A Brief Introduction to R-Shiny and Dashboards

Ryan Hafen & J. Hathaway

Agenda

1. Introduction to R-Shiny and Dashboards
2. Examples of R-Shiny
3. Making our first R-Shiny dashboard
4. A few rules for dashboards
5. How do I learn more?

Introduction to R-Shiny and Dashboards

:Dashboards:

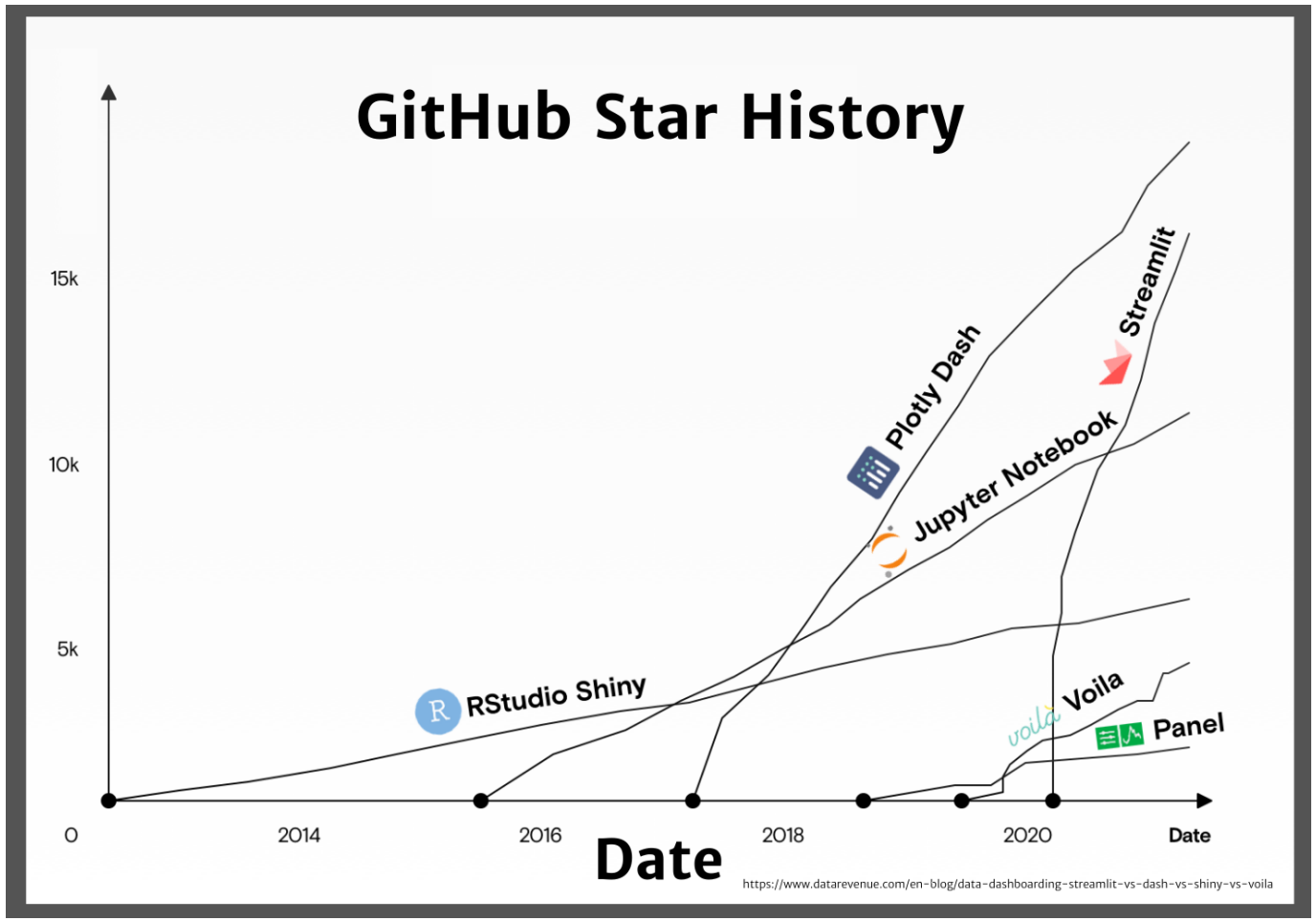
Opinionated views for decision making that facilitate user input.

What is R-Shiny?

An R package that makes it easy to build interactive web apps straight from the R language.

