Ministry for the Environment
Manatū Mō Te Taiao

R Shiny Workshop

# From Raw Data to Insightful Visualisations

Lillian Lu | 29 Mar 2023

# A bit about myself


Bachelor of Design/ magazine editor

↓

2012
Moved to NZ

↓

2014-2019
Tourism marketing

↓

2020
Career switch

↓

2021
Master of Analytics

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WellingtonNZ

CDPH California Department of PublicHealth

E/S/R Science for Communities He Pūtaiao, He Tāngata

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# What's Shiny?

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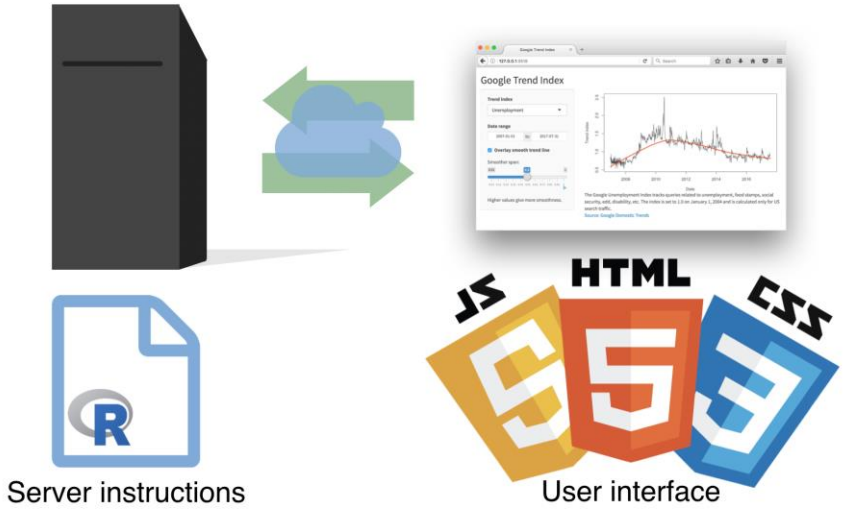
A package that makes it easy to build **interactive web applications** (apps) straight from R



# You can build...

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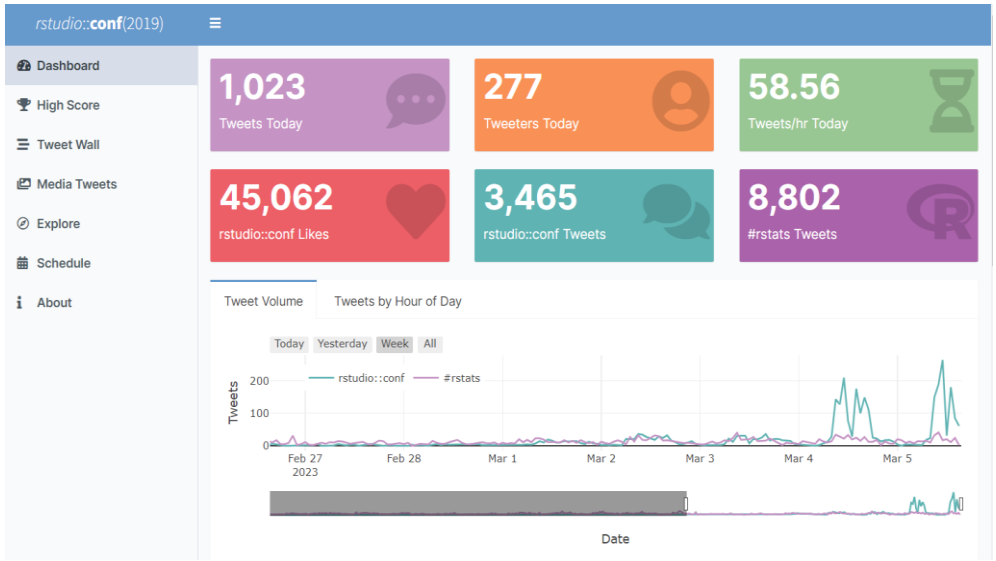


