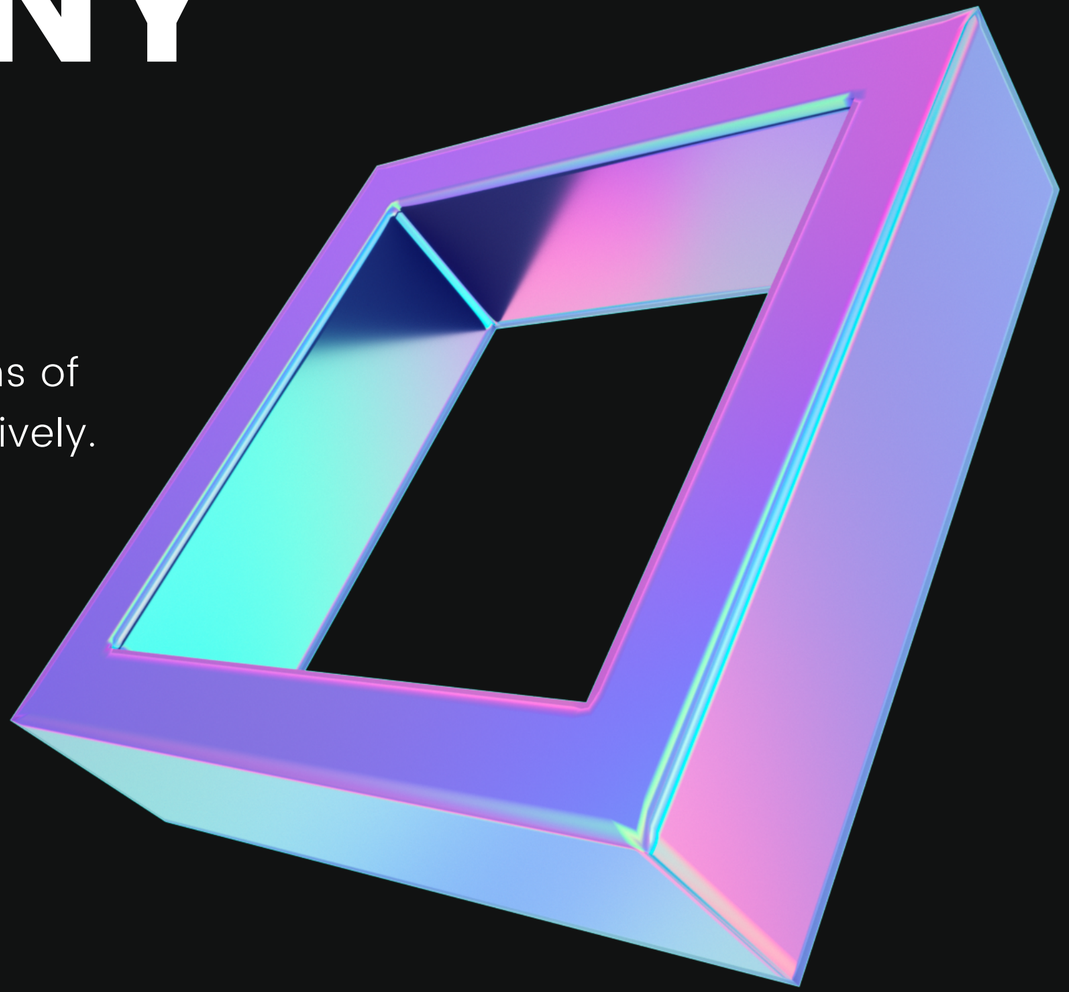
BRIGHT R SHINY OBJECTS



Achievable, shareable and understandable representations of data can help us communicate & collaborate more effectively. Shiny apps give us an easy way to do this.

UQ Advanced R Course - 2021
Dr Bill Venables - Data 61 & CSIRO
Rhetta Chappell - RIDL, Griffith University

Rhetta Chappell

Data Scientist - RIDL at Griffith University

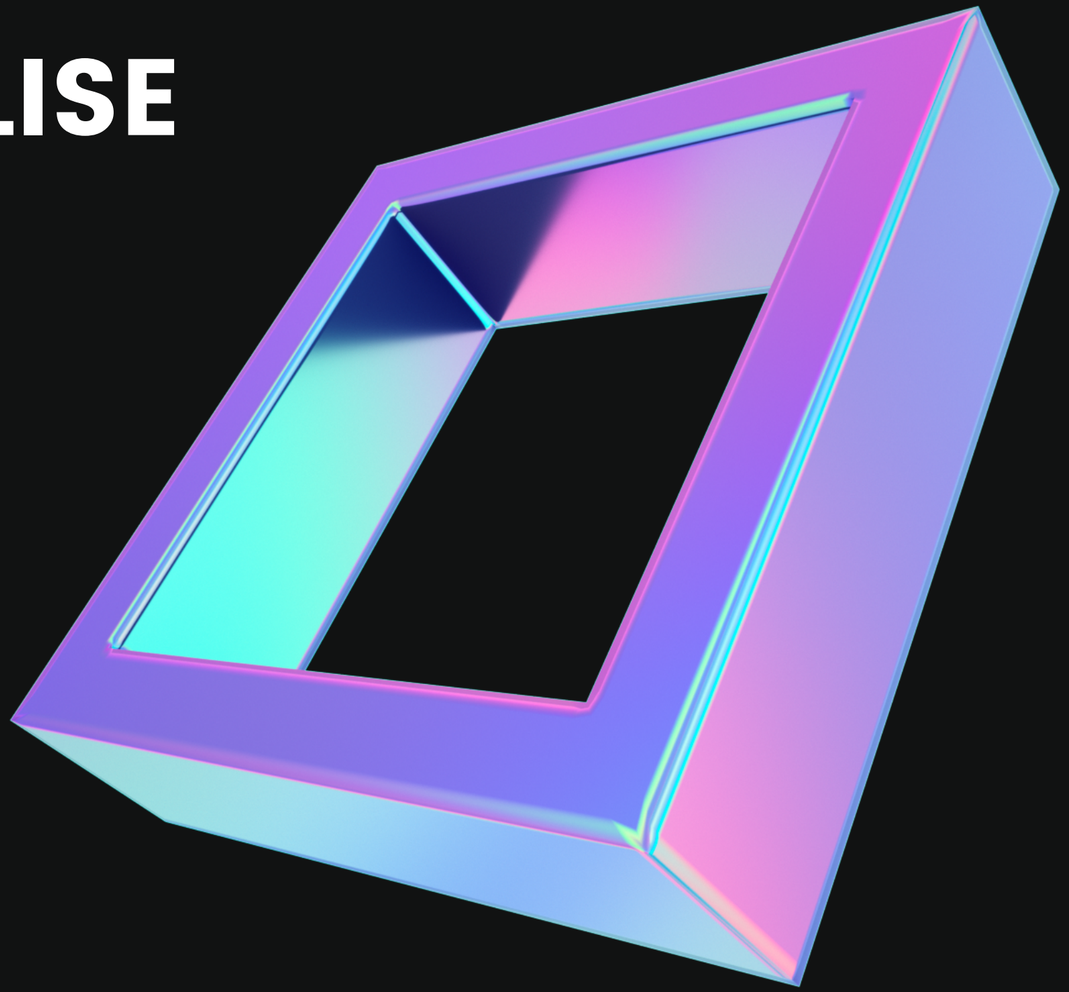
BACKGROUND

- art, design
- anthropology
- research
- data science

PROFESSIONAL INTERESTS

- data visualisation & storytelling
- democratising data - data collaboratives and coops
- actionable insights for social good
- behavioural economics & psychology