- RStudio Shiny website

What are the alternatives to R-Shiny?



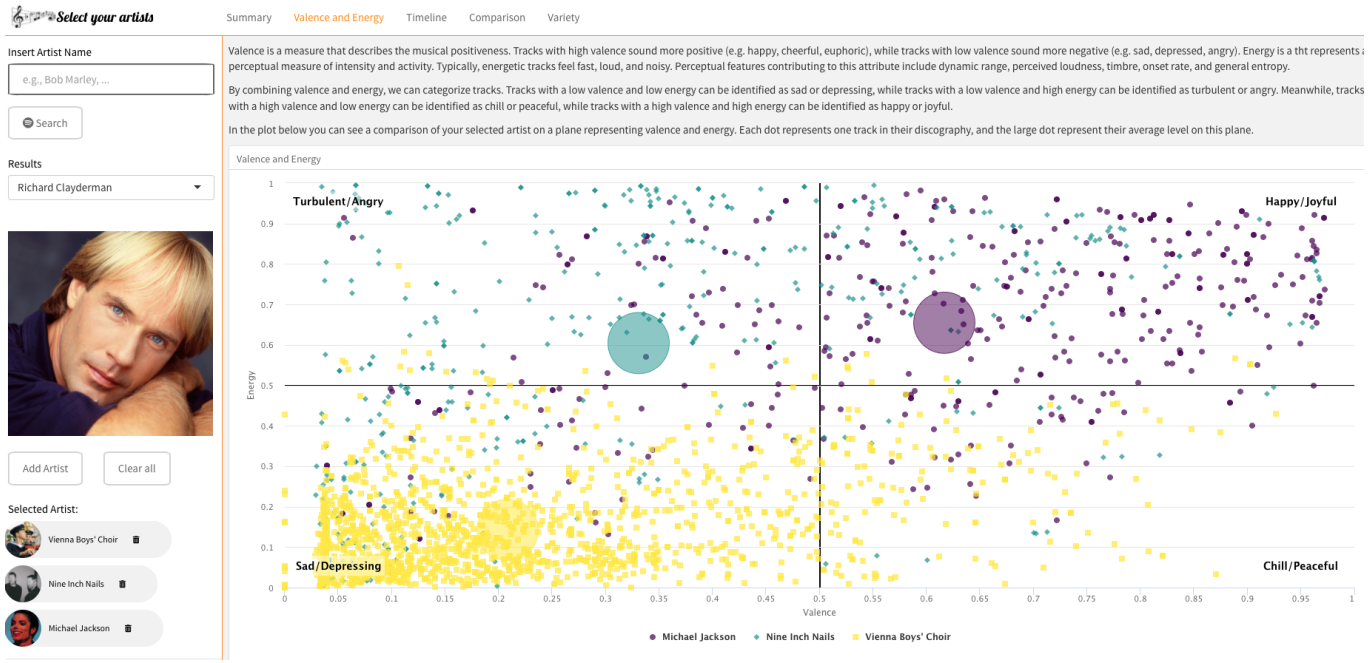
Examples of R-Shiny

Build your Own Hex Sticker

- *The app's purpose is clear.*
- *Overwhelming inputs are hidden until they are needed.*
- *GitHub Repository*