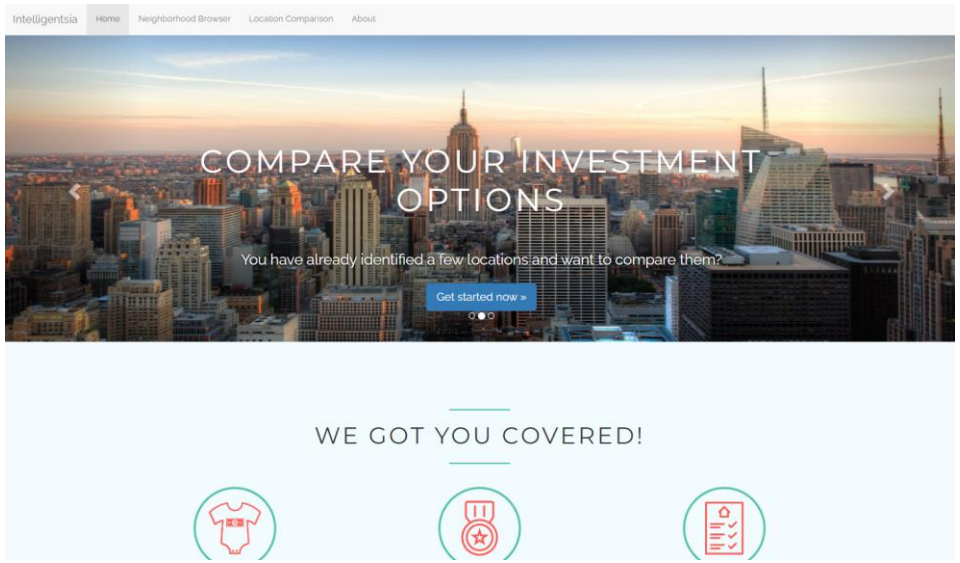


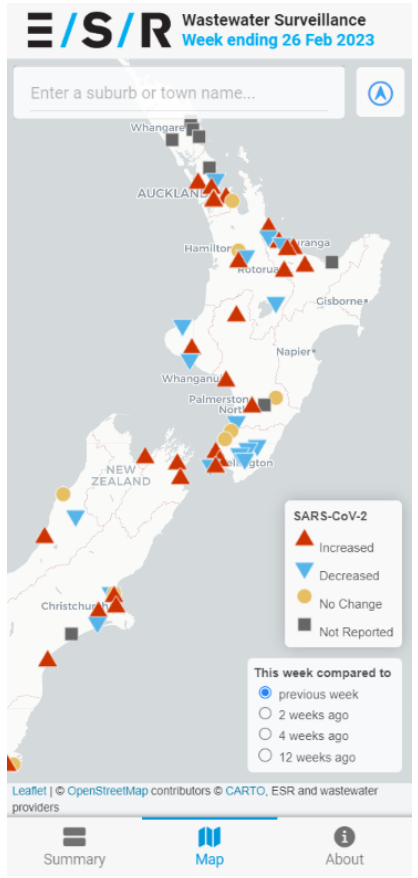

# When to use Shiny?

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Prototying

Data science showcase

Research paper insights

Provide personalised information

✔ lack of budget
✔ open source
✔ full-stack data science

✘ internal periodic reporting
✘ large scale/real-time apps

# Workshop prerequisite

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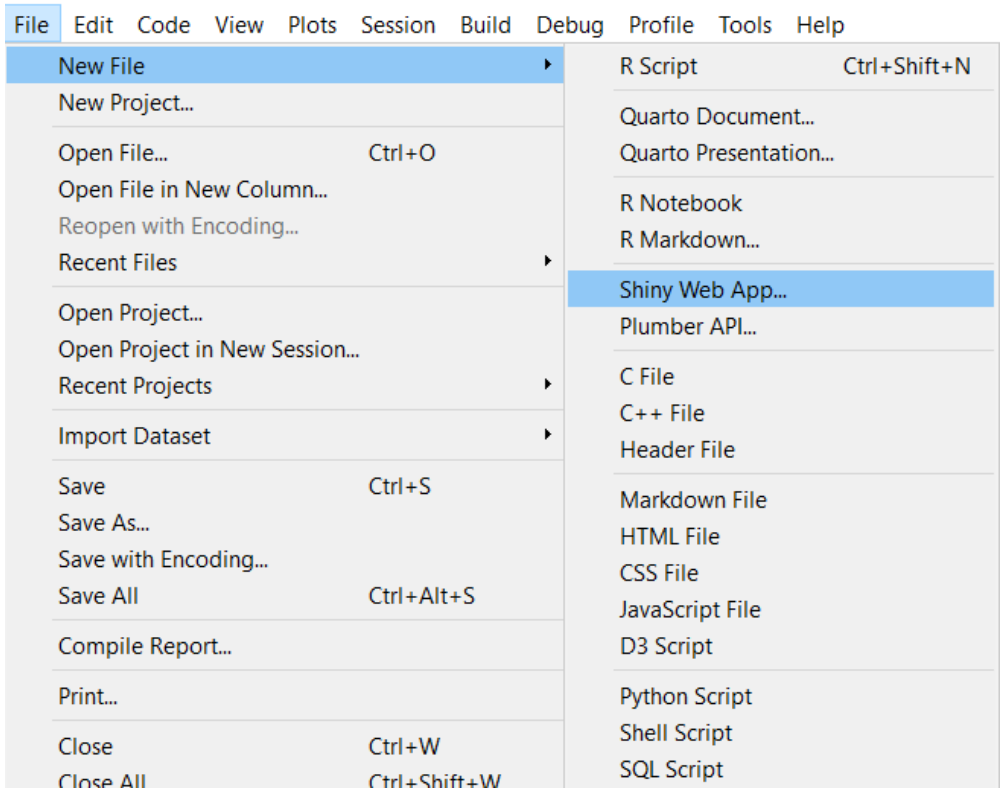
RStudio®

- Cloud version

**posit.cloud**

- movies.RData
- app.R

**github.com/lillianlu-nz/ShinyWorkshop**



# Exercise 1


Old Faithful Geyser Data
Number of bins:
1
30
50
1 6 11 16 21 26 31 36 41 46 50
Histogram of waiting times
Frequency
0 5 10 15 20 25
50 60 70 80 90
Waiting time to next eruption (in mins)

# Exercise 1

1. Change the app title to “Hello World!”

2. Set the minimum value of the slider bar to 5

3. Change the histogram border color from "white" to "orange"

4. Change the sliderInput to a numericInput, with the same id and label and value = 30

```
numericInput(inputId = "bins",
                    label = h3("Number of bins"),
                    value = 30)
```

# Shiny structure

```
library(shiny)
ui <- fluidPage()


server <- function(input, output, session) {}


shinyApp(ui = ui, server = server)
```

**User interface**
controls the layout and appearance of app

**Server function**
contains instructions needed to build app

**`shinyApp()`**
Creates the Shiny app object

# Shiny inputs (widgets)

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## Inputs

collect values from the user

Access the current value of an input object with **input$<inputId>**. Input values are **reactive**.

Action — **actionButton**(inputId, label, icon, …)

Link — **actionLink**(inputId, label, icon, …)

Choice 1
Choice 2
Choice 3 — **checkboxGroupInput**(inputId, label, choices, selected, inline)

Check me — **checkboxInput**(inputId, label, value)


**dateInput**(inputId, label, value, min, max, format, startview, weekstart, language)


**dateRangeInput**(inputId, label, start, end, min, max, format, startview, weekstart, language, separator)

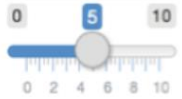
Choose File — **fileInput**(inputId, label, multiple, accept)

1 — **numericInput**(inputId, label, value, min, max, step)

••••••••• — **passwordInput**(inputId, label, value)

Choice A
Choice B
Choice C — **radioButtons**(inputId, label, choices, selected, inline)

Choice 1
Choice 1
Choice 2 — **selectInput**(inputId, label, choices, selected, multiple, selectize, width, size) (also selectizeInput())



**sliderInput**(inputId, label, min, max, value, step, round, format, locale, ticks, animate, width, sep, pre, post)

Apply Changes — **submitButton**(text, icon)
(Prevents reactions across entire app)

Enter text — **textInput**(inputId, label, value)

# Shiny outputs

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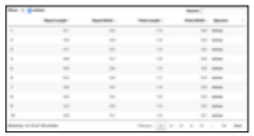
## Outputs - render*() and *Output() functions work together to add R output to the UI



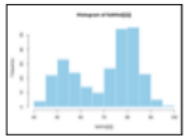
works with

dataTableOutput(outputId, icon, …)

DT::renderDataTable(expr, options, callback, escape, env, quoted)

renderImage(expr, env, quoted, deleteFile)

imageOutput(outputId, width, height, click, dblclick, hover, hoverDelay, inline, hoverDelayType, brush, clickId, hoverId)

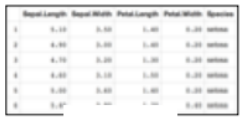


renderPlot(expr, width, height, res, …, env, quoted, func)

plotOutput(outputId, width, height, click, dblclick, hover, hoverDelay, inline, hoverDelayType, brush, clickId, hoverId)

renderPrint(expr, env, quoted, func, width)

verbatimTextOutput(outputId)



renderTable(expr,…, env, quoted, func)

tableOutput(outputId)

foo

renderText(expr, env, quoted, func)

textOutput(outputId, container, inline)

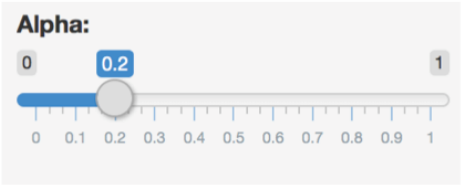
renderUI(expr, env, quoted, func)

& uiOutput(outputId, inline, container, …)
htmlOutput(outputId, inline, container, …)