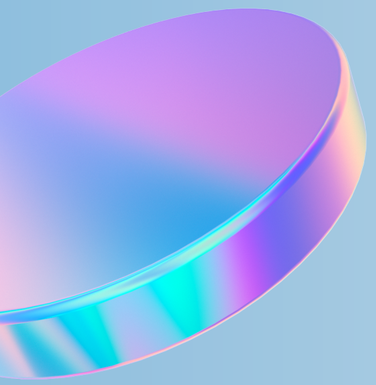
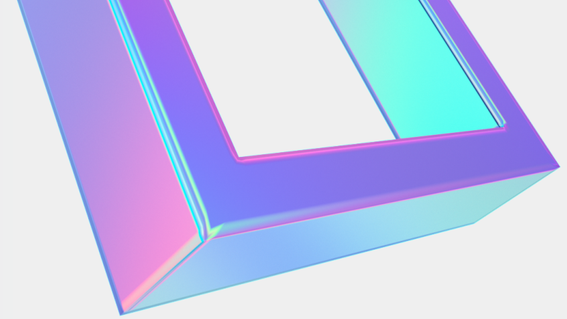
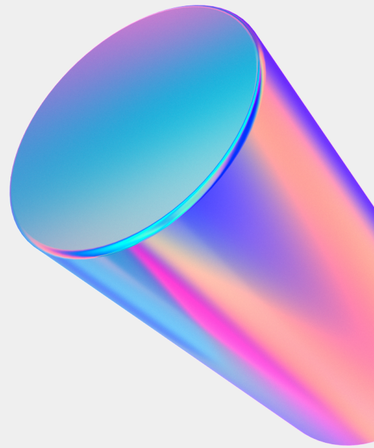
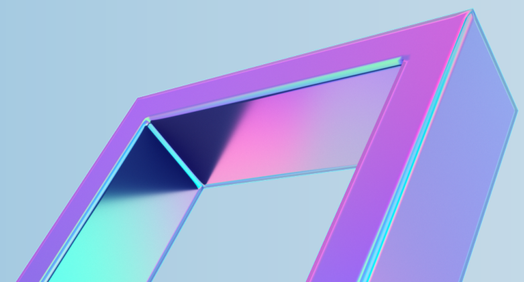
HOW DO YOU VISUALISE YOUR DATA AND COMMUNICATE YOUR REASEARCH FINDINGS?



Interact.
Analyse.
Communicate.

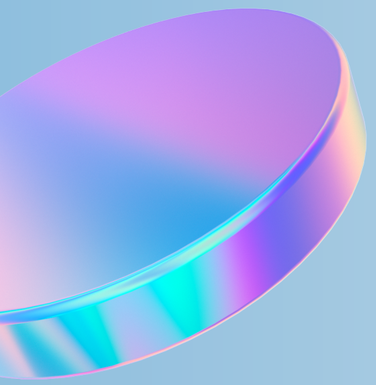
"Shiny combines the computational power of R with the interactivity of the modern web".

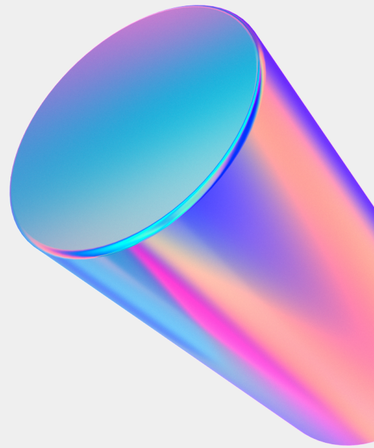
- https://shiny.rstudio.com/

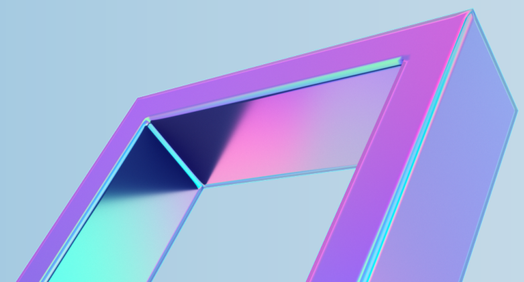





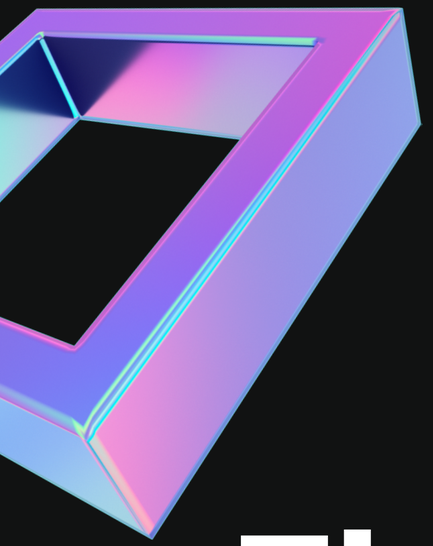
Top 7 reasons why I build Shiny apps:

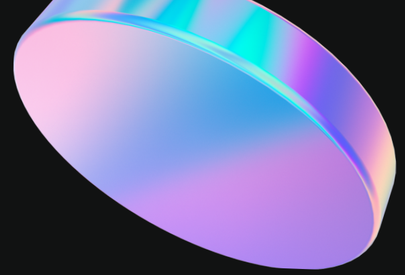
1. Research translation (PhD students, sharing project outcomes)
2. Generate & share accessible & actionable insights (Community Orgs, Local Councils)
3. Stakeholder engagement
4. Policy advocacy
5. Civic engagement
6. Wireframing / prototyping more complex applications
7. Data exploration & analysis











The ShinyR the better...

Shiny app examples:

PRACTICAL:

https://connect.thinkr.fr/hexmake/

DATA SCIENCE & OPEN DATA:

https://nz-stefan.shinyapps.io/blog-explorer/

- network graph +30,000 blog articles on R

LIFE SCIENCES/PUBLIC INTEREST:

https://vac-lshtm.shinyapps.io/ncov_tracker/?_ga=2.90997338.1162613968.1610319694-609160277.1538646407

INDUSTRY:

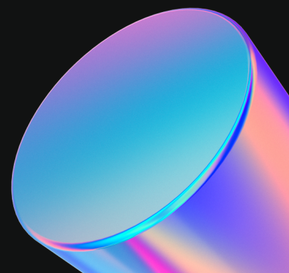
https://phillyo.shinyapps.io/intelligentsia/?_ga=2.168124897.1162613968.1610319694-609160277.1538646407

ENTERPRISE:

https://demo.appsilon.ai/apps/shiny-enterprise-demo/

POLITICS:

https://regionalinnovationdatalab.shinyapps.io/qldvotes/



Why shiny?

