INTERACTIVE WEB APPS WITH SHINY

Katarzyna M Tyc, PhD

--- Guest Lecturer ---
Virginia Commonwealth University
12/07/2022

REFERENCES

Material covered in these slides is based on the following resources:

Official Shiny tutorials: https://shiny.rstudio.com/tutorial/written-tutorial/lesson1/

Material from last year: https://bios524-r-2021.netlify.app/class/10-class/

Example: https://www.r-bloggers.com/2019/12/r-shiny-for-beginners-annotated-starter-code/

Make sure to check out shinApp gallery: https://shiny.rstudio.com/gallery/

OUTLINE

Folder set up

Structure of a Shiny app

Adding content into user interface

Widgets (interactive elements to control the app)

Connecting widgets to reactive output

SETTING UP DIRECTOREIS OF A SHINY APP

Shiny apps are contained in a single script called **app.R**

Once you save it in a directory "**newdir/**"

You can run the app by running **runApp("newdir")**

Example.

```
library(shiny)
setwd("~/Desktop/WORK_other/Shiny app class/tutorial/my_shiny_app/")
runApp("heads_tails/")

runApp("heads_tails/", display.mode = "showcase") # to see the code as well
```

EXAMPLES

```
runExample("01_hello") # a histogram
runExample("02_text") # tables and data frames
runExample("03_reactivity") # a reactive expression
runExample("04_mpg") # global variables
runExample("05_sliders") # slider bars
runExample("06_tabsets") # tabbed panels
runExample("07_widgets") # help text and submit buttons
runExample("08_html") # Shiny app built from HTML
runExample("09_upload") # file upload wizard
runExample("10_download") # file download wizard
runExample("11_timer") # an automated timer
```

THE STRUCTURE OF A SHINY APP

```
library(shiny)

# See above for the definitions of ui and server
ui <- ...

server <- ...

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

Example.

library(shiny)
shinyapp {snippet}

CREATE YOUR SHINY APP

```
library(shiny)

#  Define UI ----
ui <- fluidPage( )

# Define server logic ----
server <- function(input, output) { }

# Run the app ----
shinyApp(ui = ui, server = server)
```

ADD SOME LAYOUT

```
 ui <- fluidPage(
titlePanel("title panel"),
sidebarLayout(
        sidebarPanel("sidebar panel"),
        mainPanel("main panel") )
)
```

ADD SOME MORE LAYOUT

```
ui <- fluidPage(
titlePanel("My Shiny App"),
sidebarLayout(
        sidebarPanel(),
        mainPanel(
                h1("First level title”, align = "center"),
                h2("Second level title"),
                h3("Third level title"),
                h4("Fourth level title"),
                h5("Fifth level title"),
                h6("Sixth level title") ) ) )
```

TEXT FORMATTING

```
ui <- fluidPage(
titlePanel("My Shiny App"),
sidebarLayout( sidebarPanel(),
        mainPanel(
        p("p creates a paragraph of text."),
        strong("strong() makes bold text."),
        em("em() creates italicized (i.e, emphasized) text."),
        br(),
        code("code displays your text similar to computer code"),
        div("div creates segments of text with a similar style. This division of text is all blue
because I passed the argument 'style = color:blue' to div", style = "color:blue")  ) ) )
```

CONTROL WIDGETS

Buttons

Checkbox

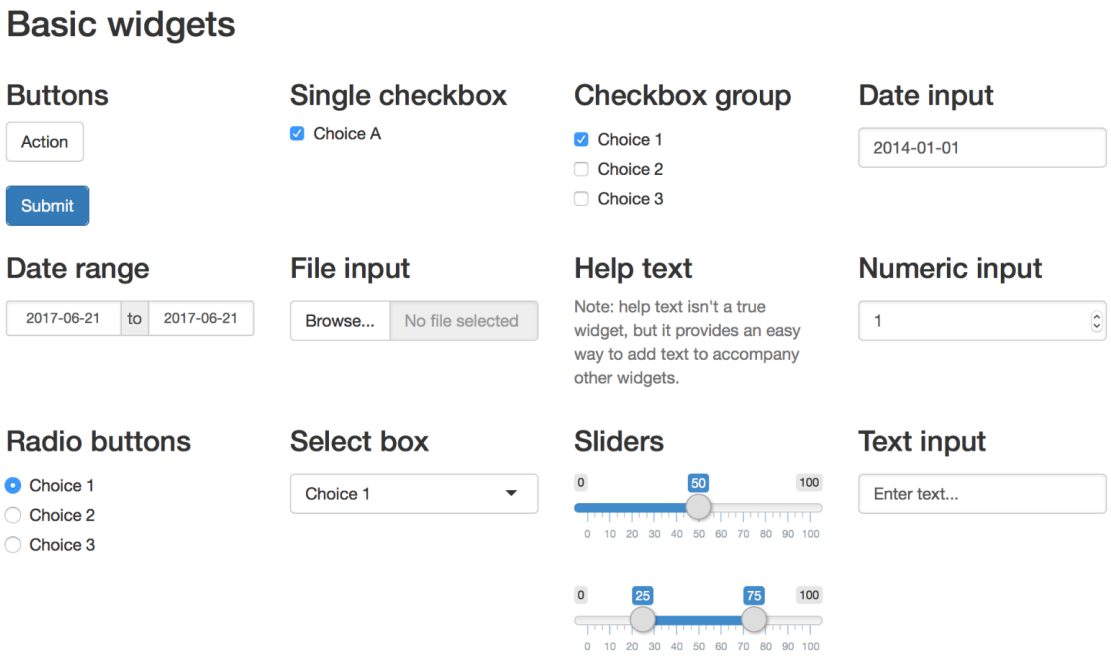
File input

Select box

Sliders

Text or numeric input

…



https://shiny.rstudio.com/tutorial/written-tutorial/lesson3/

ADD SOME WIDGETS