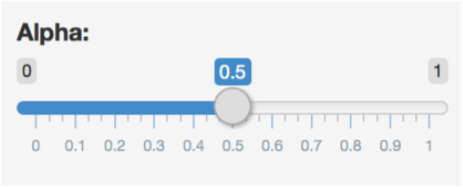
# Shiny reactivity

```
# Set alpha level
sliderInput(inputId = "alpha",
            label = "Alpha:",
            min = 0, max = 1,
            value = 0.5)
```

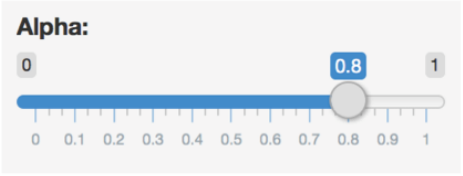
input$alpha



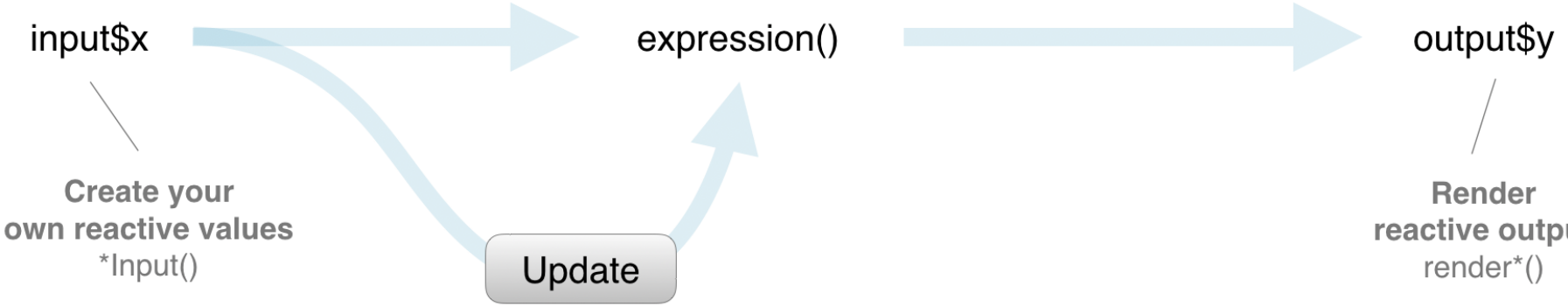

input$alpha = 0.2



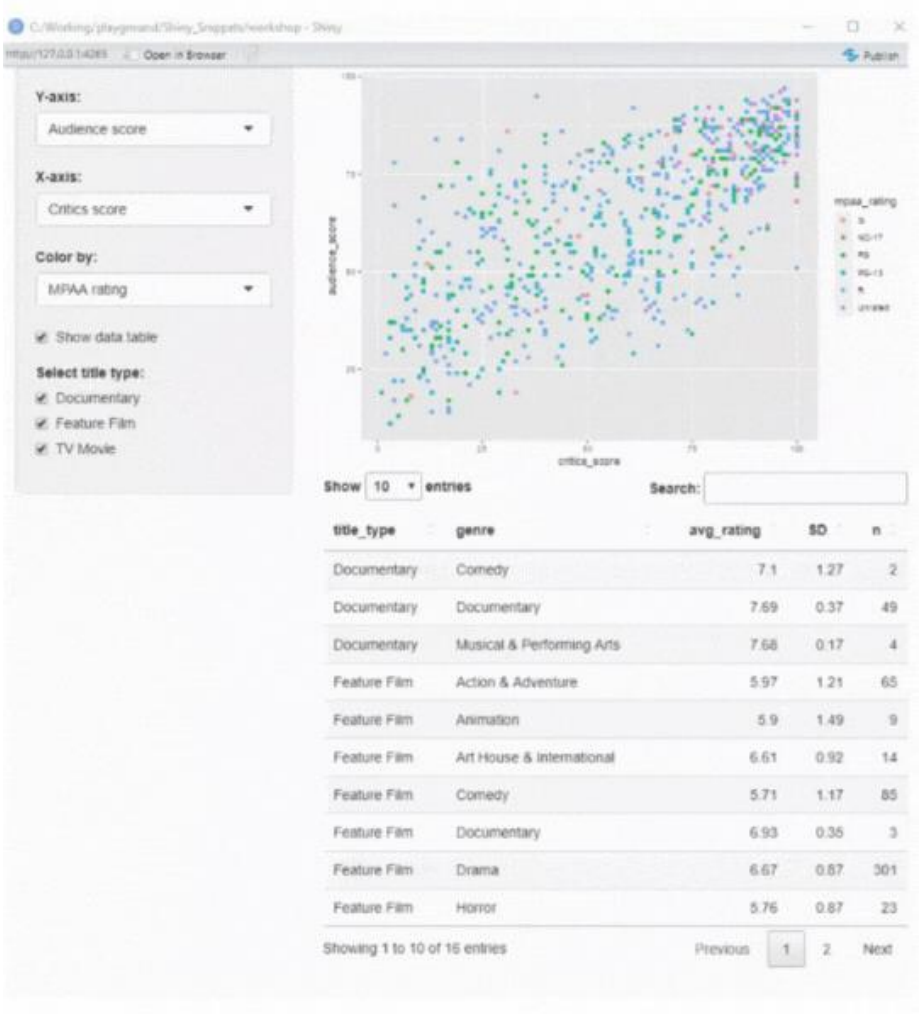

input$alpha = 0.5




input$alpha = 0.8



# Exercise 2




- Make sure the app.R & movies.RData files are saved in the same folder

app.R

```r
# Load packages ---------------------
library(shiny)
library(ggplot2)

# Load data -------------------------

load("movies.RData")
```

# Exercise 2

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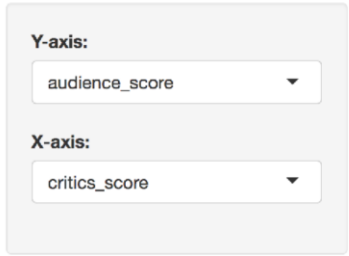
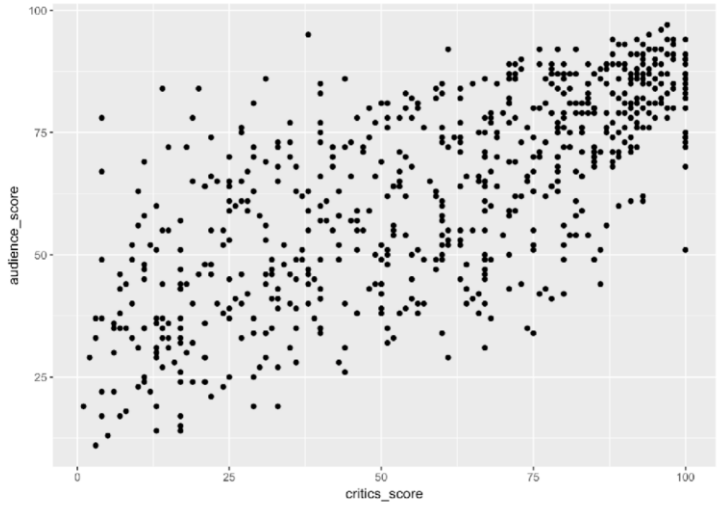
- Understand the UI

app.R

```r
ui ← fluidPage(

  sidebarLayout(

    # Inputs: Select variables to plot
    sidebarPanel(

      # Select variable for y-axis
      selectInput(
        inputId = "y",
        label = "Y-axis:",
        choices = c("imdb_rating", "imdb_num_votes", "critics_score", "audience_score", "runtime"),
        selected = "audience_score"
      ),
      # Select variable for x-axis
      selectInput(
        inputId = "x",
        label = "X-axis:",
        choices = c("imdb_rating", "imdb_num_votes", "critics_score", "audience_score", "runtime"),
        selected = "critics_score"
      )
    ),

    # Output: Show scatterplot
    mainPanel(
      plotOutput(outputId = "scatterplot")
    )
  )
)
```