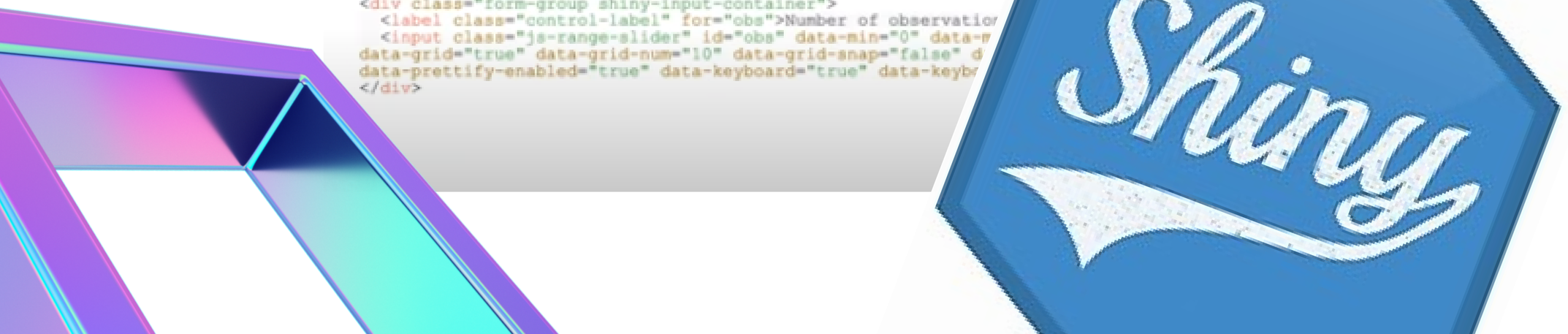
- You're already familiar with R
- No web development skills are required
  - Easy to understand interactivity through reactivity
- **Quickly** prototype and let users interact with your data and your analysis:
  - easily embed into .Rmd, blogdown and websites
  - highly customisable - basic to beautiful ui
  - free to host and share - shinyapps.io, RStudio Connect
  - lots of great packages
    - (shinydashboardPlus, shiny.demantic, shinydashboard, plumbR, leaflet, plotly, DT, data.table)
  - great for stakeholder engagement & collaboration

How does Shiny work?

- R Shiny is an R package which translates R code into html code to be understood by your web browser
    - R code = more concise and intelligible for R users
    - install.packages("shiny")

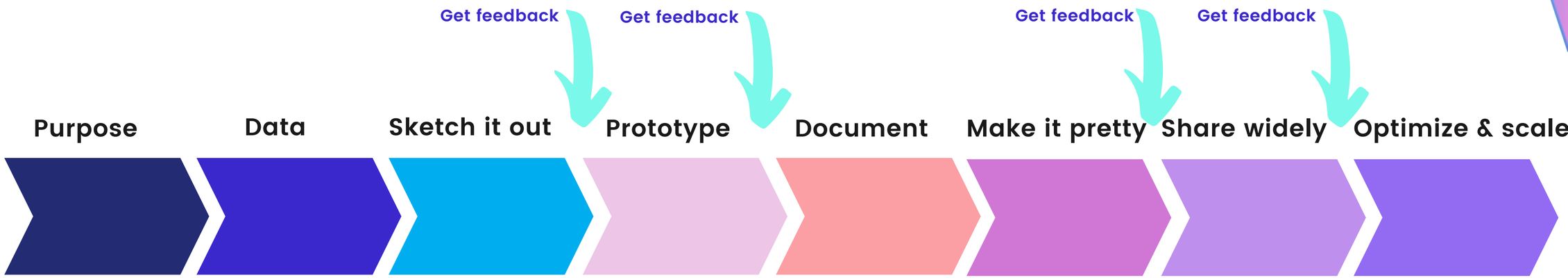
```
library(shiny)
sliderInput("obs", "Number of observations:",
   min = 0, max = 1000, value = 500
 )
```

```
<div class="form-group shiny-input-container">
  <label class="control-label" for="obs">Number of observatio
  <input class="js-range-slider" id="obs" data-min="0" data-m
data-grid="true" data-grid-num="10" data-grid-snap="false" d
data-prettify-enabled="true" data-keyboard="true" data-keyb
</div>
```



MY SHINY WORK FLOW

this is what works for me, you might be different



Why build an app?
What are you trying to communicate?

Identify, source and wrangle the data to support your purpose.

Sketch out basic UI layout and where the different data points will be used. How is the user going to interact?

Write the code for the basic components on your app - don't worry about aesthetics, focus on functionality and ease of navigation.

This kinda sucks, but its important. Documentation will help you down the track and also provides people with important information e.g. sources, data sharing restrictions, license, FAQs, when data will be updated.

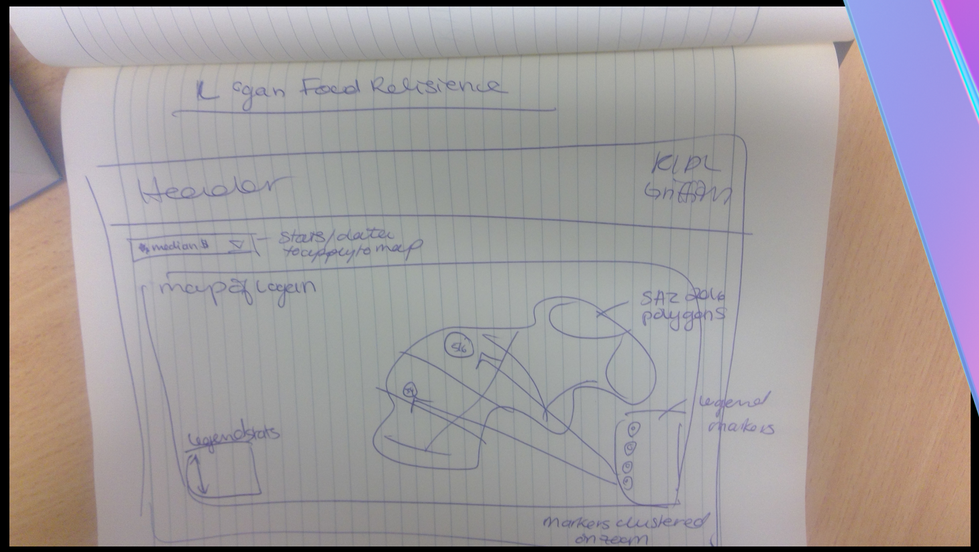
Have fun with your UI design, be creative or use preset themes. This isn't rocket science, but this will impact how people perceive and engage with what you've built.

Share this with as many people as possible, this way you can get more feedback and people can get the value out of your application

As your user base grows, you may need to revisit your code to optimise performance and scale your amazing application.

