# Development and deployment of statistical web applications using R and shiny

Lara Lusa

March 2019

# (My) Motivation

# (My) Motivation

Design studies

# (My) Motivation

Design studies

Analyze data

# (My) Motivation

Design studies

Develop methods

Analyze data

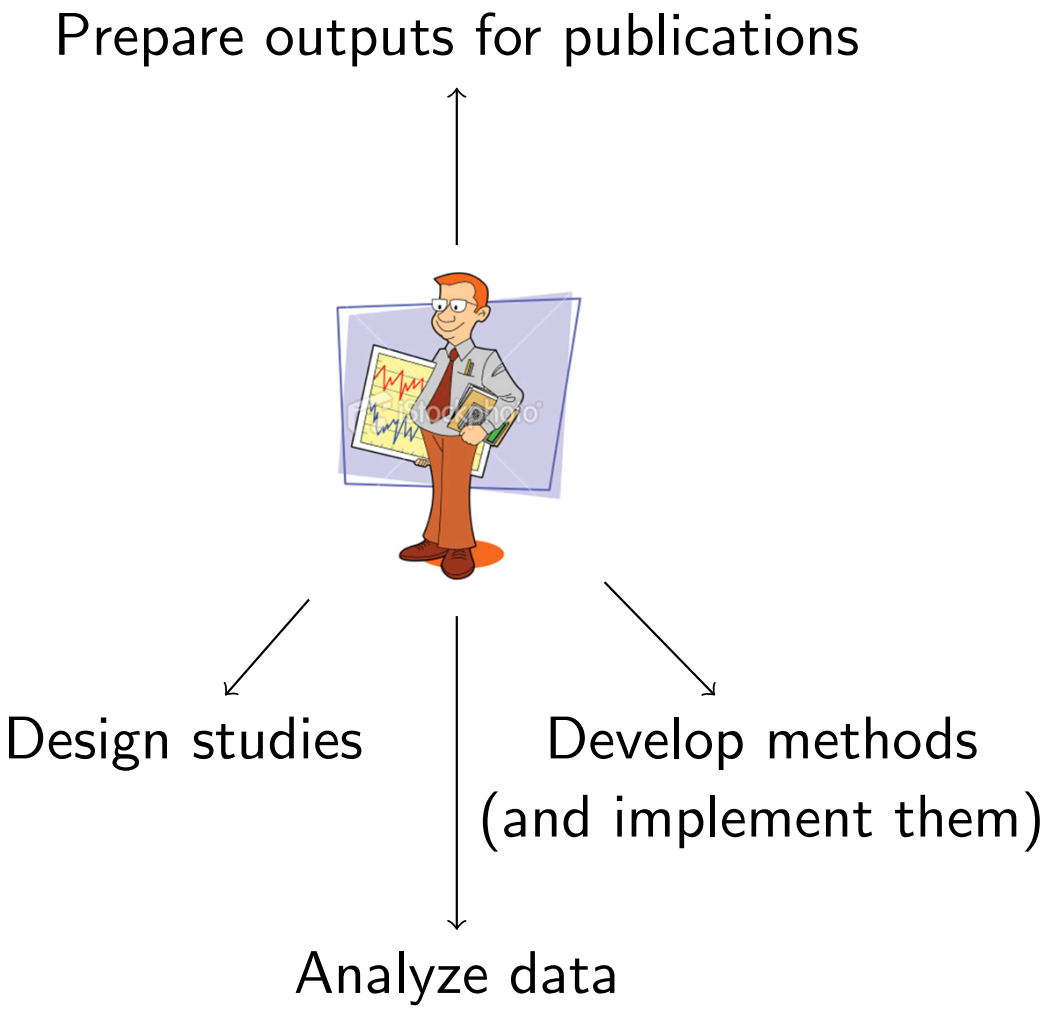
# (My) Motivation

Design studies

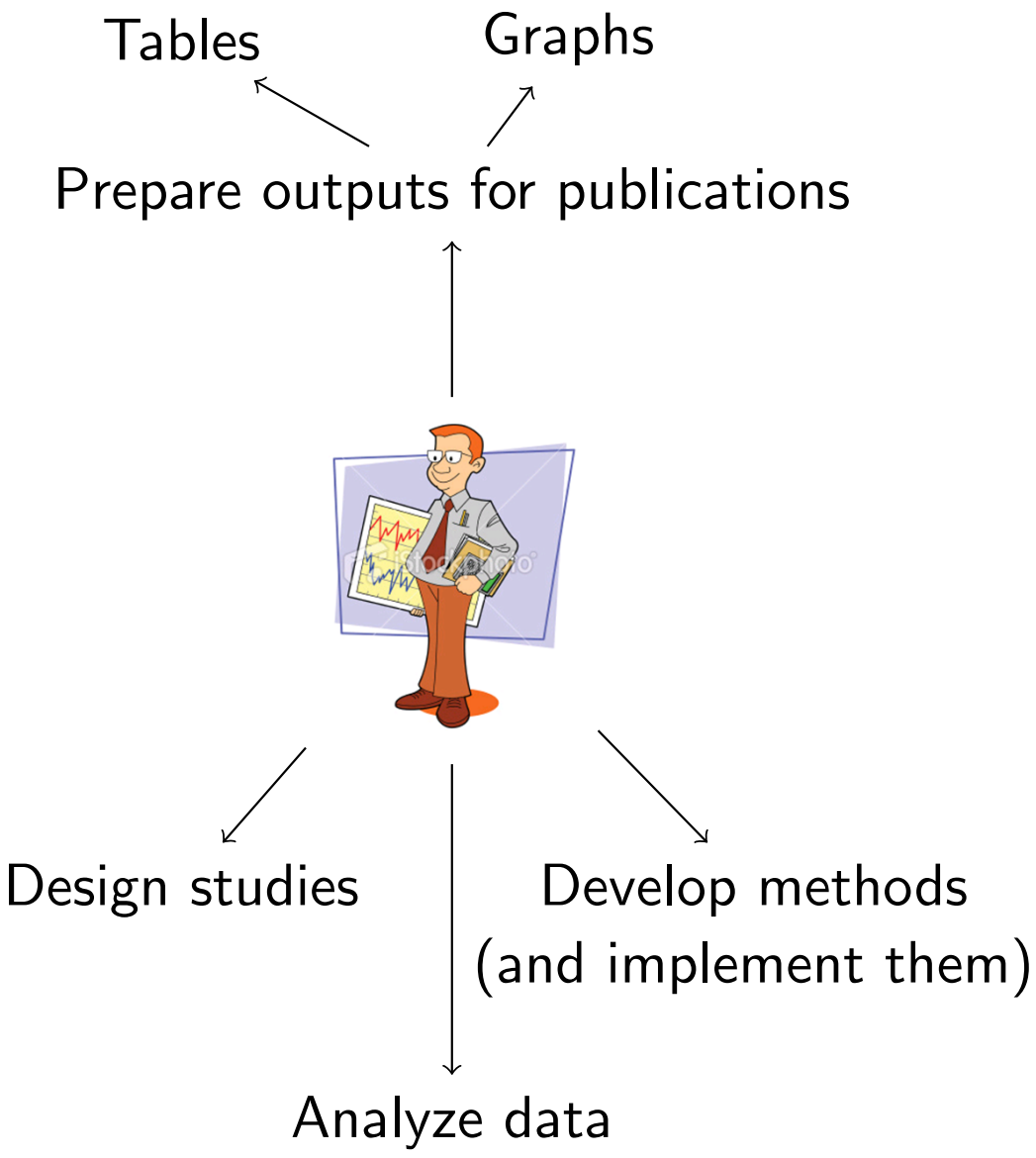
Develop methods
(and implement them)