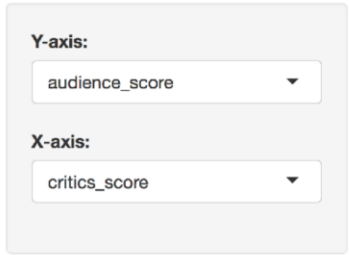



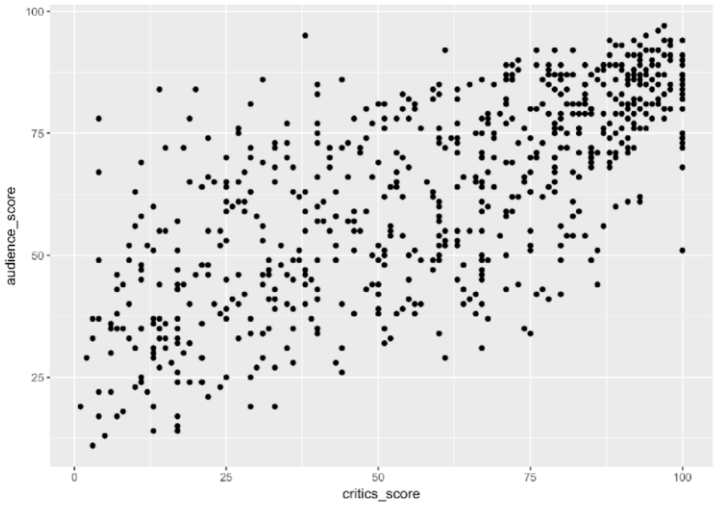
# Exercise 2

- Understand the server

app.R

```
44 server ← function(input, output, session) {
45   output$scatterplot ← renderPlot({
46     ggplot(data = movies, aes_string(x = input$x, y = input$y)) +
47       geom_point()
48   })
49 }
```



# Exercise 2 – part 1

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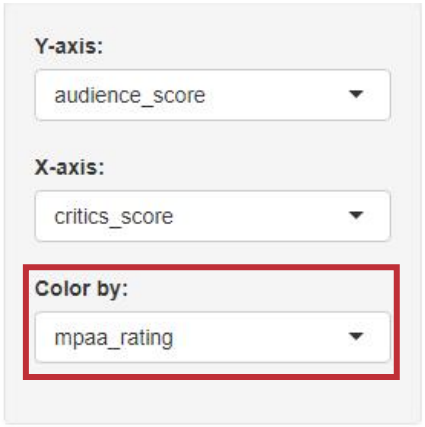
## In the UI

- Add a selectInput() to colour the points by a choice of the following variables:
  **"title_type", "genre", "mpaa_rating", "critics_rating", "audience_rating"**

- Use "z" as the inputId

## In the server

- Set the colour argument
  in ggplot() as color = input$z





Your app should look like this after

# Exercise 2 – part 2

## In the UI

- Add a checkboxInput()

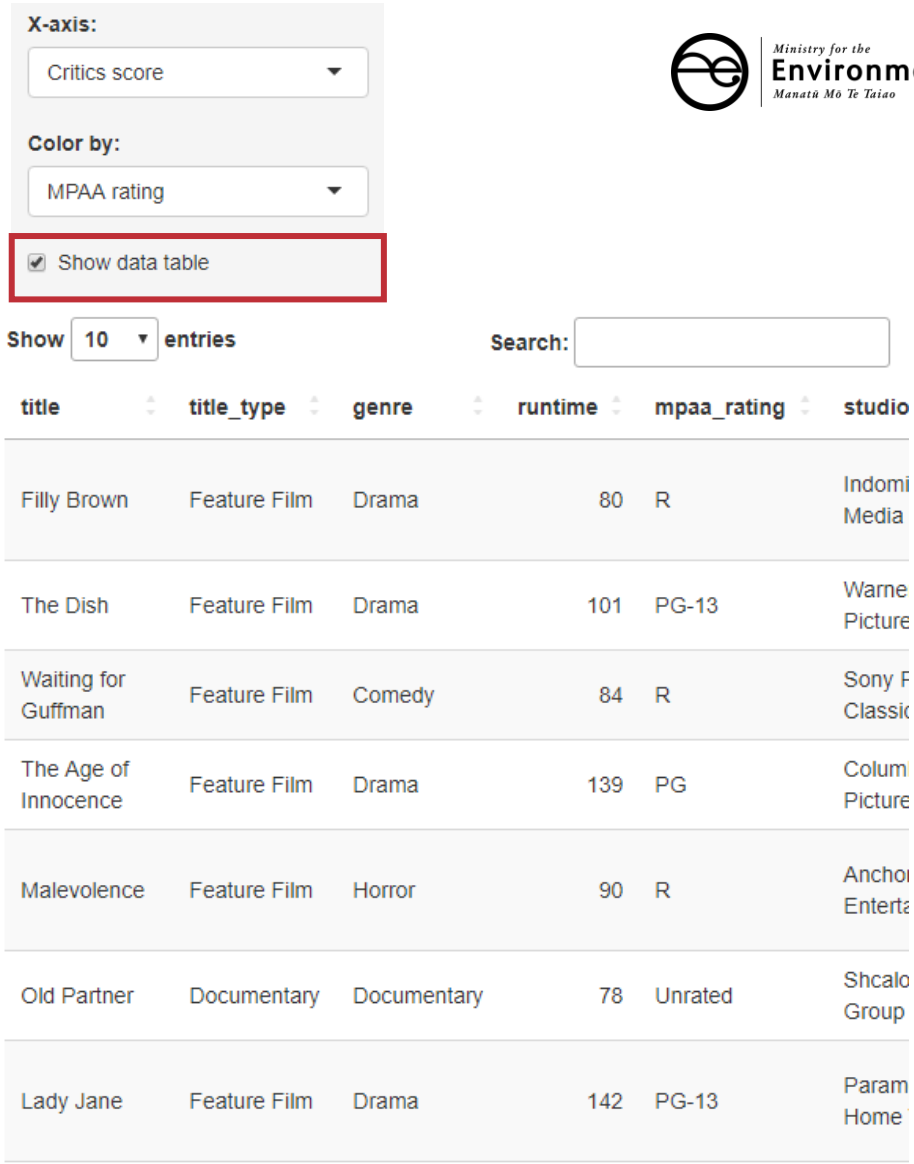
- Add a dataTableOutput() below the plot output, where a table will appear when user clicks the check box