TIP #1 - SKETCH IT OUT

- Sketch out app ui and basic reactive components (slider, dropdowns, upload)
  - doesn't need to be pretty (look at mine)
- Walk client/ stakeholder through your sketch
  - ask for feedback, rework your sketch and then start coding



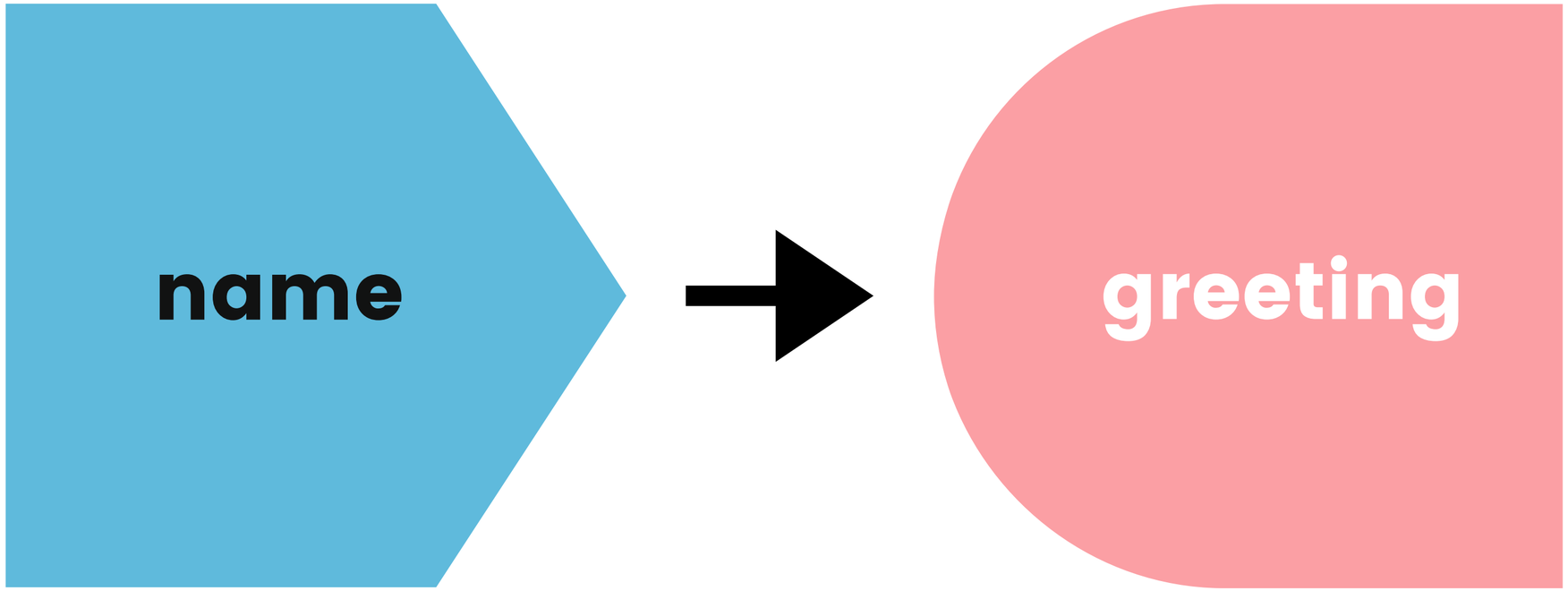
2 key components of every Shiny app:

```
library(shiny)
# 1
ui <- fluidPage(
)

#2
server <- function(input, output, session) {

}
shinyApp(ui, server)
```

- **UI**
  - front end interface
  - simpler (in the beginning)
    - all users get same version of HTML
  - defines how your app looks
- **SERVER**
  - back end logic
  - more complex (in the beginning)
    - each user gets own version of app
  - defines how your app works

Reactivity

Shiny uses a reactive programming model.



The reactive graph contains one symbol for every input and output, and we connect an input to an output whenever the output accesses the input.

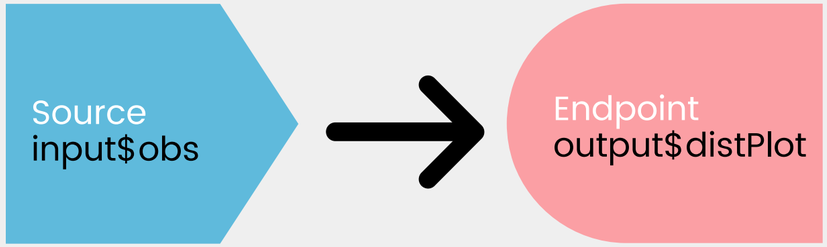
For more on reactivity: https://shiny.rstudio.com/articles/reactivity-overview.html

Reactive programming model

- 3 types of objects in reactive programming

- simple app structure = source and endpoint

```
server <- function(input, output) {

output$distPlot <- renderPlot({

#generate an r norm distribution plot
   hist(rnorm(input$obs))
 })
}
```



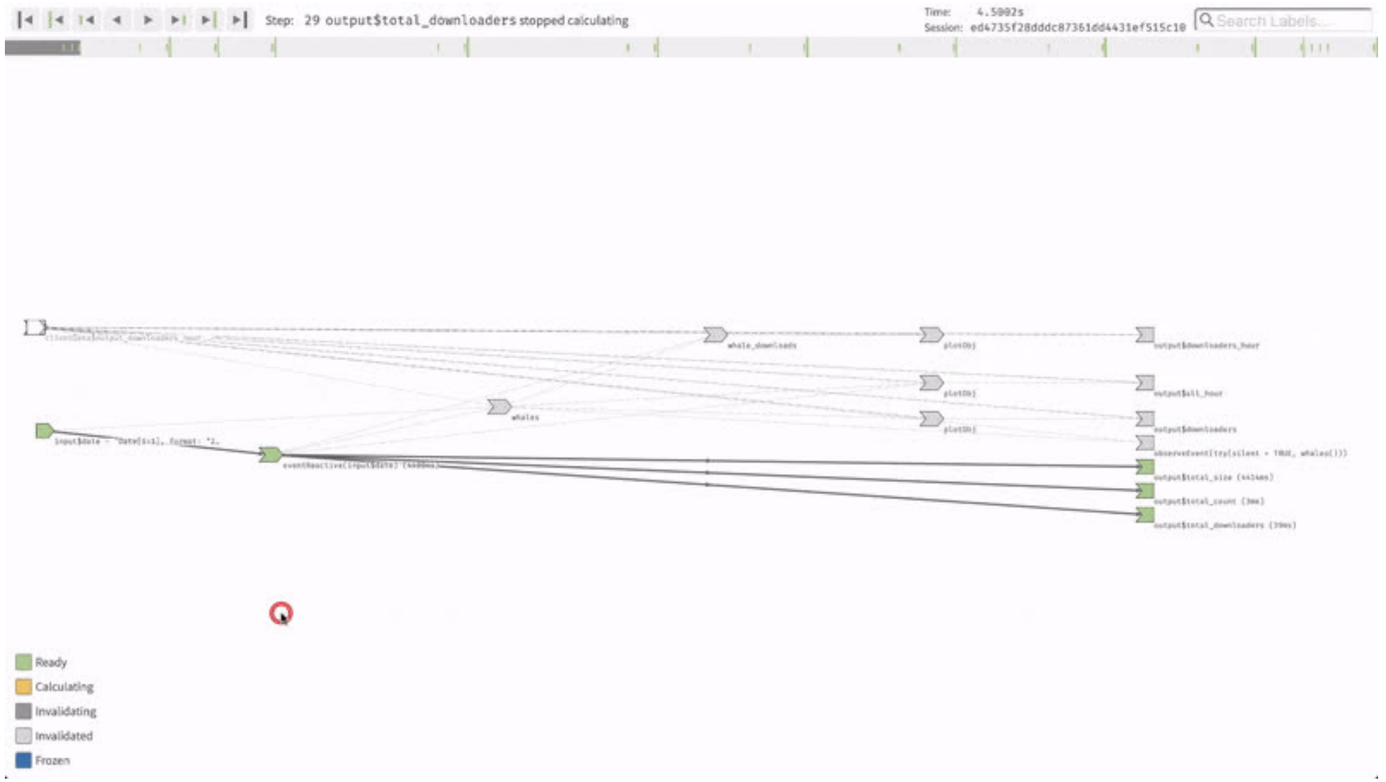
https://gallery.shinyapps.io/01_hello/?_ga=2.120228746.360158209.1611709044-609160277.1538646407