Analyze data

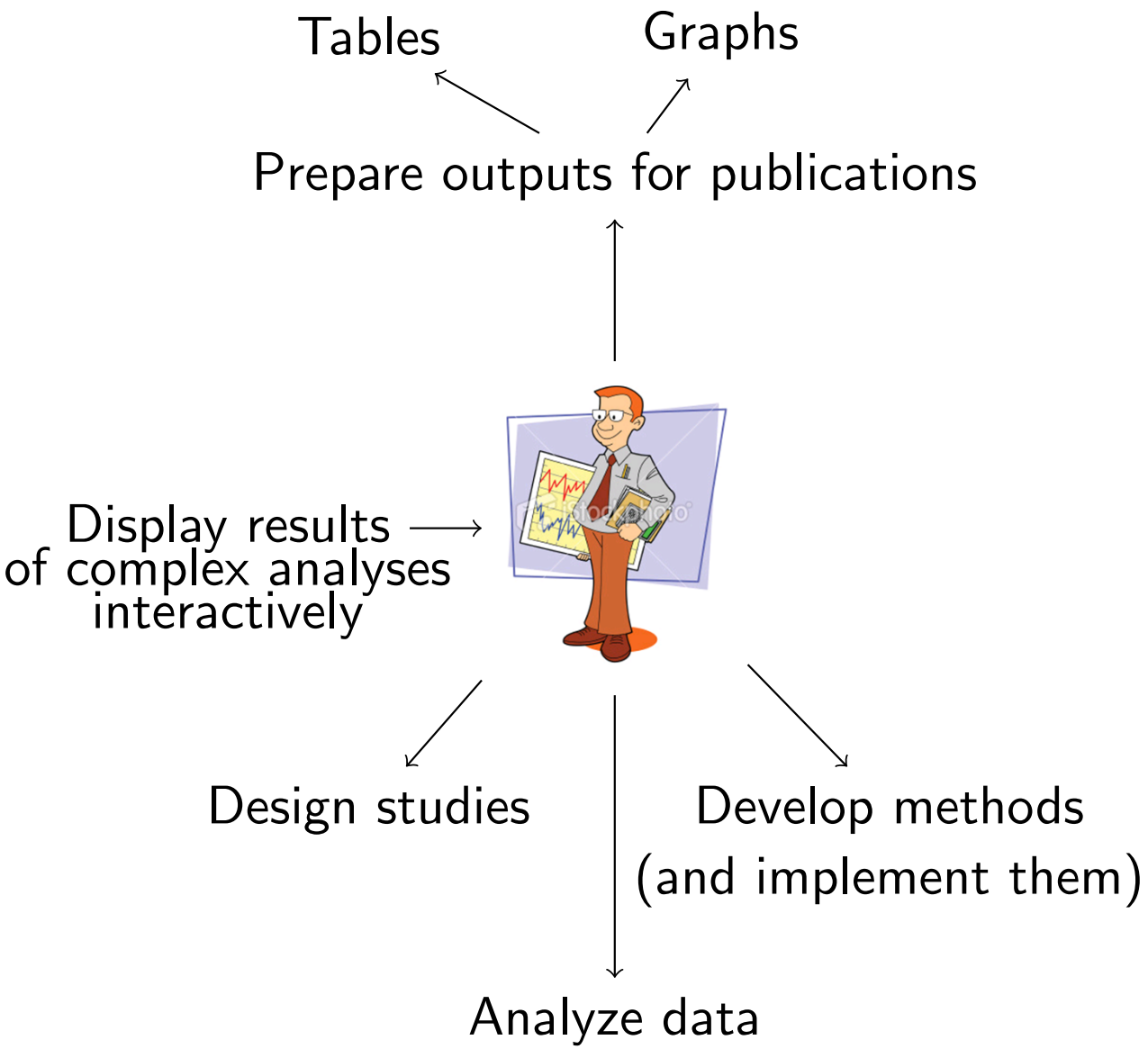
# (My) Motivation



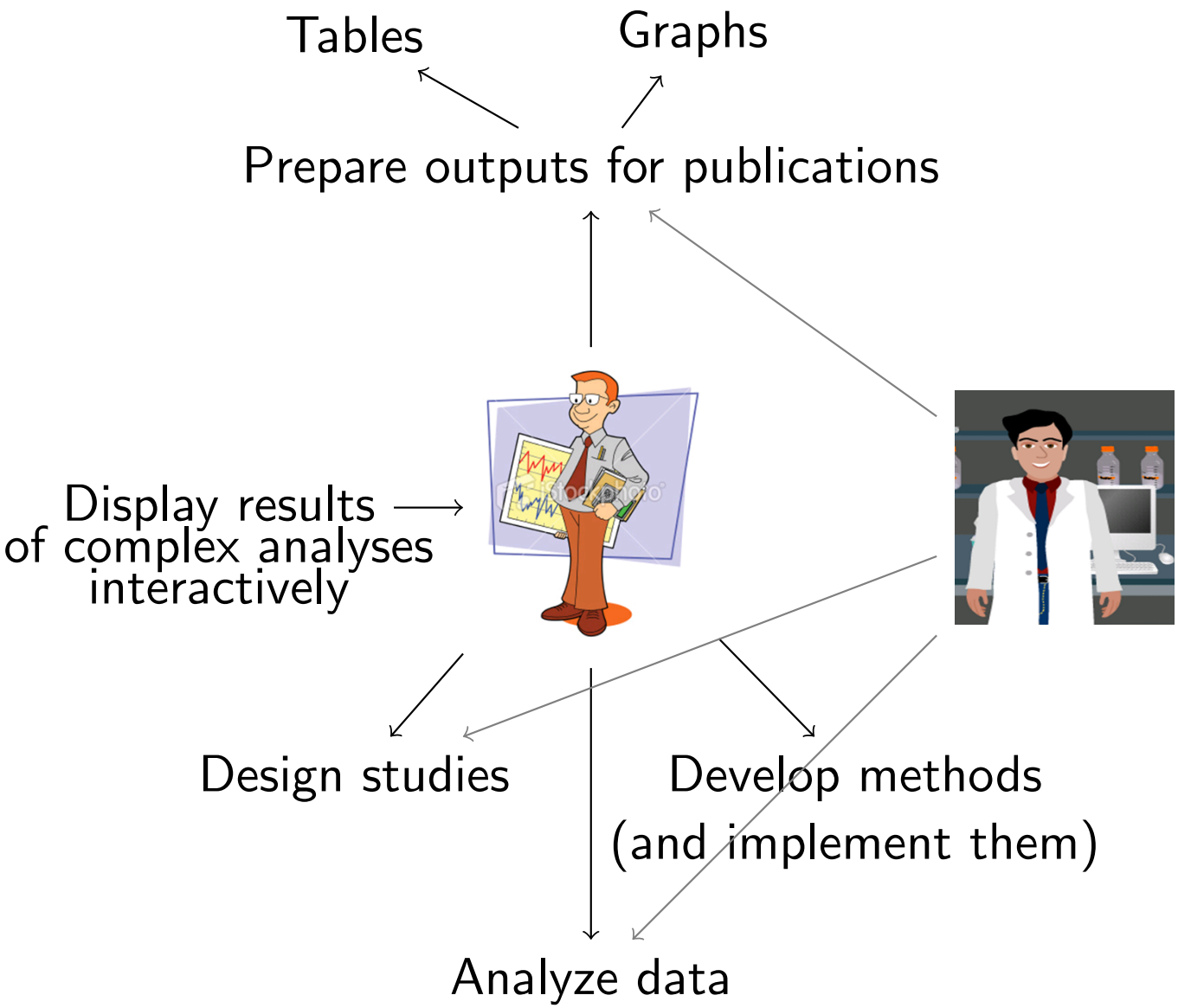
# (My) Motivation