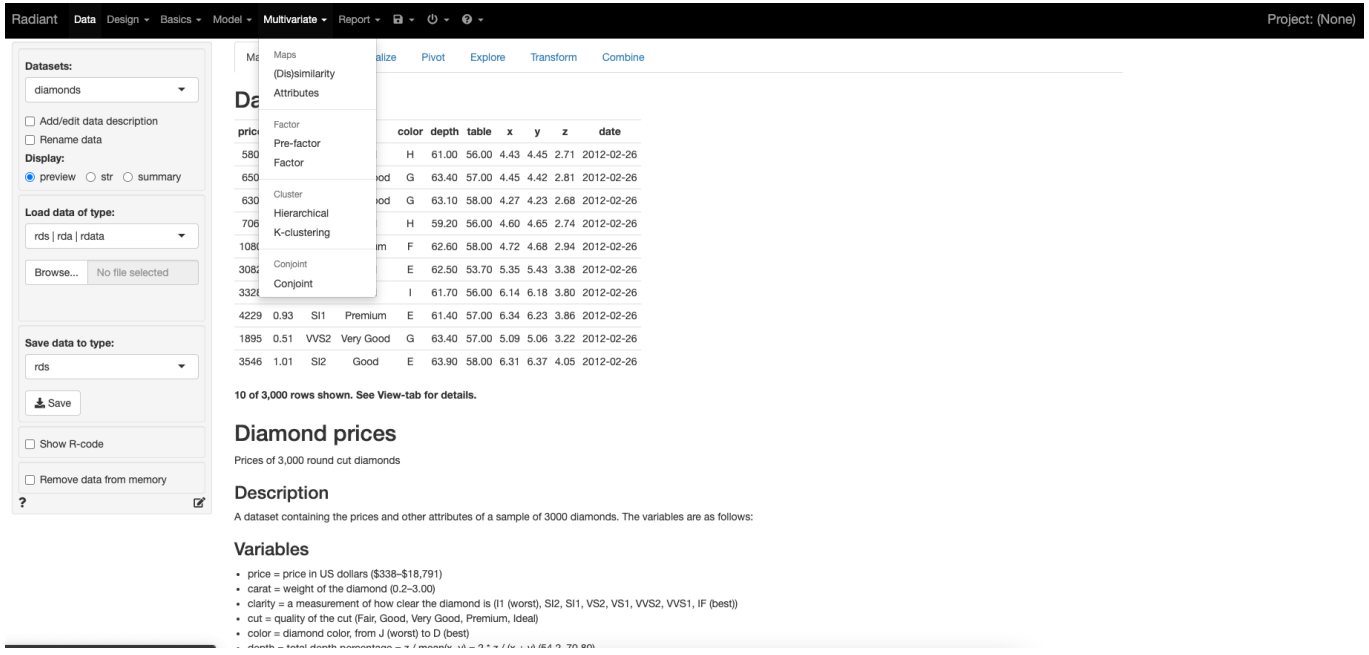
Datify: Spotify Music

- *The search input invites use.*
- *Buttons are big, clear, and organized.*
- *Slow to refresh charts after API connection.*



Radiant: Interactive 'Software' for Modeling

- *Lot's of functionality through drop-down menus.*
- *General purpose application for modeling.*
- *Confusing entry for beginners.*
- GitHub Repo



Making our first R-Shiny dashboard

Thanks to shinyintro by Lisa Debruine

- *We recommend her book for a smooth entrance into Shiny and ShinyDashboard.*
- *We will introduce dashboarding with Shiny using the 'shinydashboard' package.*

Using the `shinydashboard` package

The `shinydashboard` package is a collection of functions that make it easy to create dashboards.

You can find the code for this example at our RShinyDashboards Repository

Our first R Shiny Dashboard

- **Our Goal:** Give our user the opportunity to see reported COVID-19 cases for selected states over a specified time window using the New York Times COVID-19 data.

Starting with our chart (part 1)

- *Before we get into Shiny code, let's write the code for our key chart in the display.*

```
# load packages and format data for chart
library(ggplot2)
library(readr)
library(dplyr)
library(lubridate)

# Our data (updates daily)
url <- "https://raw.githubusercontent.com/nytimes/covid-19-data/master/us-states.csv"
nyt <- read_csv(url) %>%
  mutate(cases100k = cases / 1000)

  # Our potential inputs
variable <- c("deaths", "cases1000")[2] # what is on our y axis.
daterange <- c(ymd("2020-01-01"), ymd("2022-12-31")) # filter for x-axis
states <- c("New York", "Texas", "Florida") # which states to plot.

# Create a filtered dataset for plotting.
plotdata <- nyt  %>%
    filter(
      state %in% states,
      date >= daterange[1],
      date <= daterange[2])
```

Starting with our chart (part 2)

- *The plot code to use in a general R script. Download the chart.R script from the repository.*

```
# create the plot
# Notice the use of .data[[variable]] to select the column to place on the y-axis
ggplot(data = plotdata, aes(x = date, y = .data[[variable]], color = state)) +
  geom_point(size = .5, alpha = .8) +
  geom_line() +
  theme_bw() +
  guides(color = guide_legend(
    override.aes = list(lty = NA, size = 5, shape = 15))) +
  labs(
    title = paste0("Progression of the pandemic from ",
      daterange[1], " to ", daterange[2]),
    x = "Date",
    y = ifelse(variable == "deaths", "Deaths", "Cases (1,000)"),
    color = "State"
  )
```