For more complex apps:

https://cloud.r-project.org/package=reactlog

Display the reactivity dependency graph of your Shiny applications:

- install.packages("reactlog")
- don't want a "reactive spaghetti mess"
  - modularize your code - best practice, but more advanced



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

input parameter

- The input argument is a list-like object that contains all the input data sent from the browser, named according to the input ID.

```
ui <- fluidPage(
            numericInput( id = "count",
                          label = "Number of values",
                          value = 100) #end numeric input
          )#end fluidPage
```

- you can access the value of that input with input$count
  - It will initially contain the value 100, and it will be automatically updated as the user changes the value in the browser.
- Unlike a typical list, input objects are read-only.
  - To read from an input, you must be in a reactive context - more on this later

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

output & input parameters

- Note that the ID is quoted in the UI, but not in the server.

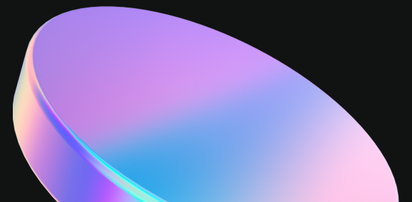
```
ui <- fluidPage(
              numericInput(id = "count",
                           label = "Number of values",
                           value = 10),# end numeric input

                textOutput(id = "message")# end text output

              )#end fluidPage


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

    output$message <- renderText({
      paste0("You selected ", input$count, "!") #end RenderText

}
```

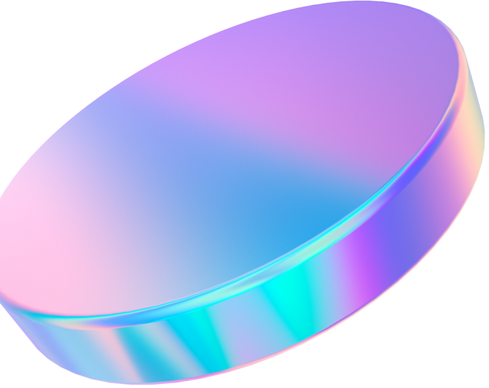
server <- function(input, output, session) { }

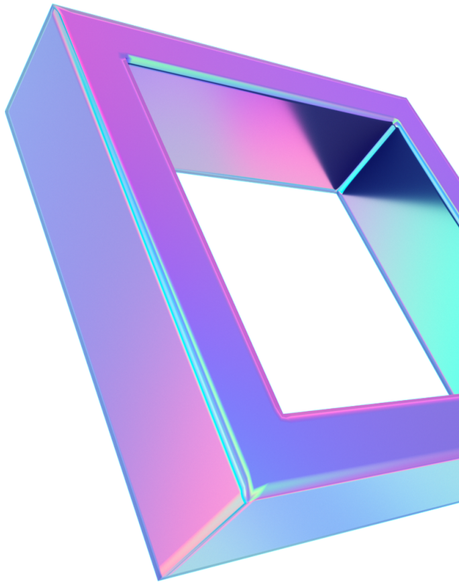
output parameter

- also a list-like object named according to the output ID
- used for sending output instead of receiving input
- always use the output object together with a render function

```
ui <- fluidPage(
        textOutput(id = "message")
                  )#end fluidPage


server <- function(input, output, session) {
  output$message <- renderText("Advanced R 2021!")#end fluidPage

}
```



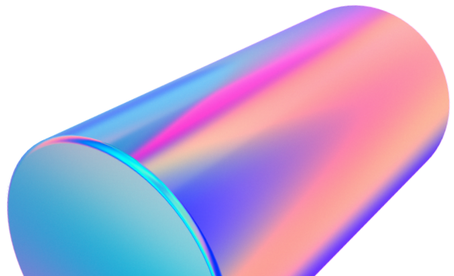




TIP #2 - SHINY IS LAZY

- check that your UI and server functions are using the same identifiers - error messages can be cryptic or more often non-existent

```
ui <- fluidPage(
        textOutput( id = "greeting")
          )#end fluidPage

server <- function(input, output, session) {
        output$greetnig <- renderText({ paste0("Hello ", input$name, "!")
                                      }) #end RenderText
                                    }
```



IMPERITIVE & DECLARATIVE PROGRAMMING

COMMANDS

IMPERITIVE - R SCRIPTS

In imperative programming, you issue a specific command and it's carried out immediately.

"Make me a Greek salad."

RECIPES

DECLARATIVE - R SHINY

In declarative programming, you express higher-level goals or describe important constraints, and rely on someone else to decide how and/or when to translate that into action.

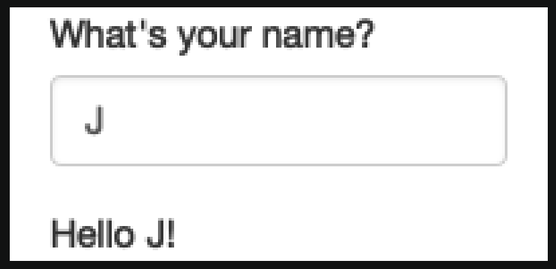
- can sometimes be tricky to frame what you want this way

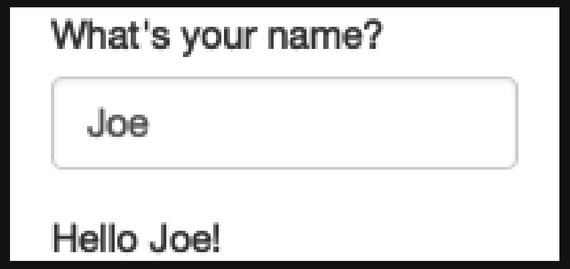
"Ensure there is a Greek salad in the fridge whenever I look inside it".

