# Shiny: Part 2

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# Reactivity

A reactive expression is like a recipie that manipulates inputs from Shiny and then returns a value. Reactivity provides a way for your app to respond since inputs will change depending on how users interact with your user interface. Expressions wrapped by `reactive()` should be expressions that are subject to change.

# Reactivity

Creating a reactive expression is just like creating a function:

```
calc_sum <- reactive({
  input$box1 + input$box2
})

# ...

calc_sum()
```

# Your First Reactive App

This application predicts the horsepower of a car given the fuel efficiency in miles per gallon for the car.

# Horsepower Prediction: ui.R Part 1

```
library(shiny)
shinyUI(fluidPage(
  titlePanel("Predict Horsepower from MPG"),
  sidebarLayout(
    sidebarPanel(
      sliderInput("sliderMPG", "What is the MPG of the car?
      checkboxInput("showModel1", "Show/Hide Model 1", valu
      checkboxInput("showModel2", "Show/Hide Model 2", valu
    ),
# ...
```

# Horsepower Prediction: ui.R Part 2

```
# ...
    mainPanel(
      plotOutput("plot1"),
      h3("Predicted Horsepower from Model 1:"),
      textOutput("pred1"),
      h3("Predicted Horsepower from Model 2:"),
      textOutput("pred2")
    )
  )
))
```

# Horsepower Prediction: server.R Part 1

```
library(shiny)
shinyServer(function(input, output) {
  mtcars$mpgsp <- ifelse(mtcars$mpg - 20 > 0, mtcars$mpg -
  model1 <- lm(hp ~ mpg, data = mtcars)
  model2 <- lm(hp ~ mpgsp + mpg, data = mtcars)

  model1pred <- reactive({
    mpgInput <- input$sliderMPG
    predict(model1, newdata = data.frame(mpg = mpgInput))
  })

  model2pred <- reactive({
    mpgInput <- input$sliderMPG
    predict(model2, newdata =
              data.frame(mpg = mpgInput,
                         mpgsp = ifelse(mpgInput - 20 > 0,
                                        mpgInput - 20, 0)))
  })
```

# Horsepower Prediction: server.R Part 2

```
output$plot1 <- renderPlot({
  mpgInput <- input$sliderMPG

  plot(mtcars$mpg, mtcars$hp, xlab = "Miles Per Gallon",
       ylab = "Horsepower", bty = "n", pch = 16,
       xlim = c(10, 35), ylim = c(50, 350))
  if(input$showModel1){
    abline(model1, col = "red", lwd = 2)
  }
  if(input$showModel2){
    model2lines <- predict(model2, newdata = data.frame(
      mpg = 10:35, mpgsp = ifelse(10:35 - 20 > 0, 10:35 -
    ))
    lines(10:35, model2lines, col = "blue", lwd = 2)
  }
```

# Horsepower Prediction: server.R Part 3

```
  legend(25, 250, c("Model 1 Prediction", "Model 2 Predicti
           col = c("red", "blue"), bty = "n", cex = 1.2)
    points(mpgInput, model1pred(), col = "red", pch = 16, c
    points(mpgInput, model2pred(), col = "blue", pch = 16,
  })

  output$pred1 <- renderText({
    model1pred()
  })

  output$pred2 <- renderText({
    model2pred()
  })
})
```