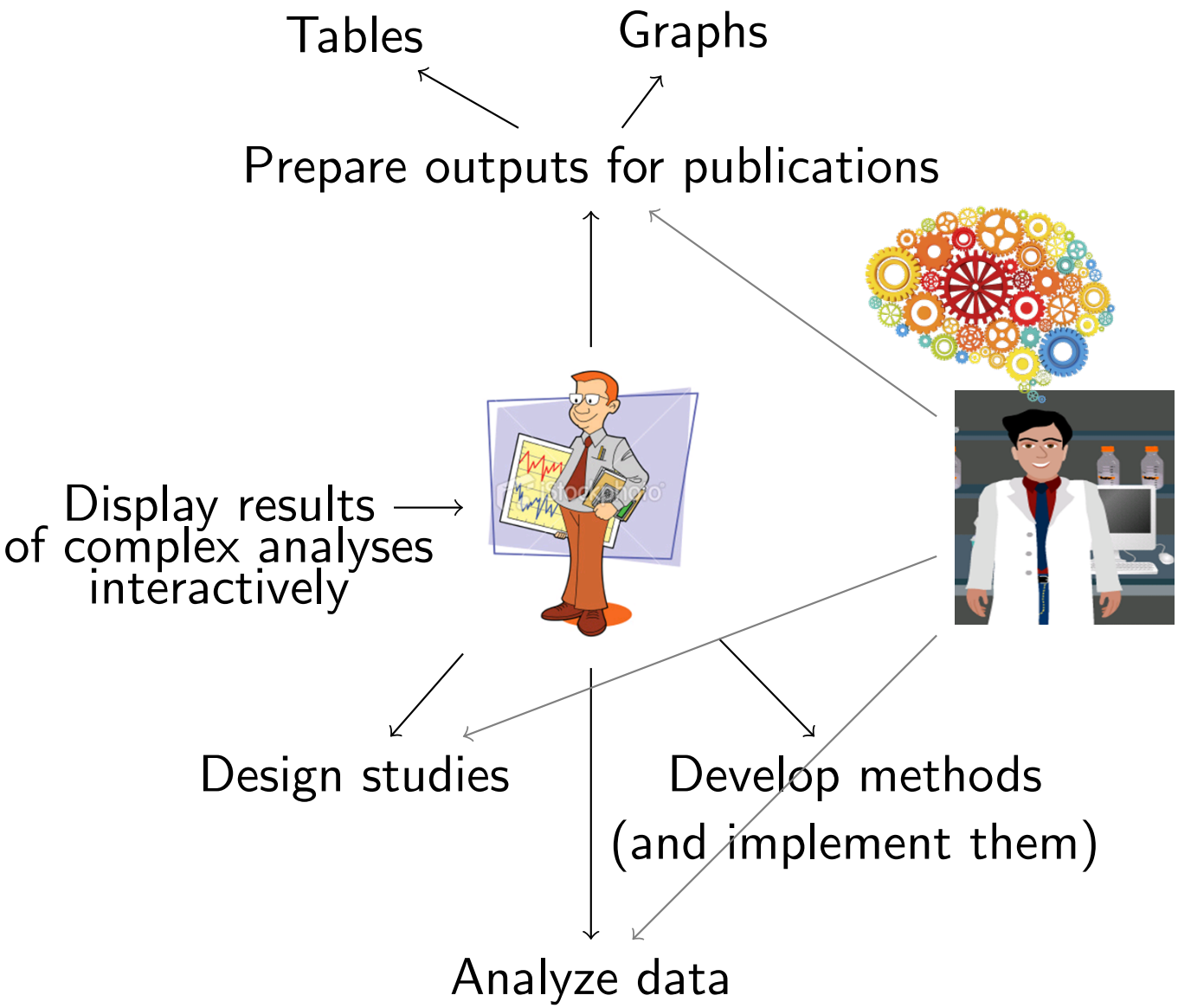
# (My) Motivation



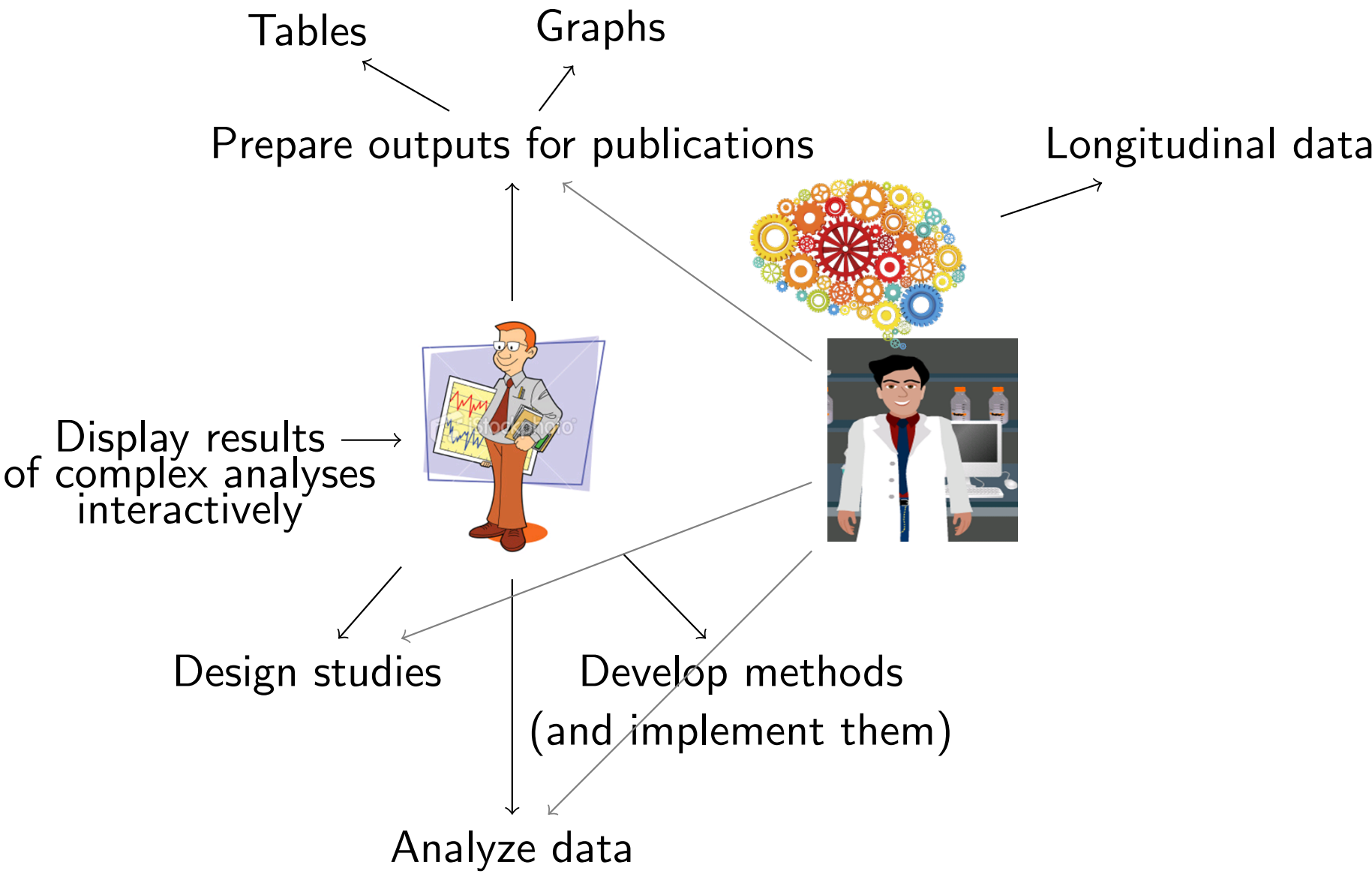
# (My) Motivation