"RECIPES INSTEAD OF COMMANDS"

Copy, Paste & Run:

```
ui <- fluidPage(
  textInput(id = "name",
            label = "What's your name?"), #end textInput
  textOutput("greeting")
) # end fluidPage

server <- function(input, output, session) {
  output$greeting <- renderText({
    paste0("Hello ", input$name, "!") #end RenderText
```





Order of execution

- Not top to bottom
- Only executes as needed
  - user interaction
  - unique sessions

TIP #2 – BE KIND TO YOUR FUTURE SELF

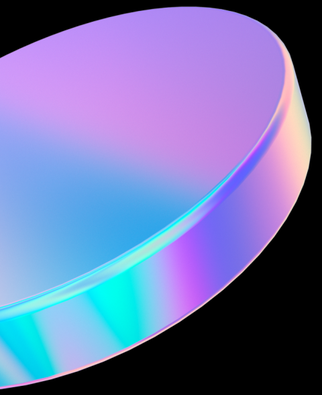
COMMENT LIKE CRAZY, AND USE A CONSISTENT NAMING CONVETION

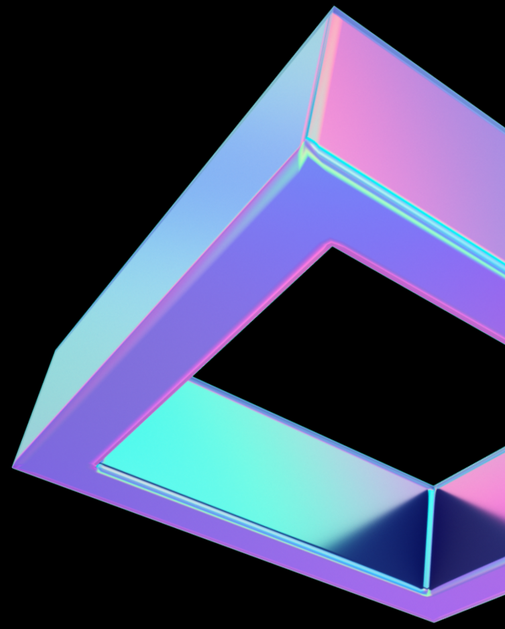
```
library(shiny)
library(shinydashboardPlus)

ui <- fluidPage(
        #drop down menu - user selects child safety service centre (CSSC)
        shinydashboardPlus::pickerInput( inputId = 'cssc_input1',
                                         label = 'Select a CSSC to update the graphs & map:',
                                         width = "100%",
                                         choices = unique(df_cssc$CSSC), # end choices
                                         options = list(`style` = 'btn-primary') #end options
                                        ) #end pickerInput
            )#end fluidPage

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

                                    }#end server
```

TIP #2 - EXAMPLE

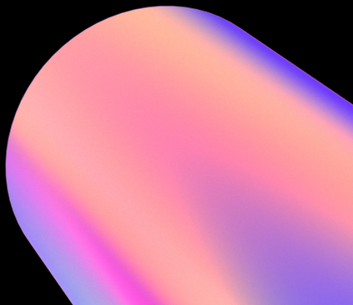
```
481   column(6,
482          withSpinner(
483            leafletOutput("map4",height = "340px", width="100%")
484            )#end spinner
485          )#end column
486      )# end fluidrow
487  ) # end FluidPage
```

```
column(6,
       withSpinner(
         leafletOutput("map4",height = "340px", width="100%")
              )
         )
       )
     )
```





BEAUTIFUL &
FUNCTIONAL UI MATTERS

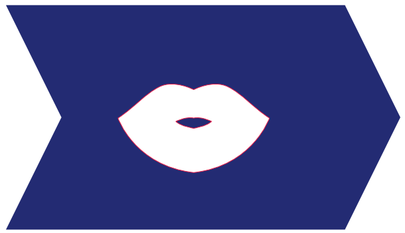



“
Design is not just what it looks like and feels like. Design is how it works.
— Steve Jobs

UI PRINCIPLES

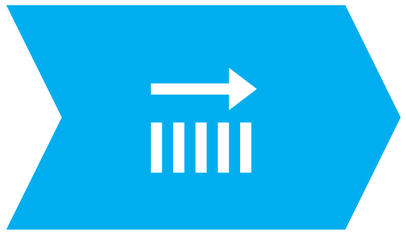
consider your audience's accessibility needs

KISS



Keep it simple, stupid

Be consistent



Colour, buttons, widgets, flows, layout, arrangement

Readability & scanability

Highlight key elements (info, navigation) using layout, contrast, light, space, font and size

Reduce frustration

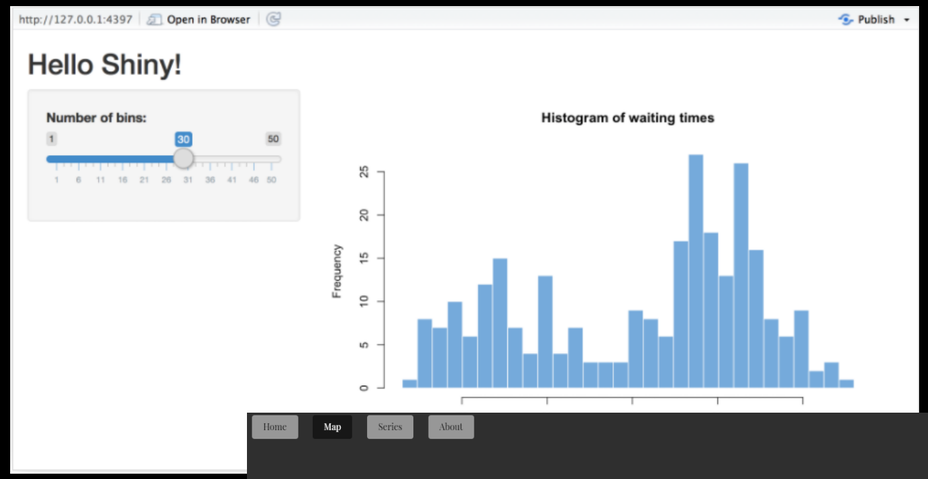
Provide users with feedback, don't let them feel lost (status bar, loaders, messages, updates)

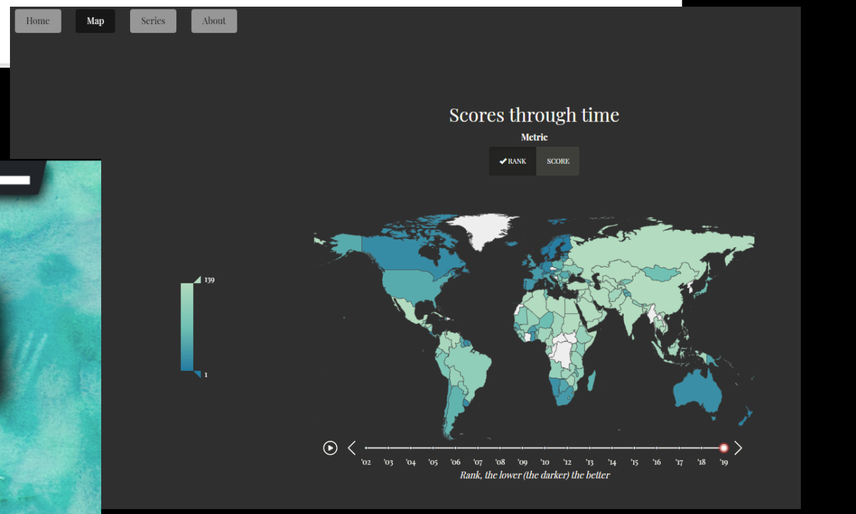
Iterate

Be ready and willing to adjust your UI to suit your users, SEEK OUT feedback, stay up to date on best practices and new packages

Don't make boring Shiny apps!