# Horsepower Prediction

## Predict Horsepower from MPG

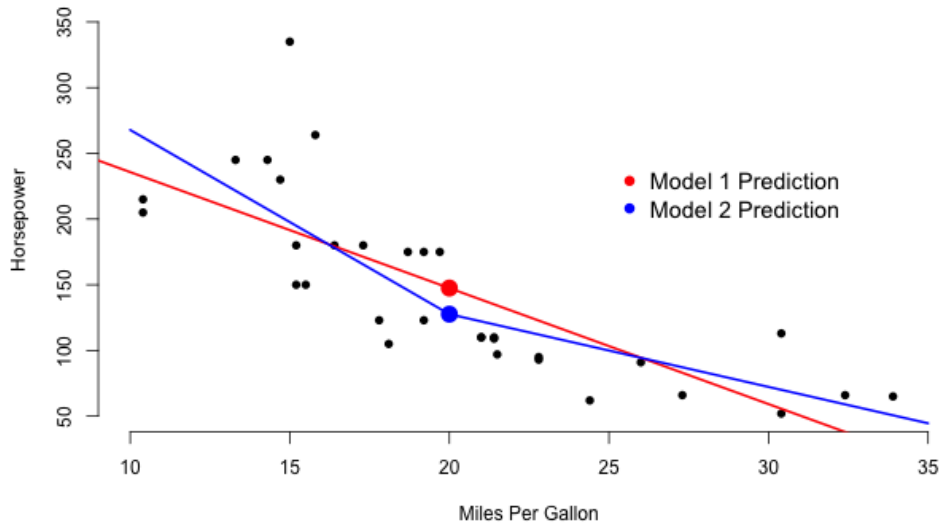
**What is the MPG of the car?**

10 20 35

10 13 16 19 22 25 28 31 34

☑ Show/Hide Model 1

☑ Show/Hide Model 2




### Predicted Horsepower from Model 1:

147.4877

### Predicted Horsepower from Model 2:

127.6234

# Delayed Reactivity

You might not want your app to immediately react to changes in user input because of something like a long-running calculation. In order to prevent reactive expressions from reacting you can use a submit button in your app. Let's take a look at last app we created, but with a submit button added to the app.

# Reactive Horsepower: ui.R

There's one new line added to the code from the last app:

```
shinyUI(fluidPage(
  titlePanel("Predict Horsepower from MPG"),
  sidebarLayout(
    sidebarPanel(
      sliderInput("sliderMPG", "What is the MPG of the car?
      checkboxInput("showModel1", "Show/Hide Model 1", valu
      checkboxInput("showModel2", "Show/Hide Model 2", valu
      submitButton("Submit") # New!
    ),
```

# Reactive Horsepower

## Predict Horsepower from MPG

What is the MPG of the car?

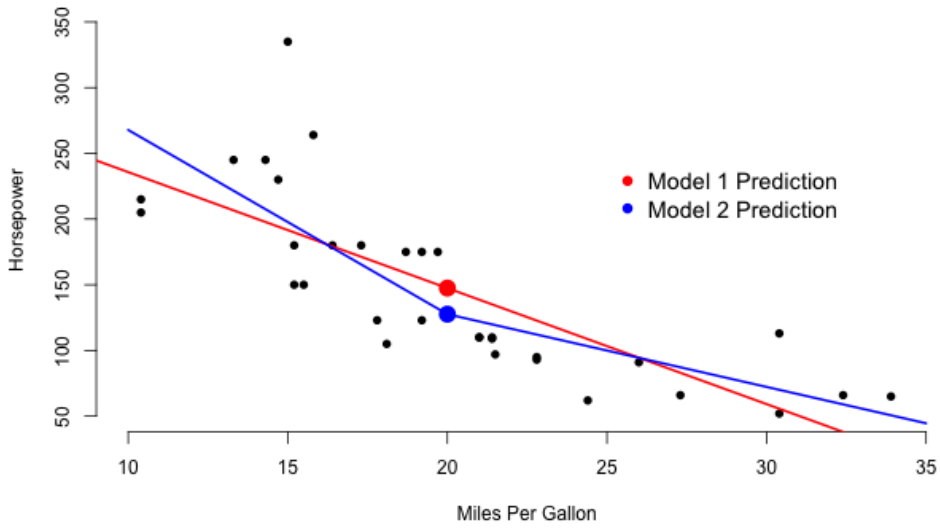
10 20 35

10 13 16 19 22 25 28 31 34

☑ Show/Hide Model 1

☑ Show/Hide Model 2

Submit




### Predicted Horsepower from Model 1:

147.4877

### Predicted Horsepower from Model 2:

127.6234

# Advanced UI

There are several other kinds of UI components that you can mix into your app including tabs, navbars, and sidebars. We'll show you an example of how to use tabs to give you app multiple views. The `tabsetPanel()` function speicifes a group of tabs, and then the `tabPanel()` function specifies the contents of an individual tab.

# Tabs: ui.R

```
library(shiny)
shinyUI(fluidPage(
  titlePanel("Tabs!"),
  sidebarLayout(
    sidebarPanel(
      textInput("box1", "Enter Tab 1 Text:", value = "Tab 1
      textInput("box2", "Enter Tab 2 Text:", value = "Tab 2
      textInput("box3", "Enter Tab 3 Text:", value = "Tab 3
    ),
    mainPanel(
      tabsetPanel(type = "tabs",
                  tabPanel("Tab 1", br(), textOutput("out1"
                  tabPanel("Tab 2", br(), textOutput("out2"
                  tabPanel("Tab 2", br(), textOutput("out3"
      )
    )
  )
))
```

# Tabs: server.R

```
library(shiny)
shinyServer(function(input, output) {
  output$out1 <- renderText(input$box1)
  output$out2 <- renderText(input$box2)
  output$out3 <- renderText(input$box3)
})
```

# Tabs

Tabs!
Enter Tab 1 Text:
Tab 1!
Enter Tab 2 Text:
Tab 2!
Enter Tab 3 Text:
Tab 3!
Tab 1
Tab 2
Tab 2
Tab 1!