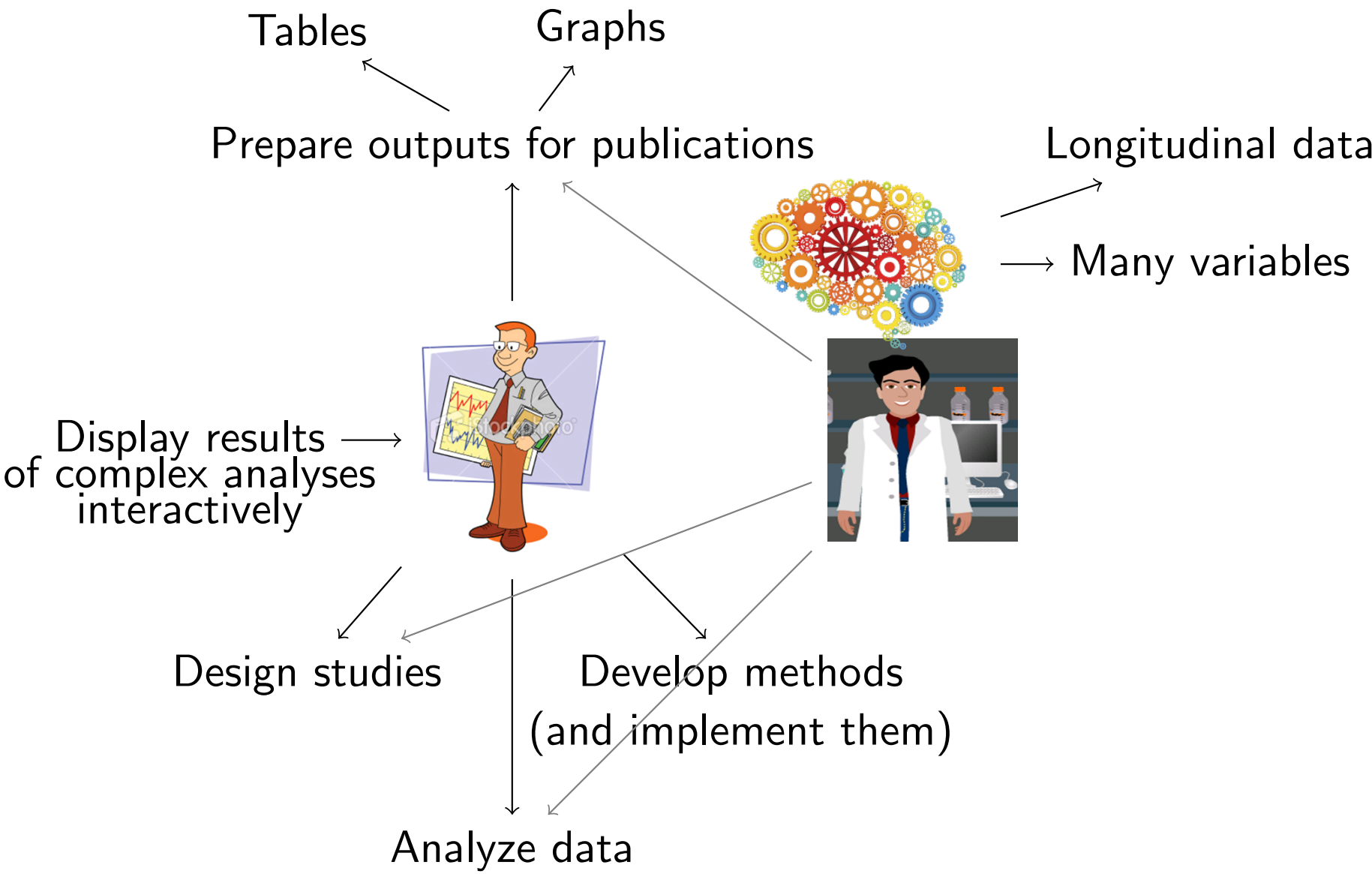
# (My) Motivation



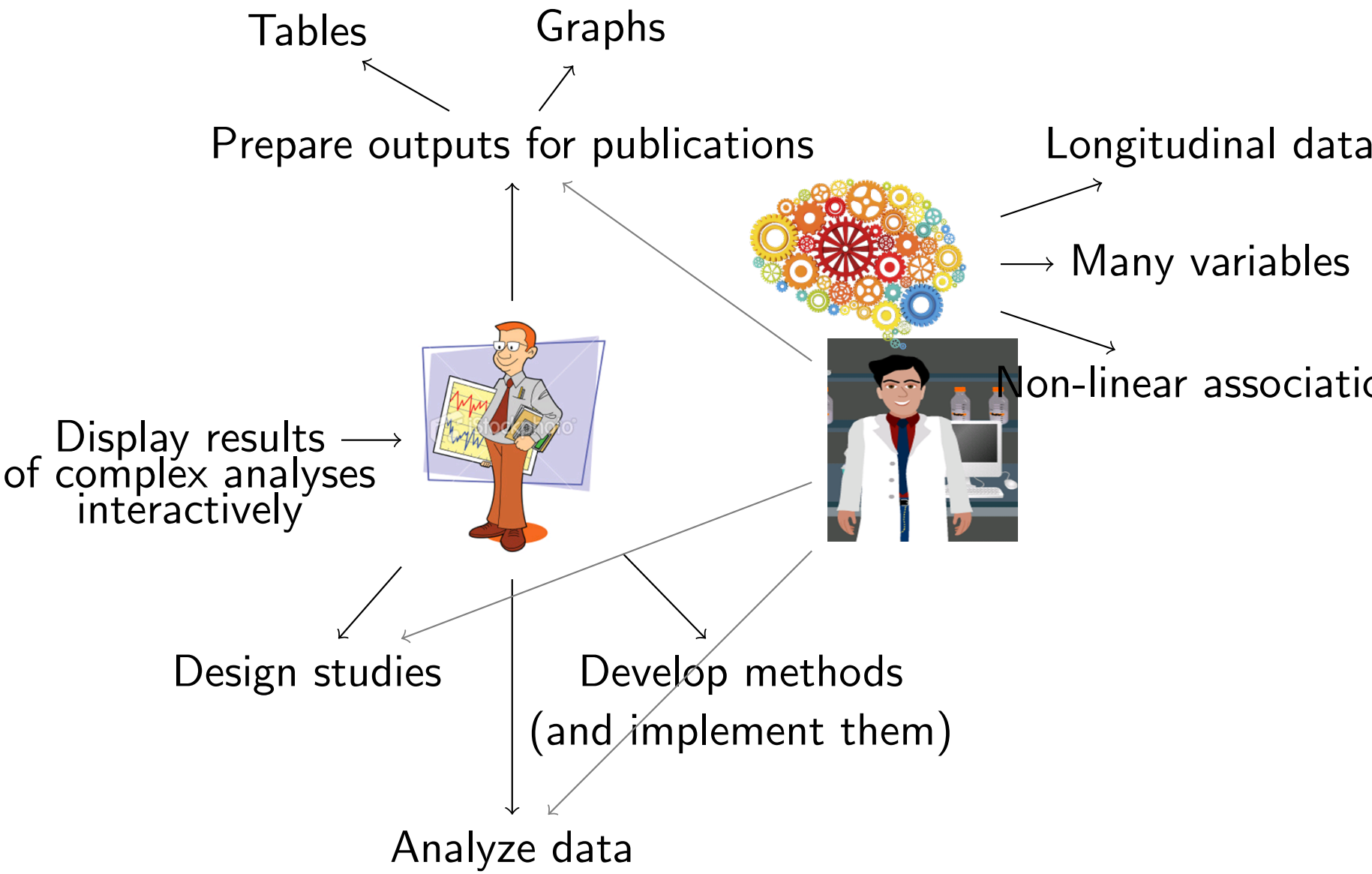
# (My) Motivation



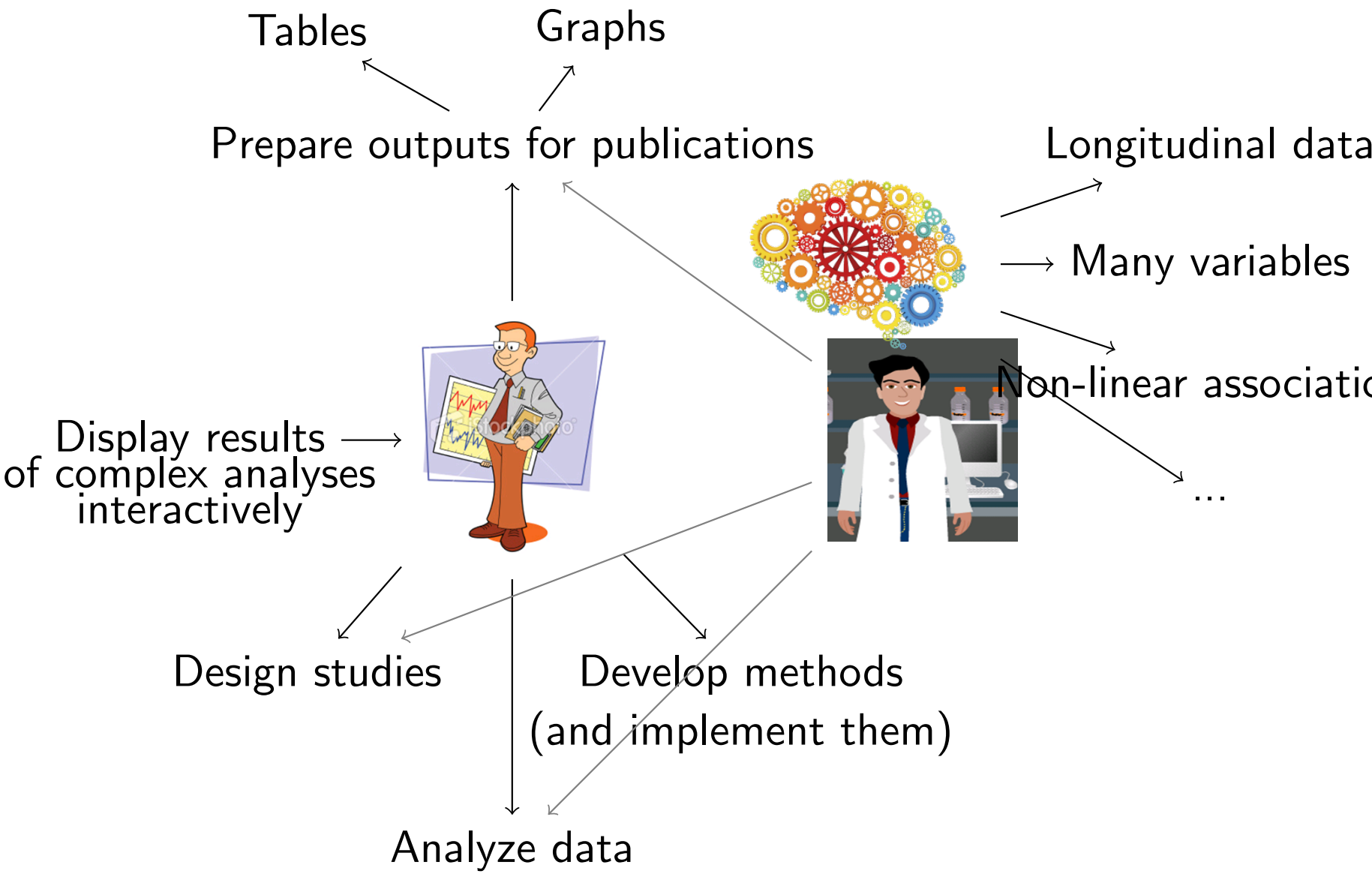