```
sidebarPanel(
        helpText("some help text"),
        selectInput(inputId = "sample",
                label = "Select sample:", choices = c("a","b","c")),
        sliderInput(inputId = "cutoff",
                label = "Select a threshold:", min = 0, max = 255, value = 10)
          )
```

DISPLAY REACTIVE OUTPUT

Output function	Creates
`dataTableOutput`	DataTable
`htmlOutput`	raw HTML
`imageOutput`	image
`plotOutput`	plot
`tableOutput`	table
`textOutput`	text
`uiOutput`	raw HTML
`verbatimTextOutput`	text

Step 1: Add an R object to the UI

```
mainPanel( textOutput("selected_cutoff") )
```

Step 2: Provide R code to build the object (happens inside `server`).

```
server <- function(input, output) {
        output$selected_cutoff <- renderText({ paste("You have selected", input$cutoff) })
        }
```

HEADS AND TAILS

```
#  Define UI ----
ui <- fluidPage(
sidebarLayout(
          sidebarPanel(sliderInput(inputId = "n", label = "No of flips:", min = 10, max = 1000, value = 10),
          sliderInput(inputId = "prob", label = "Success rate:", min = 0, max = 1, value = 0.5)
  )
mainPanel( plotOutput(outputId = "bars") )
)
```

HEADS AND TAILS: OUTPUT

Testing first:

```
rbinom(n=25, size = 1, prob =0.5)
barplot(table(rbinom(n=25, size = 1, prob =0.5)))
```

Wrap it in the output:

```
output$bars <- renderPlot({   barplot(table(rbinom(n=25, size = 1, prob =0.5)))    })
```

Connect to dynamic input:

```
output$bars <- renderPlot({  barplot(table(rbinom(n = input$n,size = 1,prob = input$prob)))
})
```

Example from: https://www.r-bloggers.com/2019/12/r-shiny-for-beginners-annotated-starter-code/

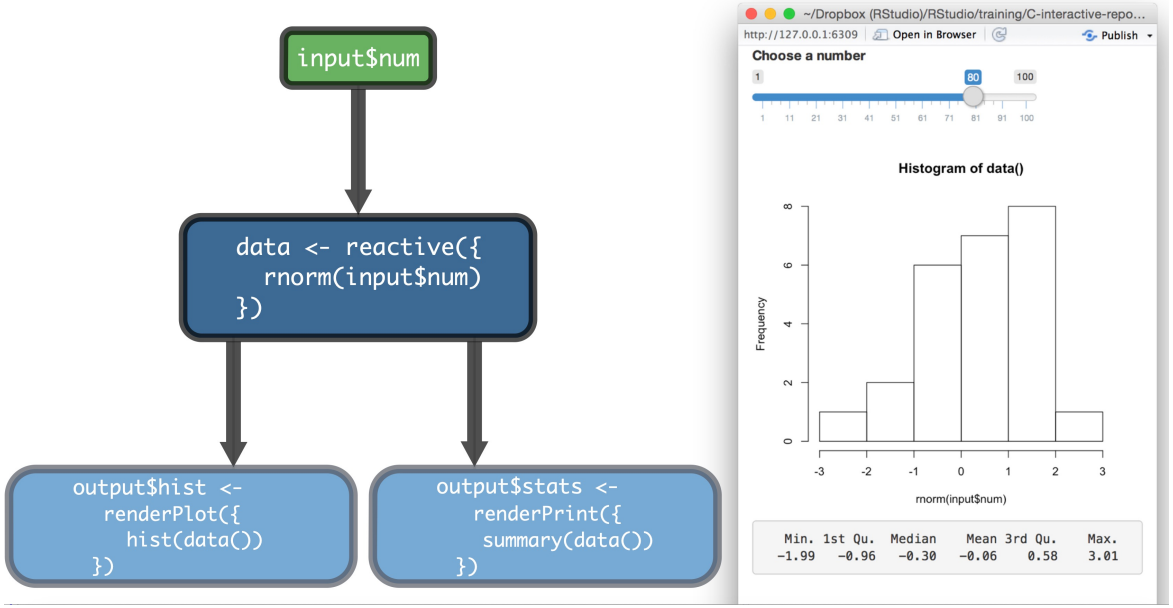
HEADS AND TAILS: ESTHETICS

