load plotly or DT directly in the app, but will rather use explicit calls:
  - plotly::renderPlotly()
  - DT::datatable()
  - etc.

stl_app_fancy_5

- We'll:
  - Use shinythemes to browse different default themes and then
  - Select one to use for our app
  - Implement our selected theme

Depending on time, reactive expressions

- What if we wanted the status codes multi select to affect both graphs? It’s probably time to write a reactive expression to filter the data only once!

```
    stl_status_codes <- reactive({
          stl_excise_establishments %>%
            filter(status_code %in% input$status_codes)
        })
```

- It’s prudent (and less expensive computationally) to only do this filtering once.
- This is saved in the GH repo as stl_app_reactive_expr_6

Resources

Resources

- RStudio Shiny website
- Mastering Shiny, a forthcoming book by Hadley Wickham he is publishing as he writes on the web
- Google, like me:
  - renderTable
  - shinythemes
  - DT options in a Shiny app (took me to StackOverflow!)

Questions???

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Code and slides @
bit.ly/klm-rladiesSTL-introshiny-dec2020