## In the server

- Add a renderDataTable reactive expression that creates the table **if the checkbox is checked**

- The table should show the data from movies.RData

Your app should look like this after



# Exercise 2 – part 3

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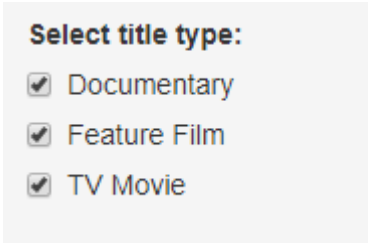
## In the UI

- Add an input widget that the user can interact with to check boxes for selected title types

## In the server

- Add a reactive expression that subsets the data following these steps:
  - **I.** **group** the data by “title_type” and “genre”
  - **II.** **summarise** “imdb_rating” by mean, standard deviation and count, round the numbers
  - **III.** **filter** the data based on the selected title types



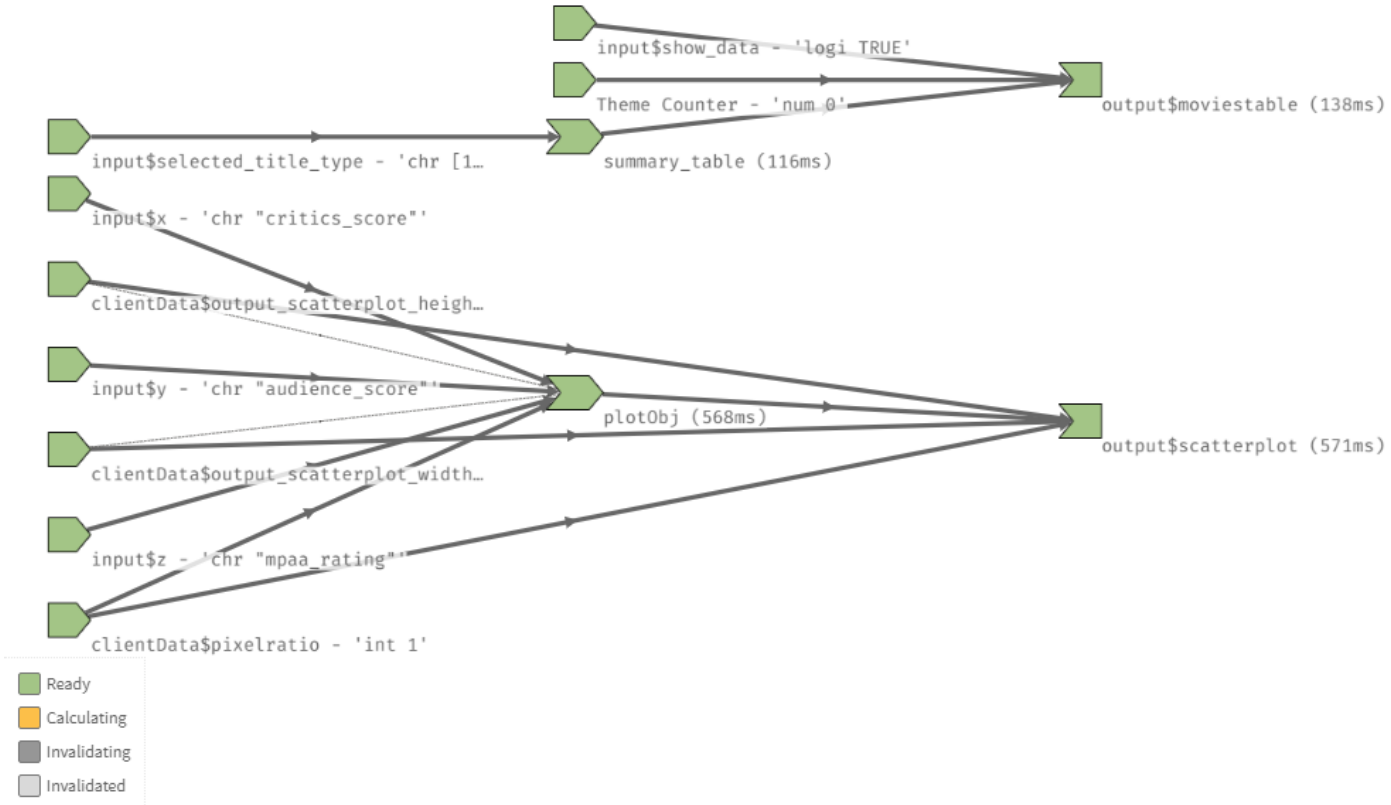

| title_type | genre | avg_rating | SD | n |
|---|---|---|---|---|
| Documentary | Comedy | 7.1 | 1.27 | 2 |
| Documentary | Documentary | 7.69 | 0.37 | 49 |
| Documentary | Musical & Performing Arts | 7.68 | 0.17 | 4 |
| Feature Film | Action & Adventure | 5.97 | 1.21 | 65 |
| Feature Film | Animation | 5.9 | 1.49 | 9 |
| Feature Film | Art House & International | 6.61 | 0.92 | 14 |
| Feature Film | Comedy | 5.71 | 1.17 | 85 |
| Feature Film | Documentary | 6.93 | 0.35 | 3 |
| Feature Film | Drama | 6.67 | 0.87 | 301 |
| Feature Film | Horror | 5.76 | 0.87 | 23 |