# (My) Motivation



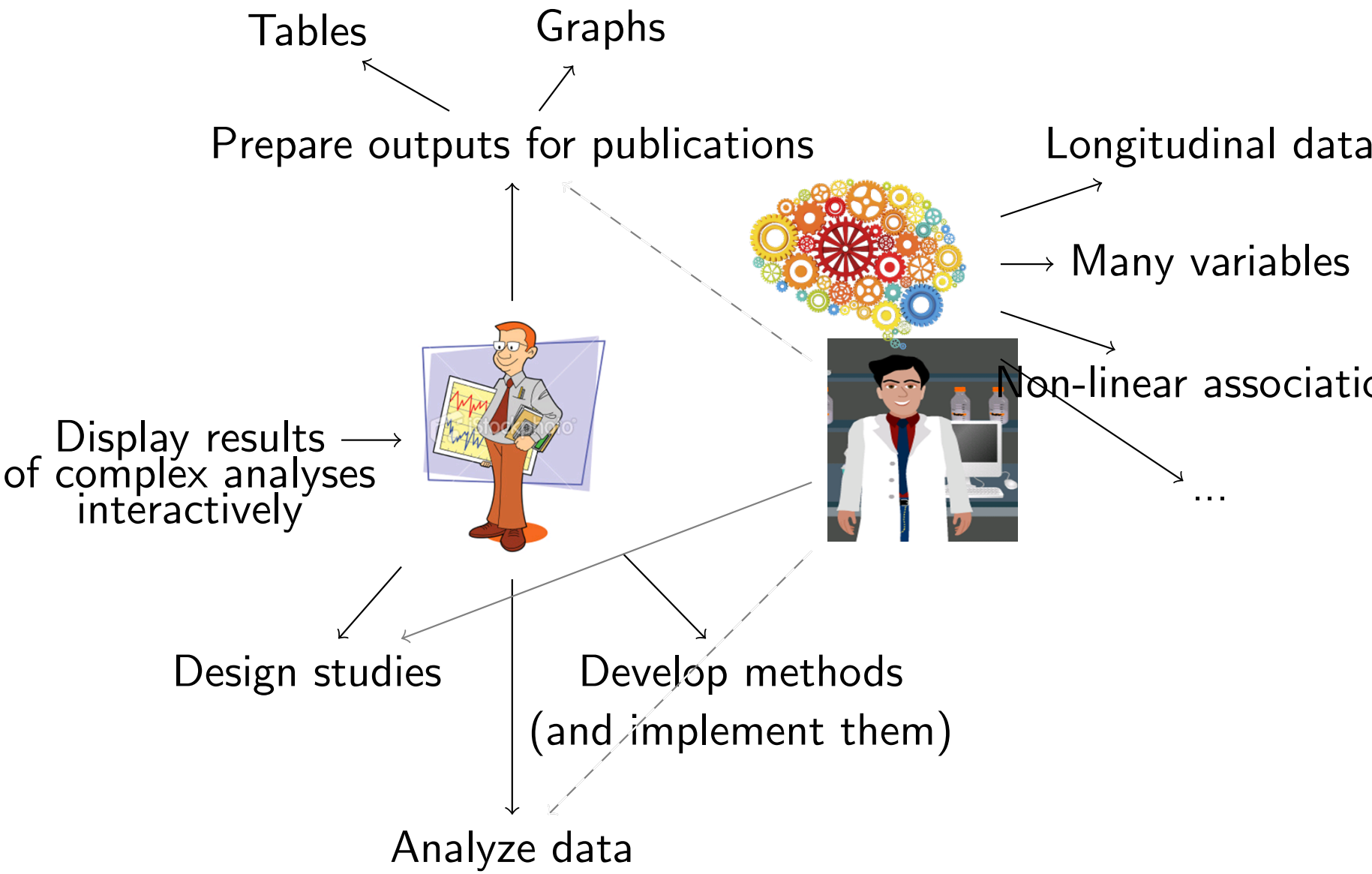
# (My) Motivation



# (My) Motivation

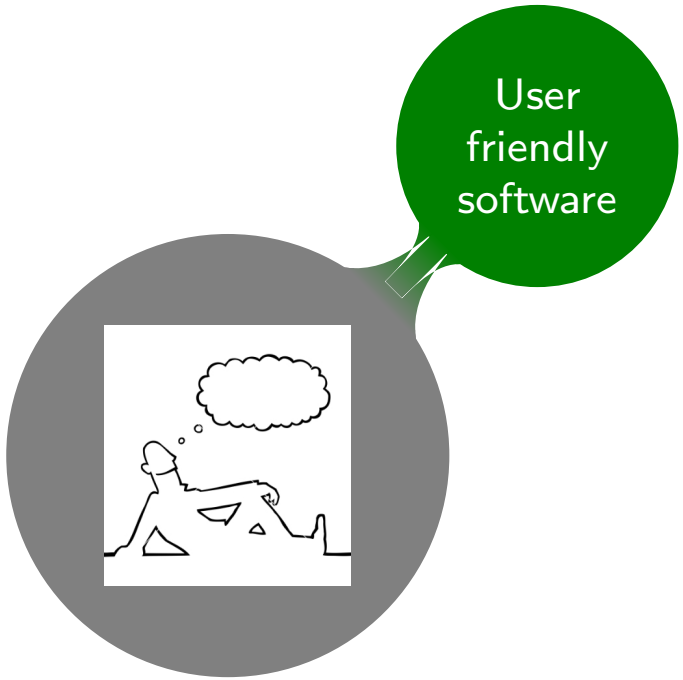