The Shiny app basics

- *Every Shiny app has three key elements: `ui`, `server` and the `shinyApp(ui, server)` call. When using `shinydashboard` our `ui` is a little different.*

```
header <- dashboardHeader(CODE FOR THE HEADER)
sidebar <- dashboardSidebar(CODE FOR THE INPUTS)
body <- dashboardBody(CODE FOR THE RESULTS)

ui <- dashboardPage(
  skin = 'purple',
  header,
  sidebar,
  body
)
```

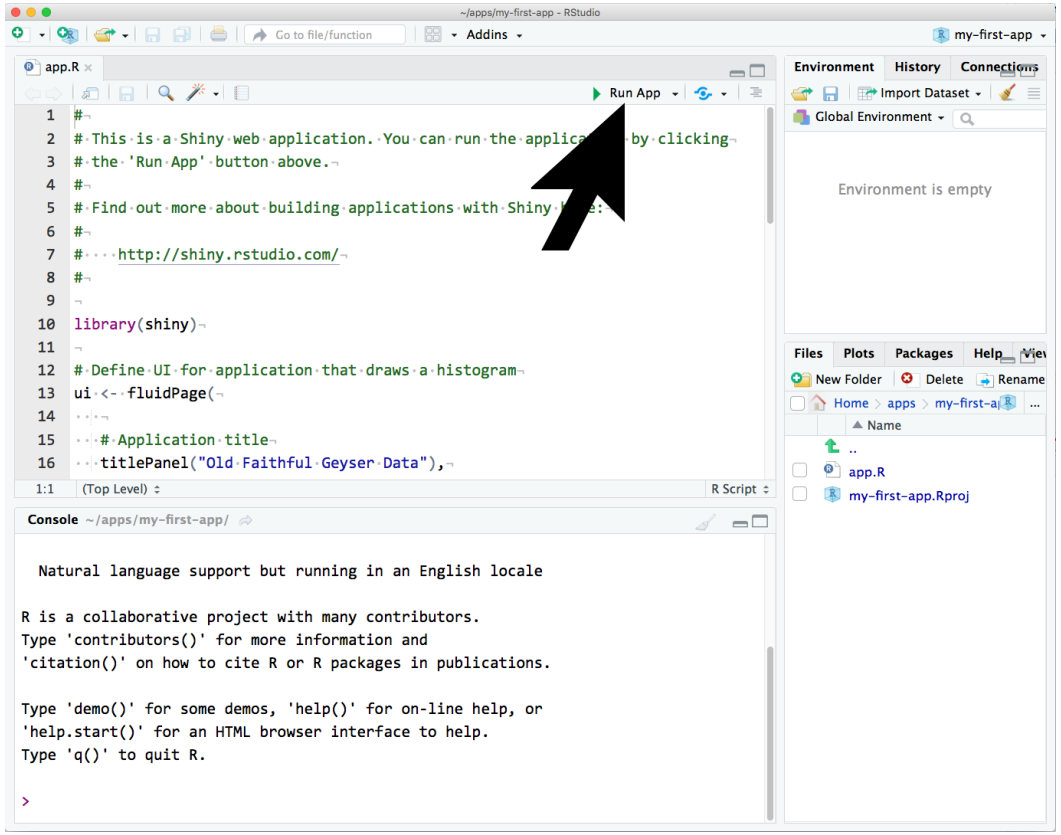
```
server <- function(input, output) {
    THE CODE THAT CREATE CHARTS, TABLES, AND TEXT FROM INPUTS
}
```

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

Our 'app.R' code for the dashboard is in the `app` folder of our repository

Using R-Studio for app development

- *Start R-Studio and create a new script `app.R` in a new `project` or `folder`. Once we have our script built we will click on `Run App`.*



Building the interface: *Copy this code and paste it into* `app.R`

```
# Setup ----
library(shiny); library(shinydashboard); library(readr); library(dplyr); library(ggplot2)
# Define UI ----
header <- dashboardHeader(title = "COVID-19 NYT Data Dashboard", titleWidth = 400)

sidebar <- dashboardSidebar(width = 400,
  actionButton('load', label = "Import New York Times data"),
  radioButtons('variable', label = "Cases or Deaths?",
    choices = c("Number of Deaths" = "deaths", "Number of Cases" = "cases1000")),
  selectInput("state", "Which states?",state.name, multiple = TRUE, selected = "New York" ),
  dateRangeInput("daterange", "Date range:", start = "2020-01-01", end   = "2022-12-31"),
  actionButton('makeplot', label = "Explore Visualization")
)

body <- dashboardBody(
  box(
    title = "Pandemic time-series (USA)", solidHeader = TRUE, width = 16, collapsible = TRUE,
    plotOutput("timeseries", height = 500, width = 'auto')
  ),
  box(title = "Total reported cases (USA)", solidHeader = TRUE, width = 6,
    div(style = "font-size:50px",textOutput("casetotal"))),
  box(title = "Total reported deaths (USA)", solidHeader = TRUE, width = 6,
    div(style = "font-size:50px",textOutput("deathtotal")))
)

# Run the application ----
ui <- dashboardPage(skin = "purple", header, sidebar, body)
server <- function(input, output) {}
shinyApp(ui, server)
```