- Shiny app UI
  - Bootstrap open source, responsive grid system and library of shiny components
  - https://shiny.rstudio.com/articles/layout-guide.html
- Many people don't bother to customise their UI
  - ways to customise your UI:
    - HTML, CSS style sheets, JasvaScript, SASS, preset themes





UI packages I'm loving at the moment:

Layout/Widgets/Themes/UX:

- shinydashboard
- shinydashboardPlus
  - https://github.com/RinteRface/shinydashboardPlus
- shiny.semantic
- shinythemes
  - https://rstudio.github.io/shinythemes/
- bslib
  - https://github.com/rstudio/bslib

Maps:

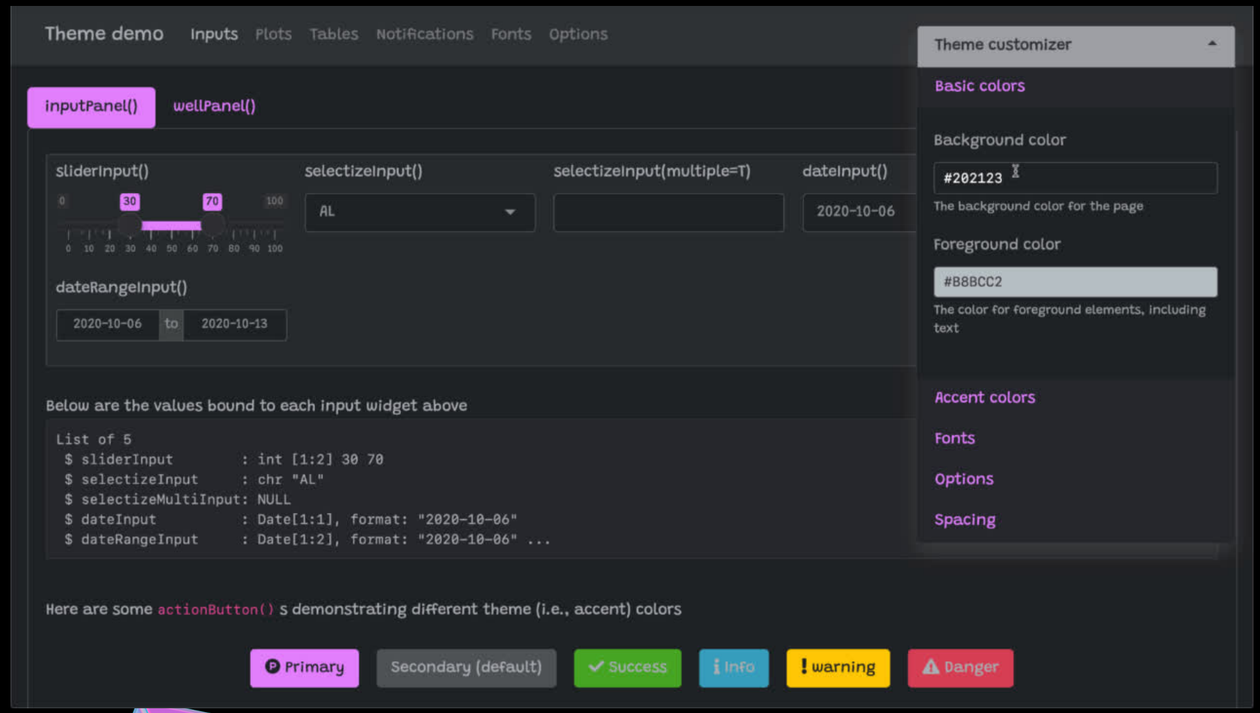
- leaflet

Data Vis:

- plotly, ggplot (ggplotly)
- r2d3 - D3 visualizations (advanced)

Displaying tables, upload / download data:

- data.table
- DT



TIP #3 - MAKE YOUR DOCUMENTS SHINE

INTEGRATE YOUR SHINY SKILLS IN YOUR .RMD DOCUMENTS & PRESENTATIONS

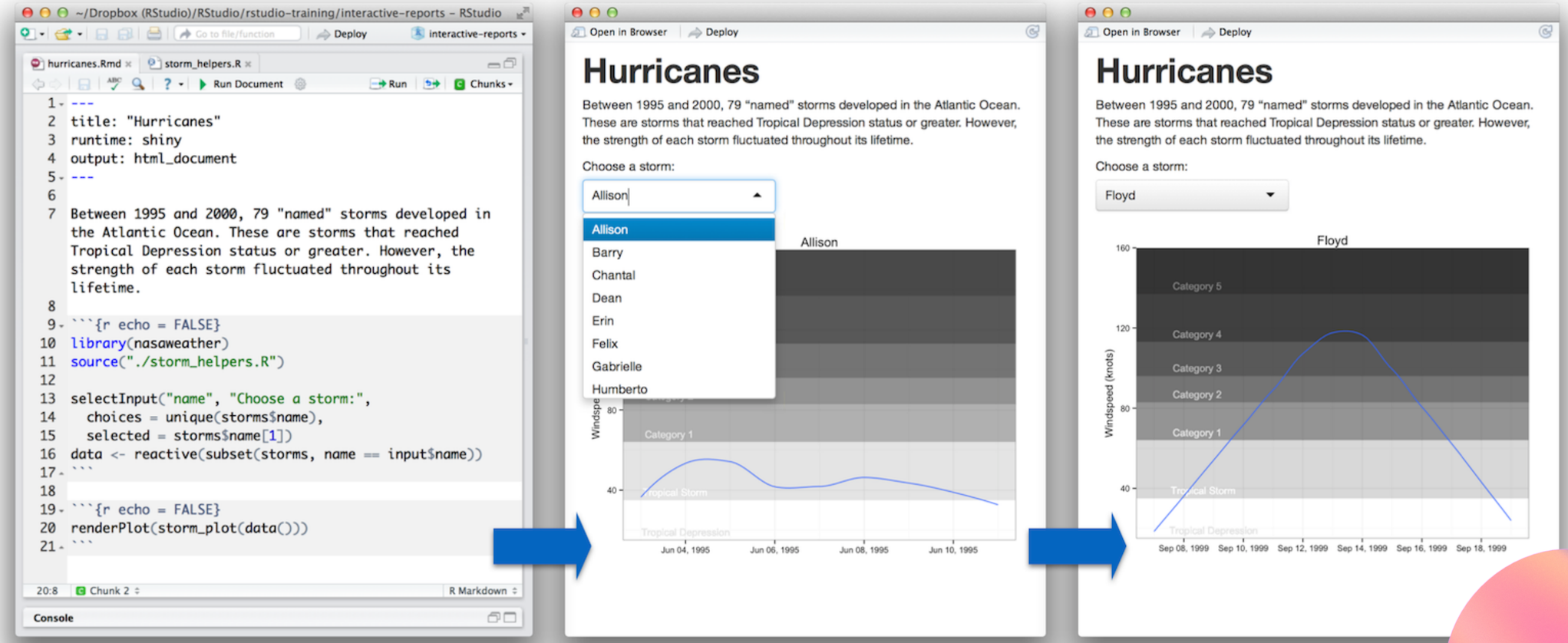
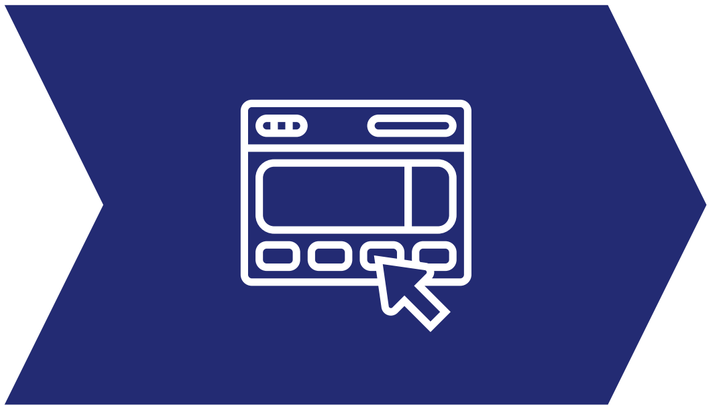