# (My) Motivation

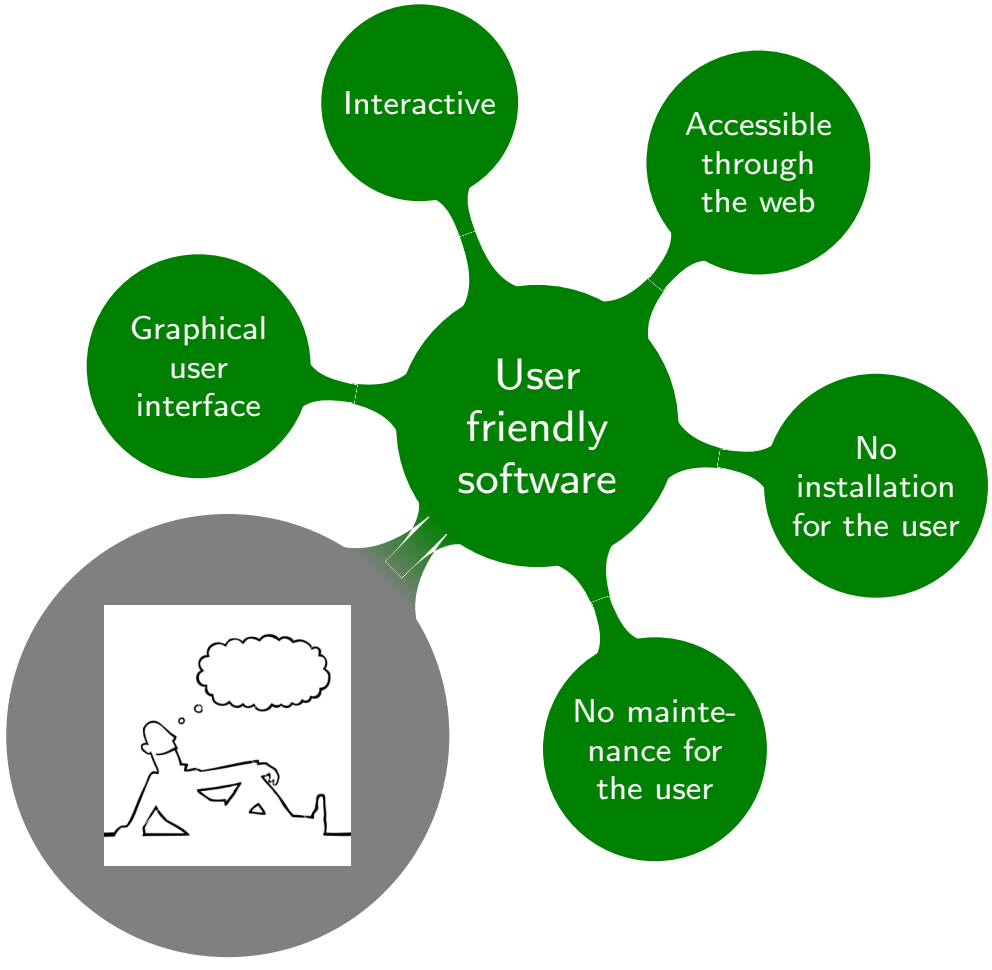


# (My) Motivation

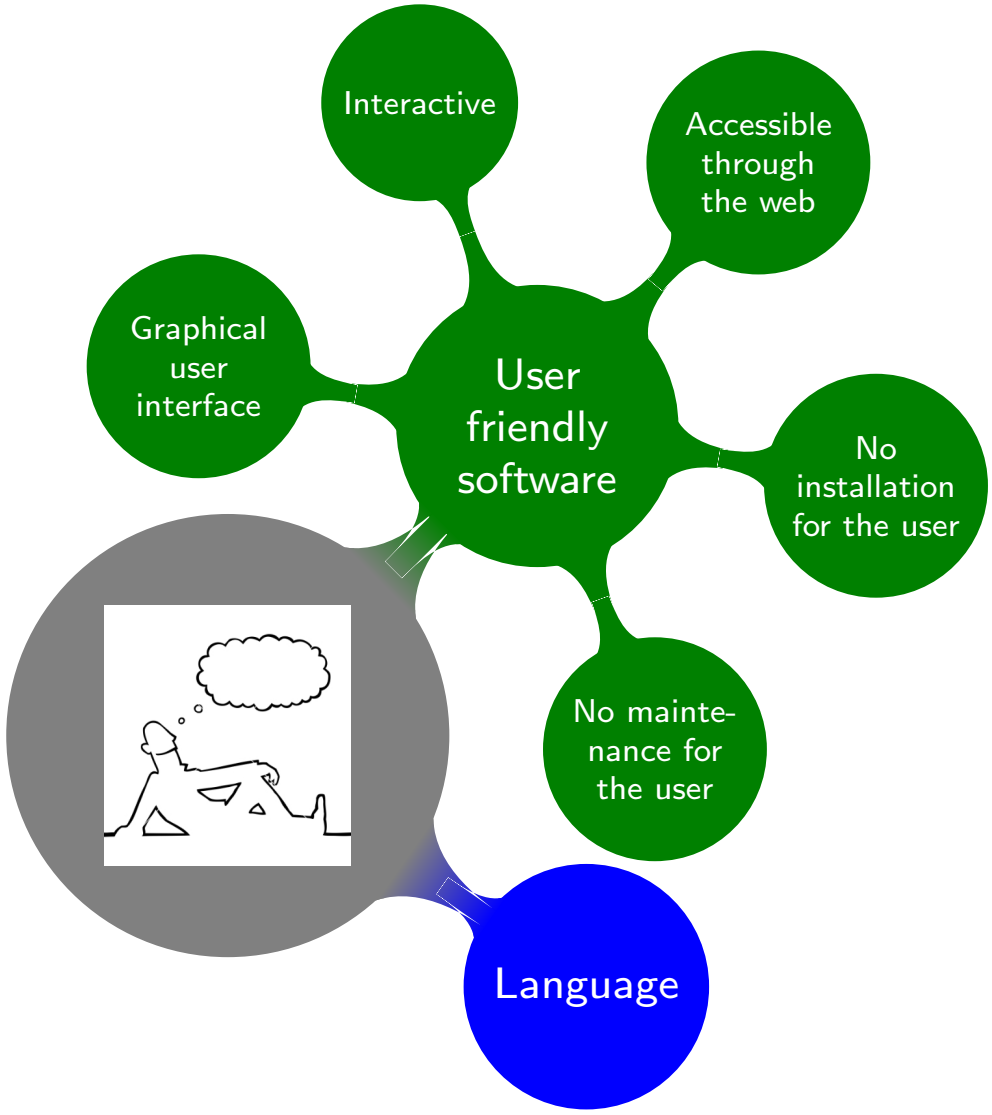