Adding the body elements within `server` (Data & Totals).

- *Include these `reactiveVal()` assignments before the `server` function.*

```
nyt <- reactiveVal()
plotdata <- reactiveVal()
```

- *Now include our data import event within the `server <- function(input, output) { }`.*
- *We can `Reload App` to see if the 'Import New York Times data' button works.*

```
# Data ingestion and total number calculations. Set to work after `input$load` occurs from clicking on Import Data.
observeEvent(input$load, {
  url <- "https://raw.githubusercontent.com/nytimes/covid-19-data/master/us-states.csv"
  fulldata <- readr::read_csv(url) %>%
    mutate(cases100k = cases/1000)

  nyt(fulldata) # This reactive item now is composed of the NYT COVID-19 data.
  # assigning them into the output object allows them to be called by the `ui`.
  output$deathtotal <- renderText(
    fulldata %>% filter(date == max(date)) %>%
    pull(deaths) %>% sum() %>% format(big.mark = ","))

  output$casetotal <- renderText(
    fulldata %>% filter(date == max(date)) %>%
    pull(cases) %>% sum() %>% format(big.mark = ","))
})
```

Adding the body elements within `server` (Chart).

```
observeEvent(input$makeplot, {
  # notice the use of `input$` to pull the user input values into the function.
  # if statement stops the outputs from being created if the user hasn't clicked import
  if (length(nyt()) != 0) {
    newdat <- nyt() %>%
      filter(state %in% input$state, date >= input$daterange[1], date <= input$daterange[2])

    plotdata(newdat) # This reactive item now has is composed of the filtered data.
    # notice the use of plotdata() as the data object to signal a reactive dataset.
    output$timeseries <- renderPlot({
      ggplot(data = plotdata(), aes(date, .data[[isolate(input$variable)]], color = state)) +
      geom_point(size = .8, alpha = .8) +
      geom_line() +
      theme_bw() +
      labs(
        title = paste0("Progression of the pandemic from ",
          input$daterange[1], " to ", input$daterange[2]),
        x = "Date",
        y = ifelse(isolate(input$variable) == "deaths", "Deaths", "Cases (1,000)"),
        color = "State") +
      guides(color = guide_legend(override.aes = list(lty = NA, size = 5, shape = 15)))
    })
  }
})
```

Our final dashboard

- *You can see the complete script at [app/app.R](app/app.R)*

A few rules for dashboards

“Know the user,

they are not programmers

Define your production goals

- How often will it be used?
- How reliable does it need to be?
- What is the impact if it is innacurate?

Design with a purpose

To design without purpose is to design without a goal, without an objective or without a target. It's just design for design's sake. Not nearly as fulfilling as design with a direction. Without purpose, design is just decoration—aesthetics without true meaning.

THEIL

How do I learn more?

Online Reading Material

- Mastering Shiny
- Learn Shiny
- Get Started w/ shinydashboard
- Use shinydashboard
- Engineering Production-Grade Shiny Apps
- shinyjs
- shinydashboards
- Building Web Apps with R Shiny
- stat545 Shiny Tutorial
- R markdown: The Definitive Guide - Shiny
- YouTube: A Gentle Introduction to Creating R Shiny Webb Apps
- YouTube: Dynamic Dashboards with Shiny

Short Courses

- Building Web Applications with Shiny in R
- Shiny Fundamentals with R
- Building Data Apps with R and Shiny: Essential Training
- Creating Interactive Presentations with Shiny and R
- Interactive Visualization with R

Shinyverse of R packages

There are so many packages available. awesome-shiny has an extensive list. Use the below list to start your journey.

- shinydashboard
- shinydashboardPlus
- Shiny Themes
- shinymanager
- shiny.semantic
- shiny.react
- shiny.fluent
- shiny sense

Thanks