Showing 1 to 10 of 16 entries  Previous 1 2 Next

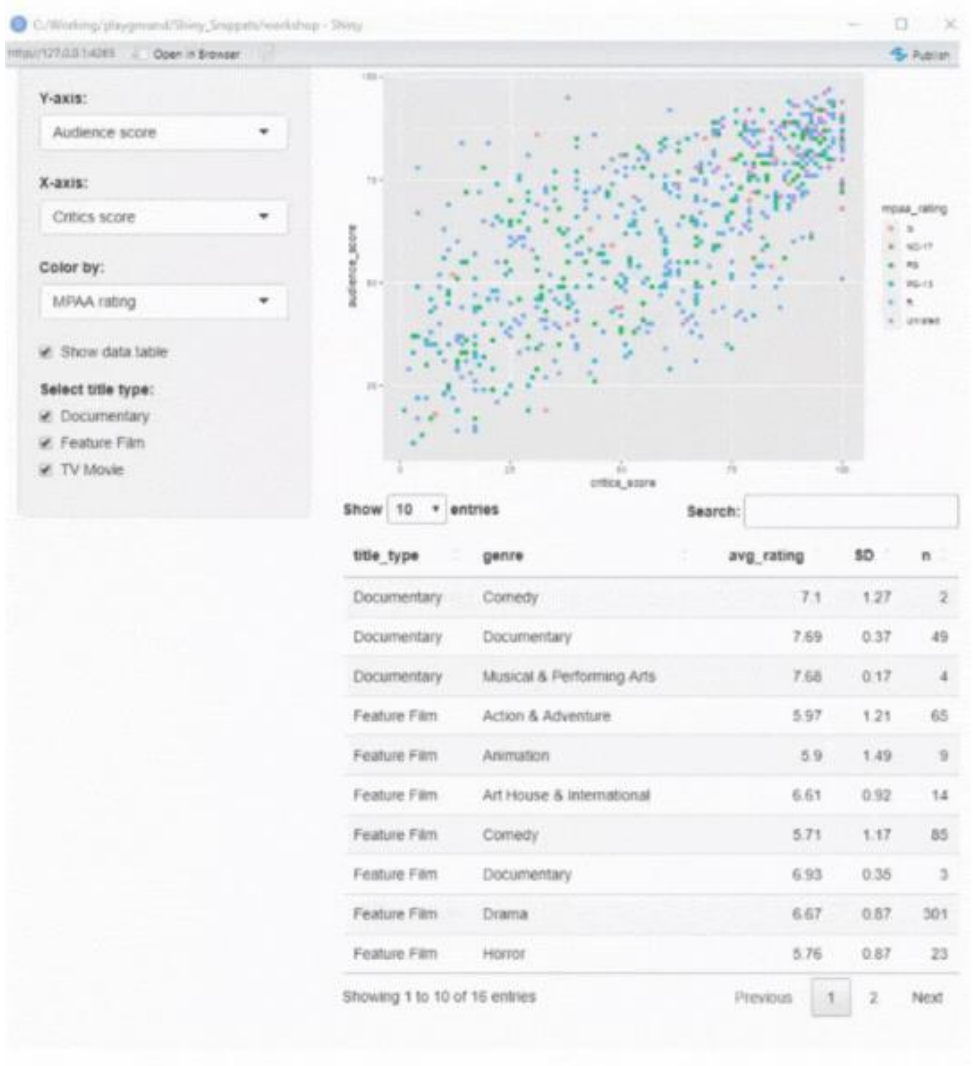
Your app should look like this after

# Exercise 2 – reactlog

- Run install.packages("reactlog")
- Restart your R session and run options(shiny.reactlog = TRUE)
- Then launch your app as you normally would
- In the app press Ctrl + F3 (or on a Mac: Cmd + F3)



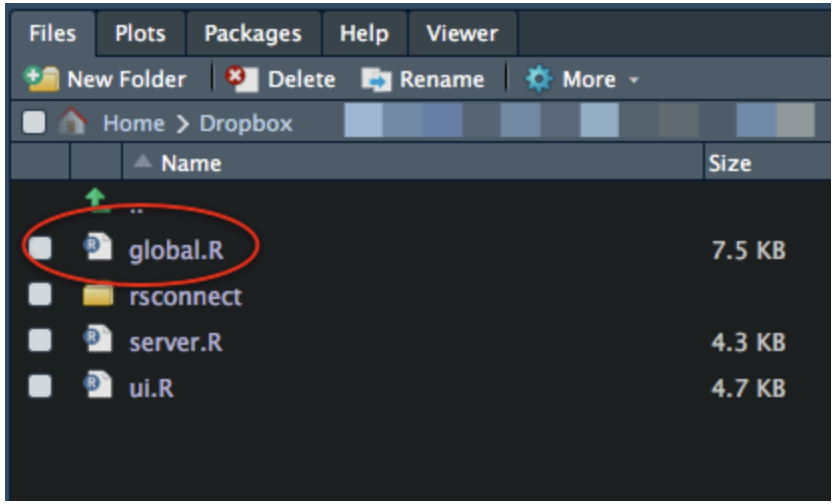
# Exercise 2 - recap




## Improvements

- ✔ app title
- ✔ show/hide “select title type”
- ✔ interactive graph
- ✔ …

# global.R




**A script automatically runs before UI and server.**

- Load libraries
- Source functions
- Clean / wrangle data

# Shiny modules

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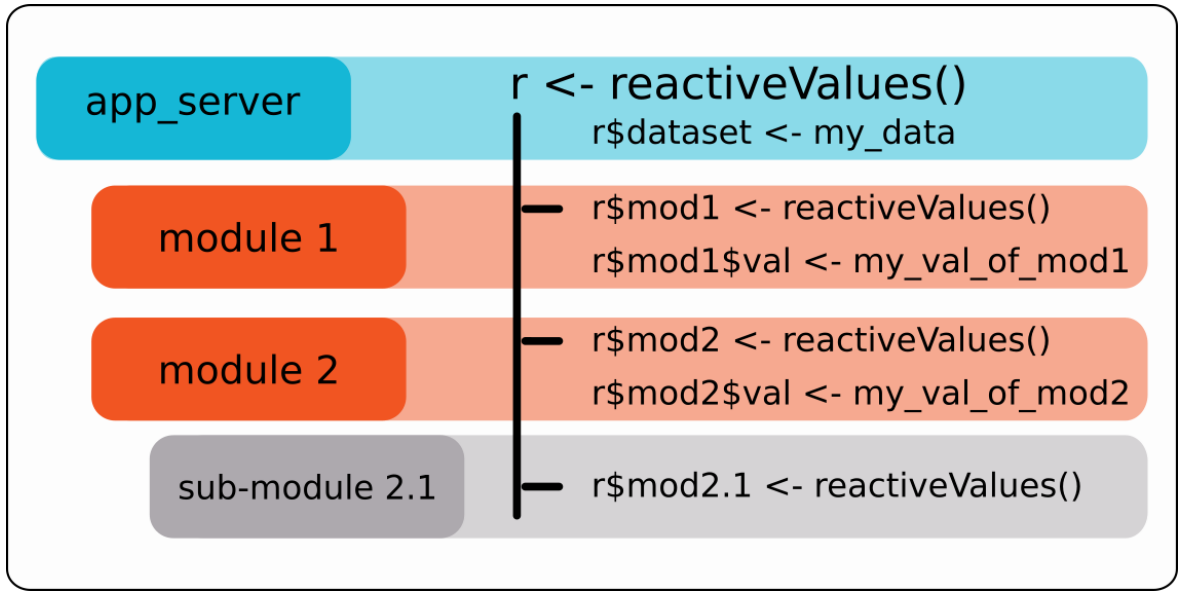
"Copy-and-paste is a powerful tool, but you should avoid doing it more than twice."