# (My) Motivation



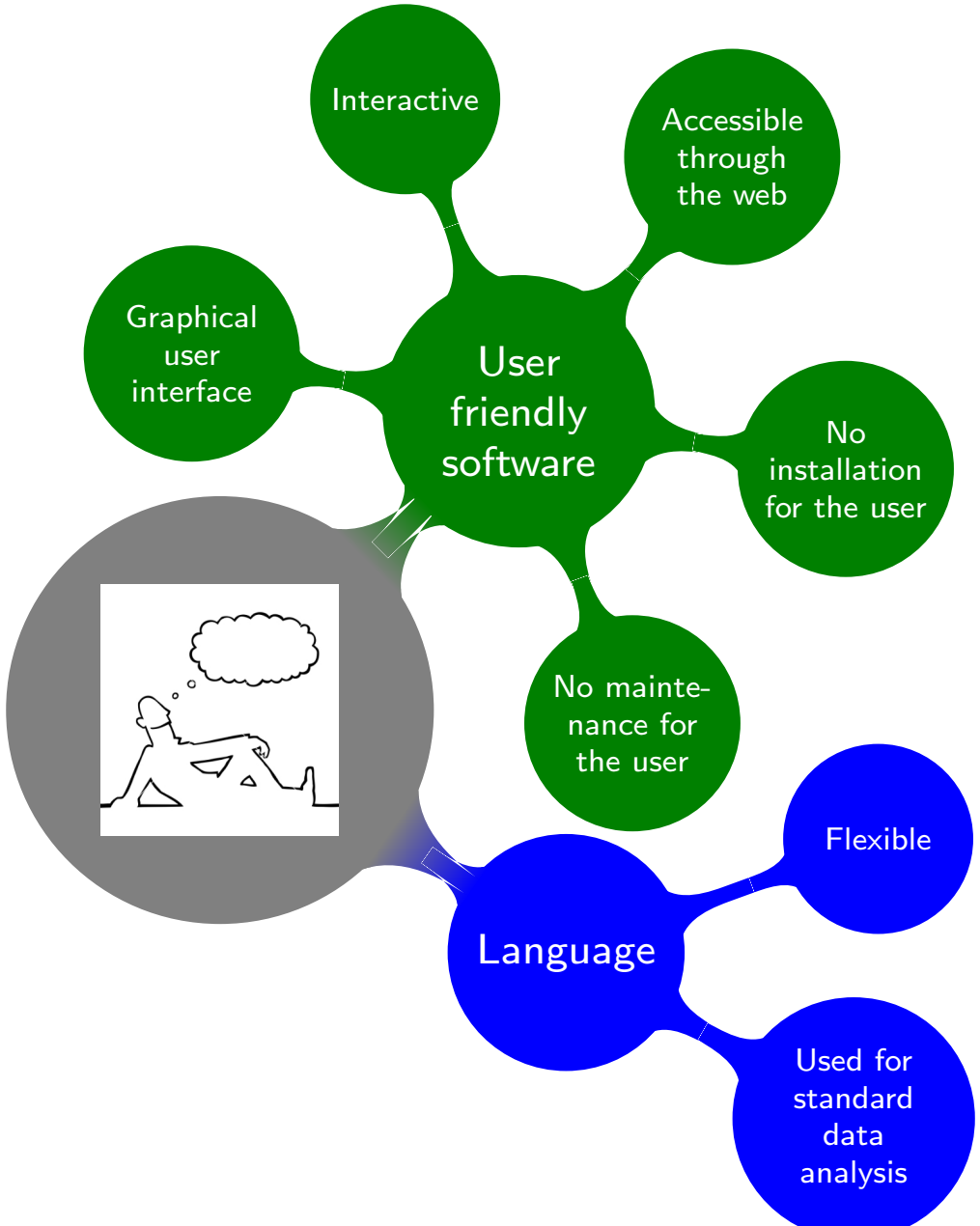
# (My) Motivation



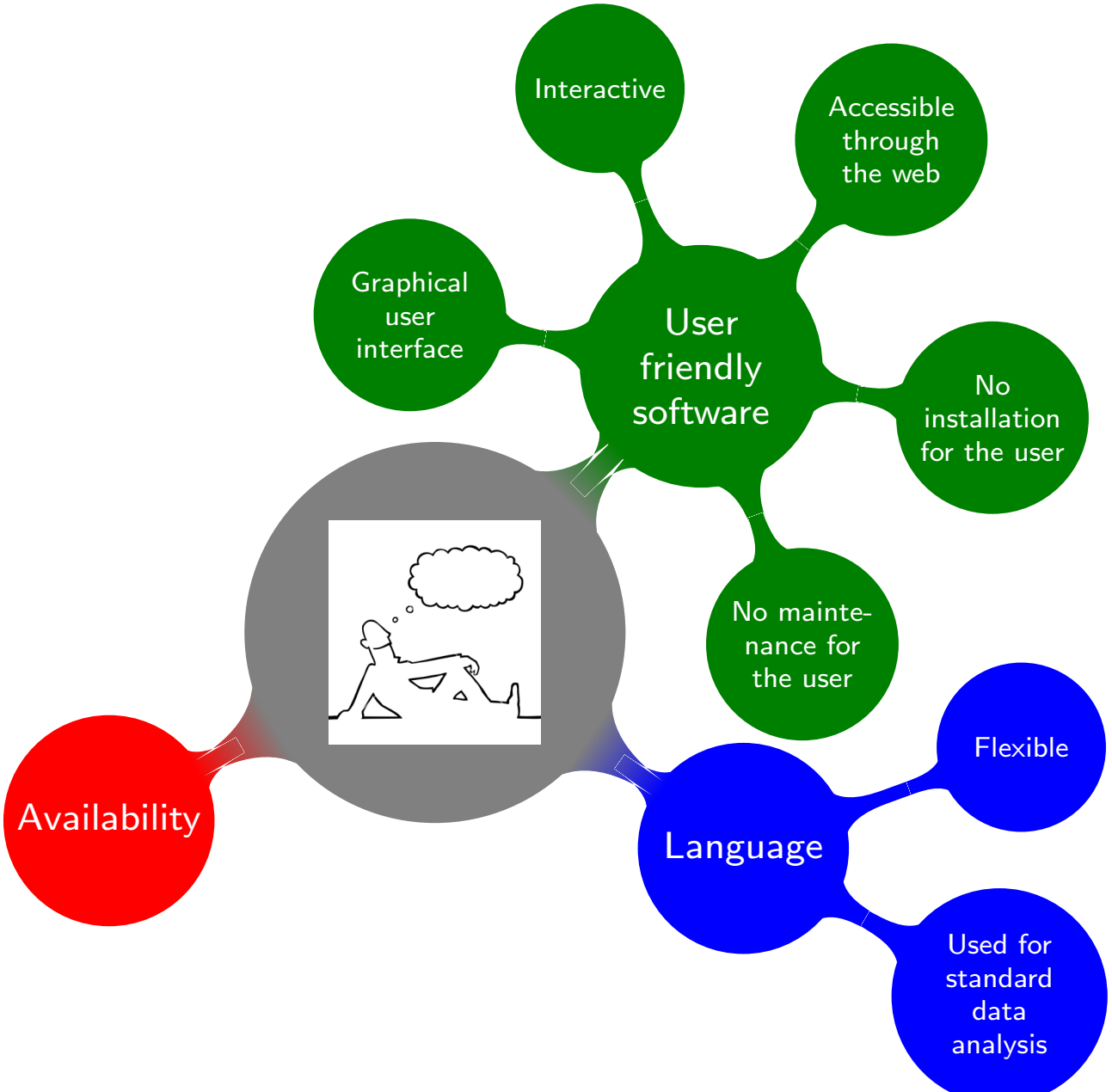
# (My) Motivation