```
flips <- tibble(flips = rbinom(input$n, 1, input$prob)) %>%
    mutate(flips = if_else(flips == 1, "Heads", "Tails"))
flips %>%
    count(flips) %>%
    ggplot(aes(flips, n, fill = flips)) +
    geom_col() +
    geom_label(aes(flips, n, label = n), size = 5) +
    theme(legend.position = "none",
        axis.text = element_text(size = 15)) +
    labs(x = "", y = "") +
    ggtitle(str_c("Results of ", input$n,
            " flips with Heads probability ",
            sprintf("%.2f", input$prob)))
```

REACTIVE EXPRESSION

```
data <- reactive(table(rbinom(input$n, 1, input$prob)))
```

```
output$bars <- renderPlot({
    barplot(data())
})
```



ADD REACTIVE EXPRESSION

```
# modify mainPanel in the ui:
mainPanel(plotOutput(outputId = "bars"),
          plotOutput(outputId = "hist"))

# and update the server:
server <- function(input, output) {
   data <- reactive(table(rbinom(input$n, input$size, input$prob)))
   output$bars <- renderPlot({  barplot(data()) })
   output$hist <- renderPlot({ hist(data())  })
 }
```

EXAMPLE: MORE TESTING OF REACTIVE EXPRESSION

```
library(shiny)

ui <- fluidPage(

  sidebarLayout(

    sidebarPanel(sliderInput(inputId = "n", label = "No. of coin flips", min = 10, max = 1000, value = 10),

      sliderInput(inputId = "prob", label = "Success of rate", min = 0, max = 1, value = 0.5) ),

   mainPanel( plotOutput(outputId = "xxxxx"),

              plotOutput(outputId = "aaa"),

              plotOutput(outputId = "ccccc") ) )

)

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

  call_it_something <- reactive(table(rbinom(n=input$n, size = 1, prob = input$prob))) # values are drawn just once and saved in this reactive expression

  output$xxxxx <- renderPlot({   barplot(call_it_something() )  })

   output$aaa <- renderPlot({    barplot(call_it_something() )   })

   output$ccccc <- renderPlot({barplot(table(rbinom(n=input$n, size = 1, prob = input$prob)))   }) # since we do not use reactive expression, values will be drawn on the fly and the result will
be different from the two above

}

shinyApp(ui, server)
```

SHARE YOUR APP

Via GitHub: https://github.com/rstudio/shiny_example/ # repository must be public

e.g.: using runGitHub or runUrl

```
shiny::runGitHub("shiny_example", "rstudio")
shiny::runUrl('https://github.com/rstudio/shiny_example/archive/main.tar.gz')
```

Or using shinyapps.io

MORE EXAMPLES

```
runApp("example2/", display.mode = "showcase")

runApp("example3/", display.mode = "showcase") # uncomplete

runApp("iris_app/", display.mode = "showcase")
```

https://shiny.rstudio.com/articles/action-buttons.html

ACTION BUTTONS

```
library(shiny)

ui <- fluidPage(
actionButton(inputId = "clicks", label = "Click me") )

server <- function(input, output) {
observeEvent(input$clicks, { print(as.numeric(input$clicks)) })
}