— Hadley Wickham, Mine Çetinkaya-Rundel, and/or Garrett Grolemund, R for Data Science (2e)




# JavaScript, HTML & CSS

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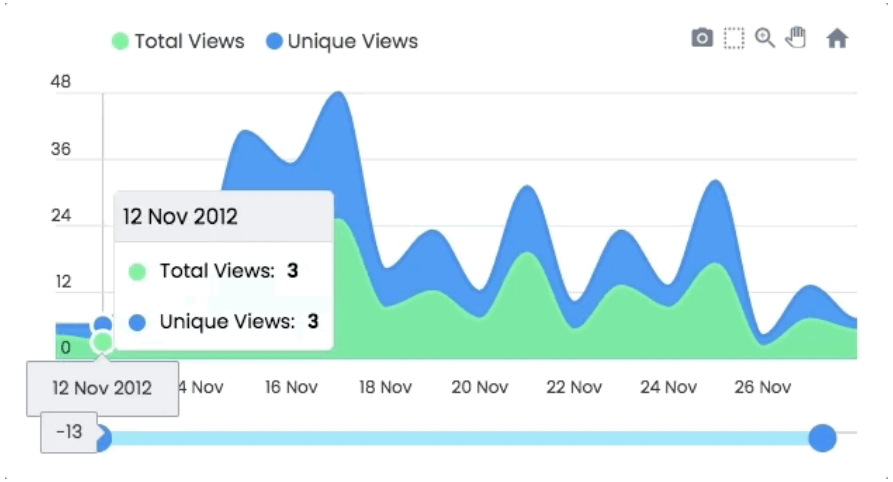
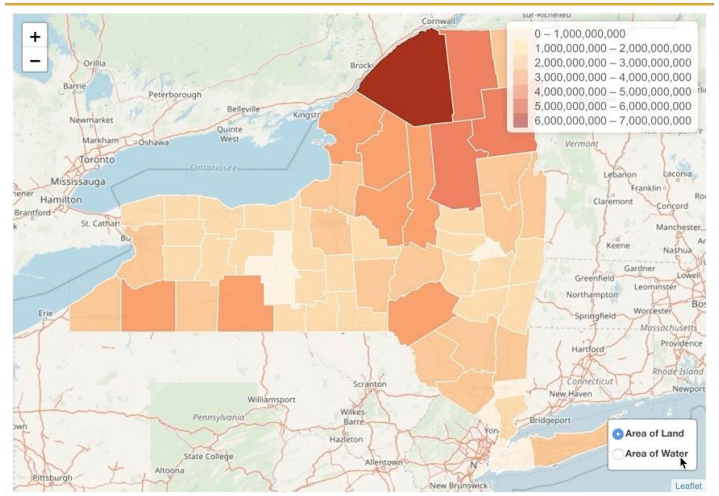
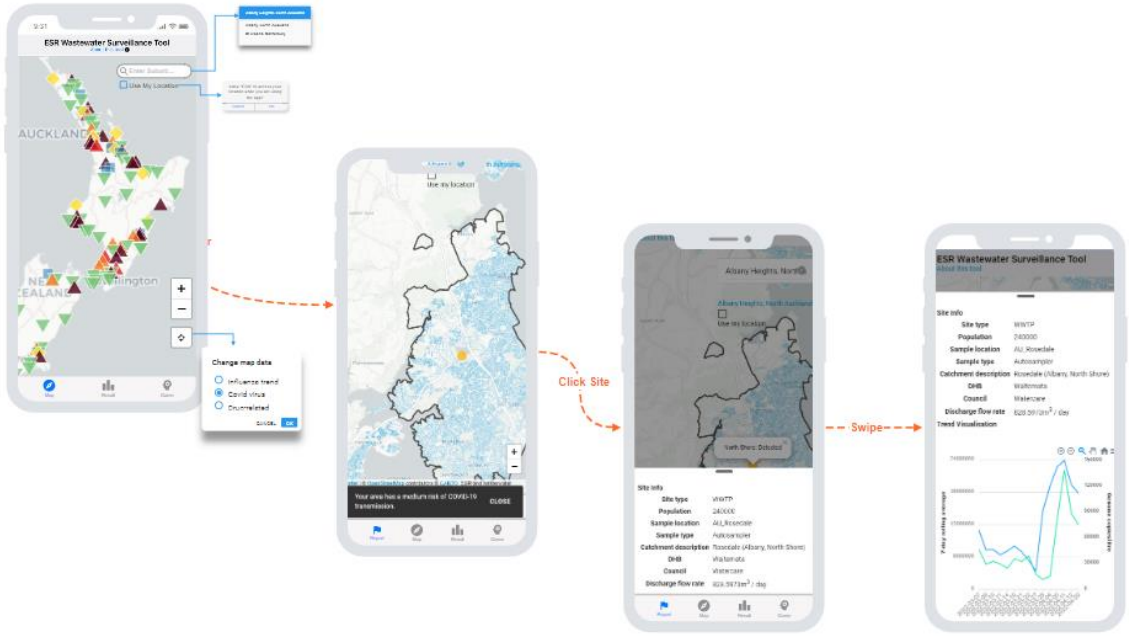