Image: https://blog.rstudio.com/2014/06/19/interactive-documents-an-incredibly-easy-way-to-use-shiny/

SCALING SHINY APPS

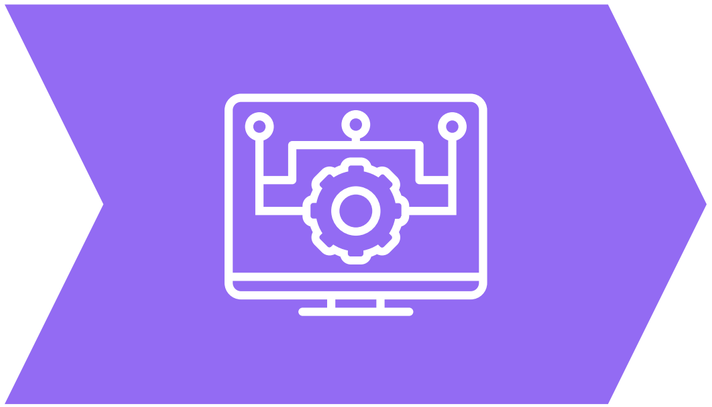
scale vertically first (more users 1 machine), then horizontally (across multiple machines)

Leverage the front end (UI)



Modularise code, render outputs in ui not server, JavaScript (package by Dean Atali ShinyJS)

Extract computations



Remote API - load only whats needed (package called Plumbr - generate rest API)

Use a database & organise architecture

SHINY DOCUMENTS & PRESENTATIONS

See the .Rmd documents in the Shiny/Code_Slides/ folder for code examples

THANK you

get in touch:

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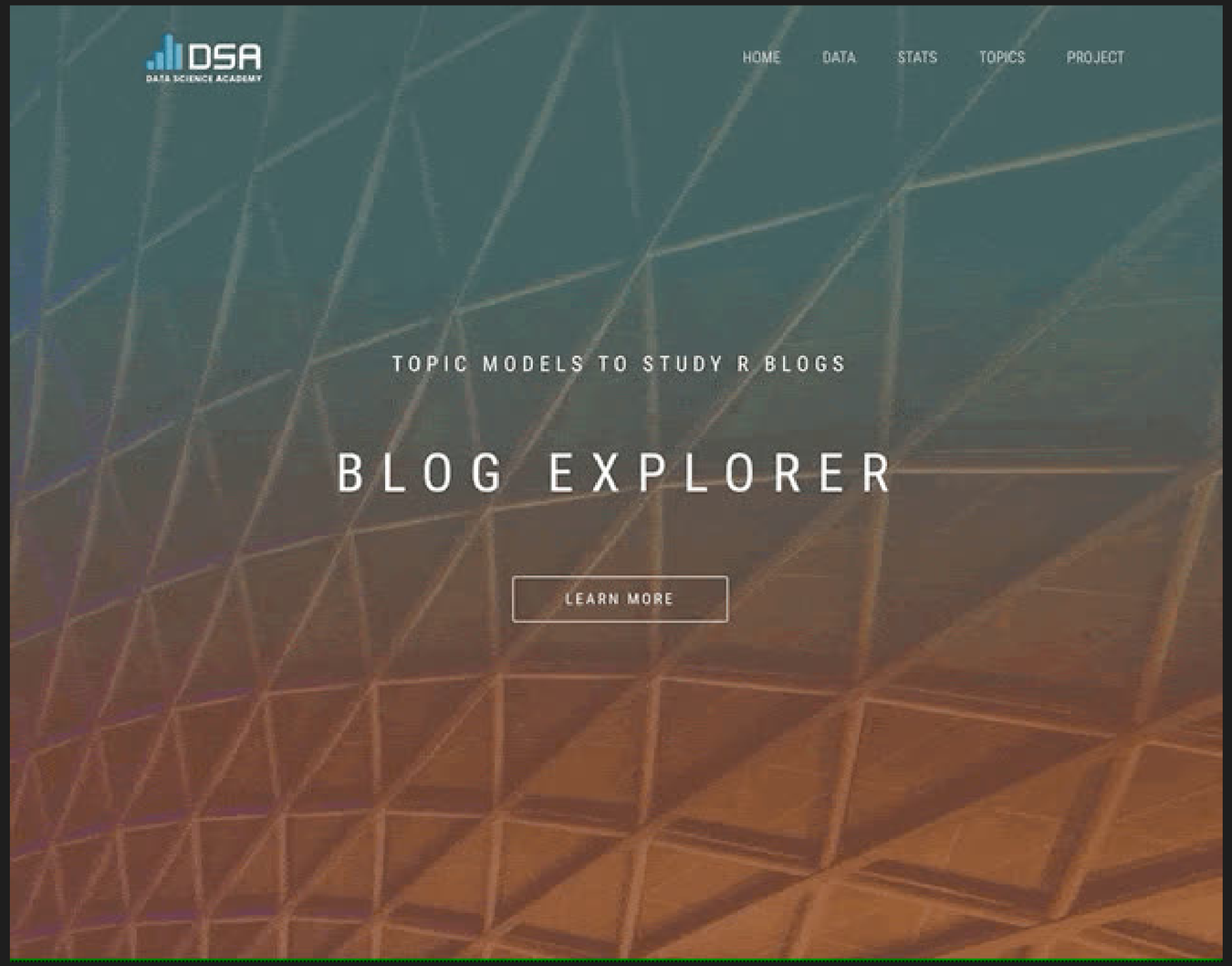

https://nz-stefan.shinyapps.io/blog-explorer/