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

USE ACTION BUTTONS TO DELAY REACTIONS

```
library(shiny)
ui <- fluidPage(
sliderInput(inputId = "num", label = "Choose a number", value = 25, min = 1, max =
100),
plotOutput("hist") )


server <- function(input, output) {


output$hist <- renderPlot({ hist(rnorm(input$num))
}) }


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

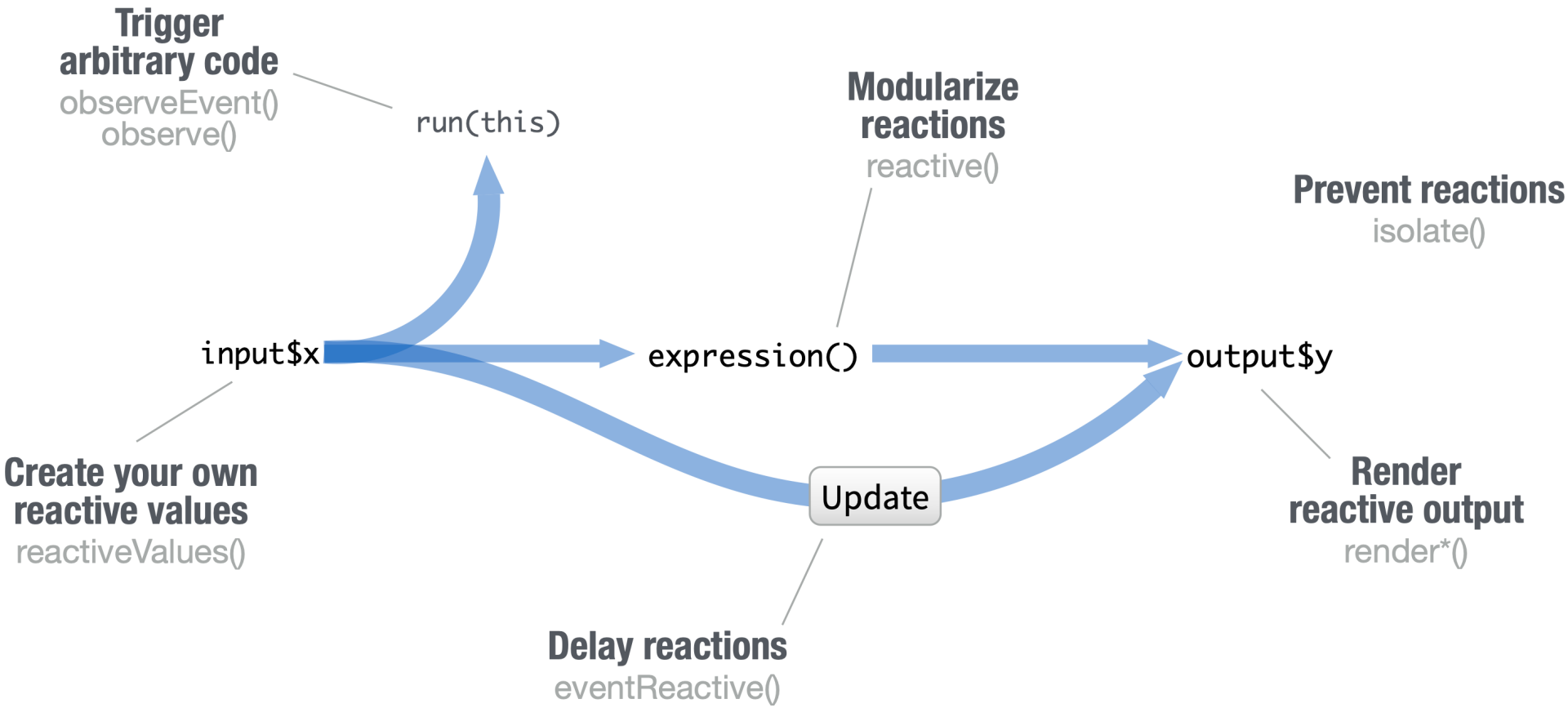
ADD BUTTON

```
library(shiny)
ui <- fluidPage(
sliderInput(inputId = "num", label = "Choose a number", value = 25, min = 1, max =
100),
actionButton(inputId = "go", label = "Update"), plotOutput("hist") )

server <- function(input, output) {
data <- eventReactive(input$go, { })
output$hist <- renderPlot({ hist(rnorm(input$num))
}) }

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

```
server <- function(input, output) {
data <- eventReactive(input$go, { rnorm(input$num) })
output$hist <- renderPlot({ hist(data())
})
}
```

REACTIVEVALUES()

```
library(shiny)

ui <- fluidPage(

       actionButton(inputId = "norm", label = "Normal"),
       actionButton(inputId = "unif", label = "Uniform"),
       plotOutput("hist") )

server <- function(input, output) {

       rv <- reactiveValues(data = rnorm(100))
       observeEvent(input$norm, { rv$data <- rnorm(100) })
       observeEvent(input$unif, { rv$data <- runif(100) })

       output$hist <- renderPlot({ hist(rv$data) }) }

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


Trigger
arbitrary code
observeEvent()
observe()
run(this)
Modularize
reactions
reactive()
Prevent reactions
isolate()
input$x
expression()
output$y
Create your own
reactive values
reactiveValues()
Update
Render
reactive output
render*()
Delay reactions
eventReactive()