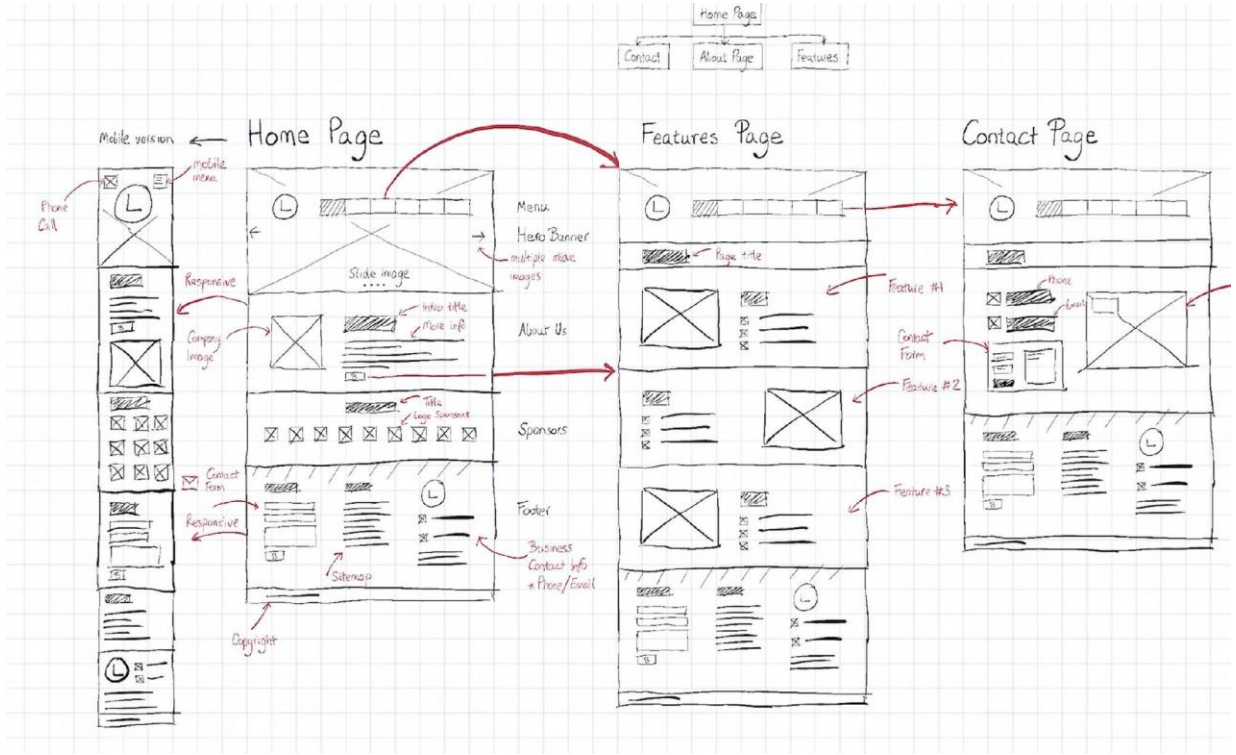




Preview

# Beyond the codes

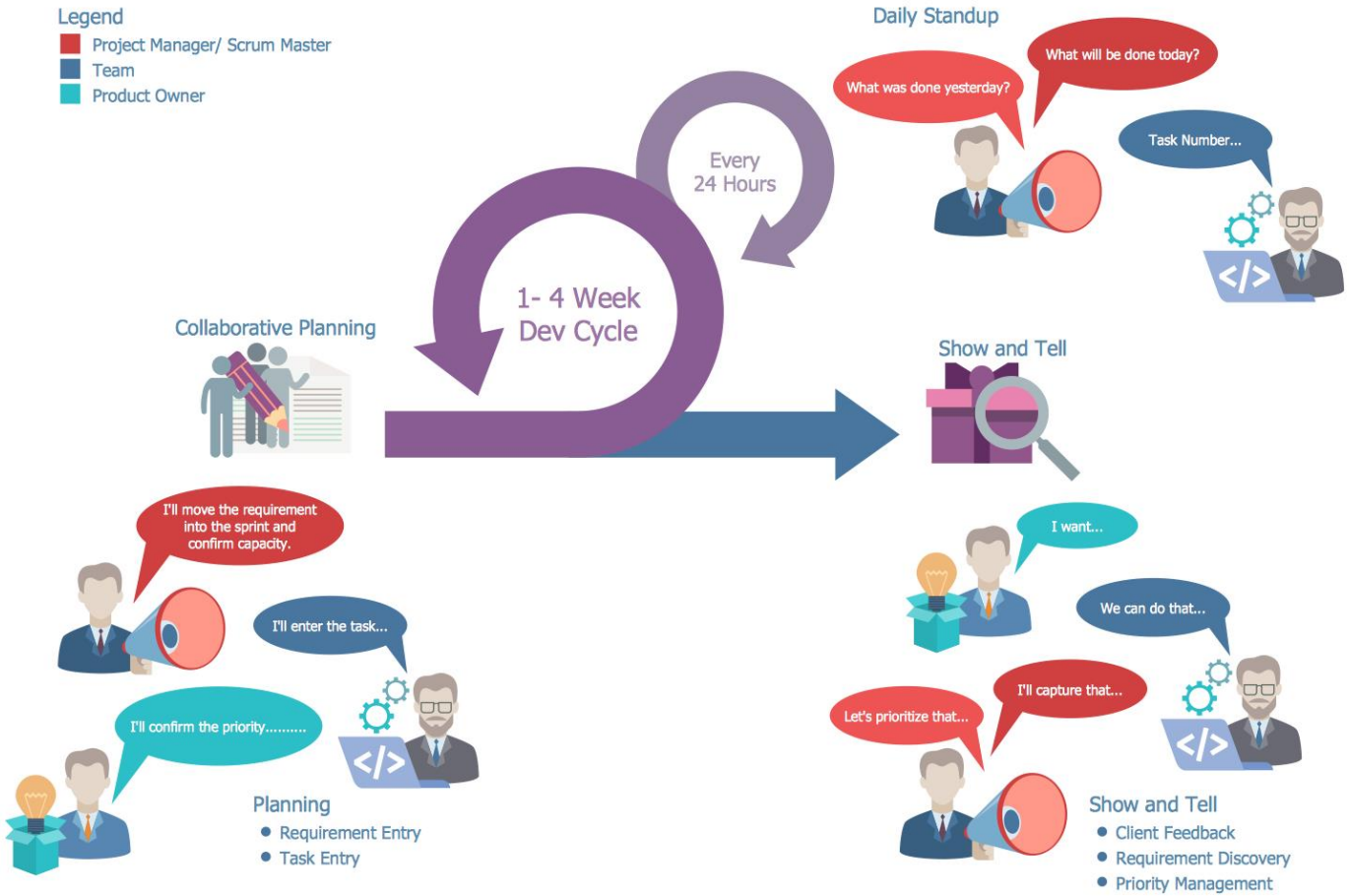
- Understand what you are building – wireframe design



# Beyond the codes

- Understand what people are expecting – communications



# Case study

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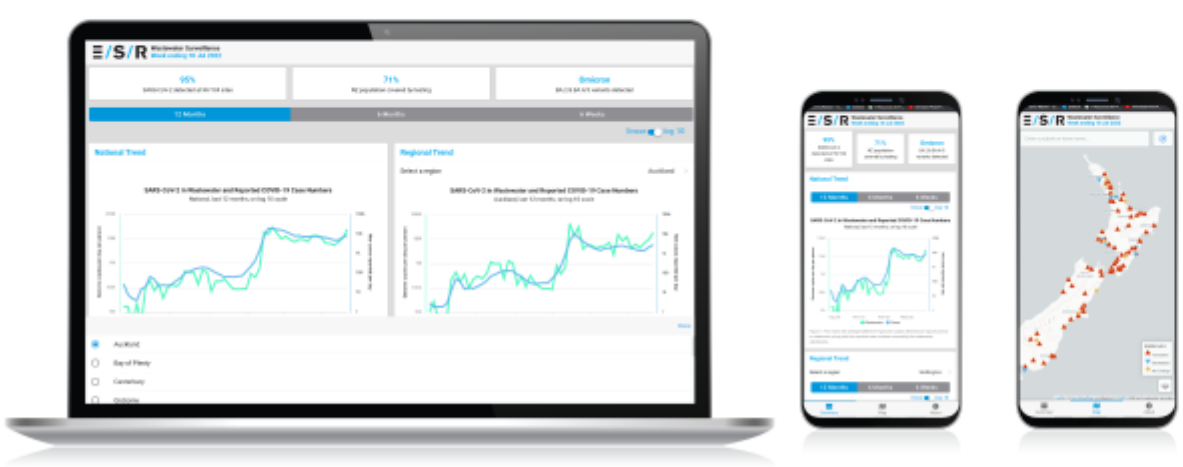
## Wastewater Surveillance Dashboard

This dashboard is designed to share ESR's wastewater science, and help the public track potential COVID-19 risks in their local areas with easy-to-digest data visualisation. It is optimised for both desktop and mobile use.



# Shiny resources

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| Type | Title | URL |
|---|---|---|
| Tutorial | Shiny official website | shiny.rstudio.com |
| News | Appsilon | appsilon.com |
| Community | R for Data Science | r4ds.io |
| Book | Mastering Shiny | mastering-shiny.org |
| Book | Engineering Production-Grade Shiny Apps | engineering-shiny.org |
| Book | JavaScript for R | book.javascript-for-r.com |
| Library | htmlwidgets | gallery.htmlwidgets.org |
| Library | R2D3 | rstudio.github.io/r2d3 |

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**Lillian Lu**

data + environment🌱 diving + tourism🤿


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