# Interactive Graphics

One of my favorite features of Shiny is the ability to create graphics that a user can interact with. One method you can use to select mutltiple data points on a graph is by specifying the `brush` argument in `plotOutput()` on the `ui.R` side, and then using the `brushedPoints()` function on the `server.R` side. The following exmaple app fits a linear model for the selected points and then draws a line of best fit for the resulting model.

# Interactive Graphics: ui.R

```
library(shiny)
shinyUI(fluidPage(
  titlePanel("Visualize Many Models"),
  sidebarLayout(
    sidebarPanel(
      h3("Slope"),
      textOutput("slopeOut"),
      h3("Intercept"),
      textOutput("intOut")
    ),
    mainPanel(
      plotOutput("plot1", brush = brushOpts(
        id = "brush1"
      ))
    )
  )
))
```

# Interactive Graphics: server.R Part 1

```
library(shiny)
shinyServer(function(input, output) {
  model <- reactive({
    brushed_data <- brushedPoints(trees, input$brush1,
                                  xvar = "Girth", yvar = "Volume"
    if(nrow(brushed_data) < 2){
      return(NULL)
    }
    lm(Volume ~ Girth, data = brushed_data)
  })
  output$slopeOut <- renderText({
    if(is.null(model())){
      "No Model Found"
    } else {
      model()[[1]][2]
    }
  })
# ...
```

# Interactive Graphics: server.R Part 2

```
# ...
output$intOut <- renderText({
    if(is.null(model())){
      "No Model Found"
    } else {
      model()[[1]][1]
    }
  })
  output$plot1 <- renderPlot({
    plot(trees$Girth, trees$Volume, xlab = "Girth",
         ylab = "Volume", main = "Tree Measurements",
         cex = 1.5, pch = 16, bty = "n")
    if(!is.null(model())){
      abline(model(), col = "blue", lwd = 2)
    }
  })
})
```

# Interactive Graphics

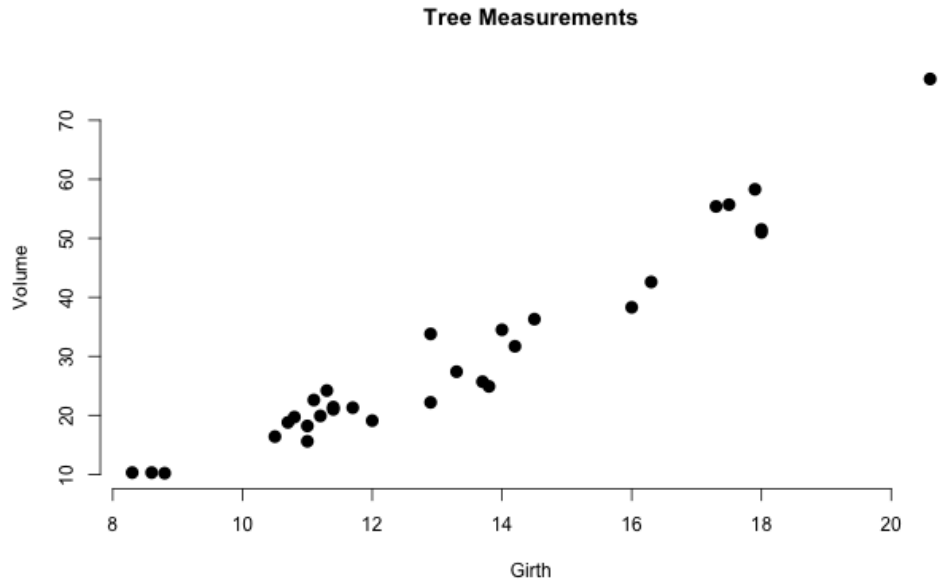
## Visualize Many Models

**Slope**

No Model Found

**Intercept**

No Model Found



# Sharing Shiny Apps

Once you've created a Shiny app, there are several ways to share your app. Using shinyapps.io allows users to interact with your app through a web browser without needing to have R or Shiny insatlled. Shinyapps.io has a free tier, but if you want to use a Shiny app in your business you may be interested in paying for the service. If you're sharing your app with an R user you can post your app to GitHub and instruct the user to use the `runGist()` or `runGitHub()` function to launch your app.

# More Shiny Resources

- The Official Shiny Tutorial
- Gallery of Shiny Apps
- Show Me Shiny: Gallery of R Web Apps
- Integrating Shiny and Plotly
- Shiny on Stack Overflow