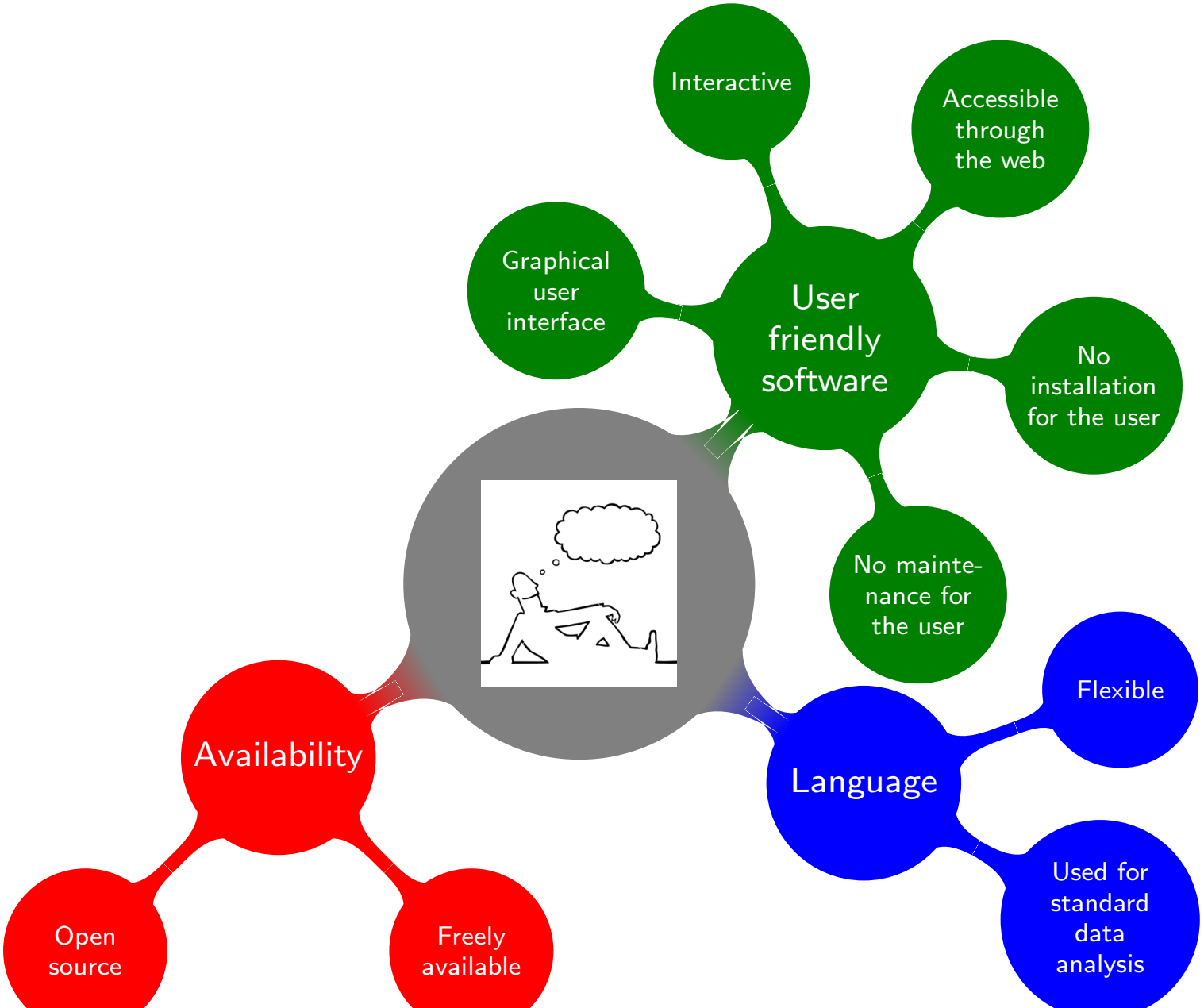
# (My) Motivation



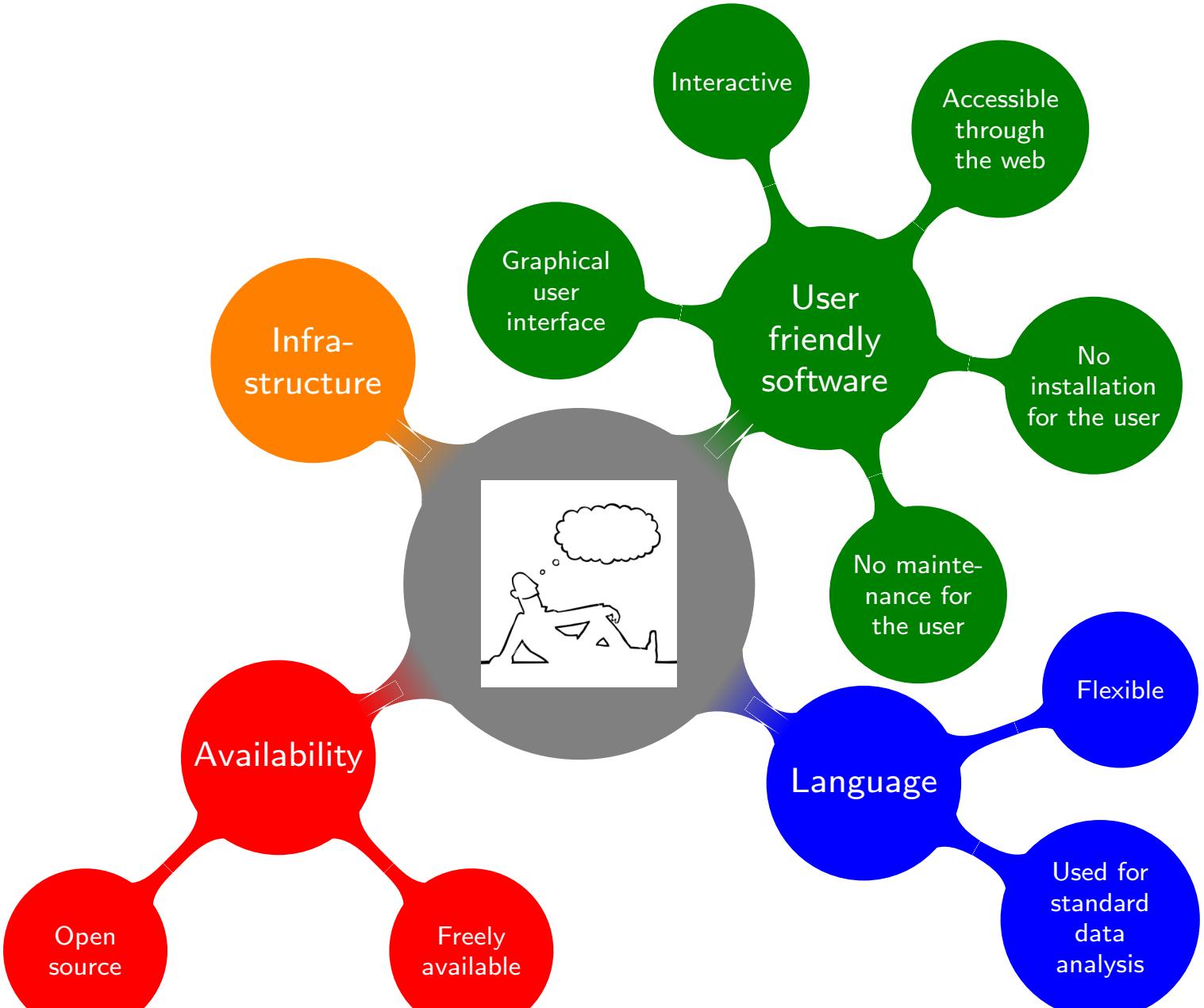
# (My) Motivation



# (My) Motivation



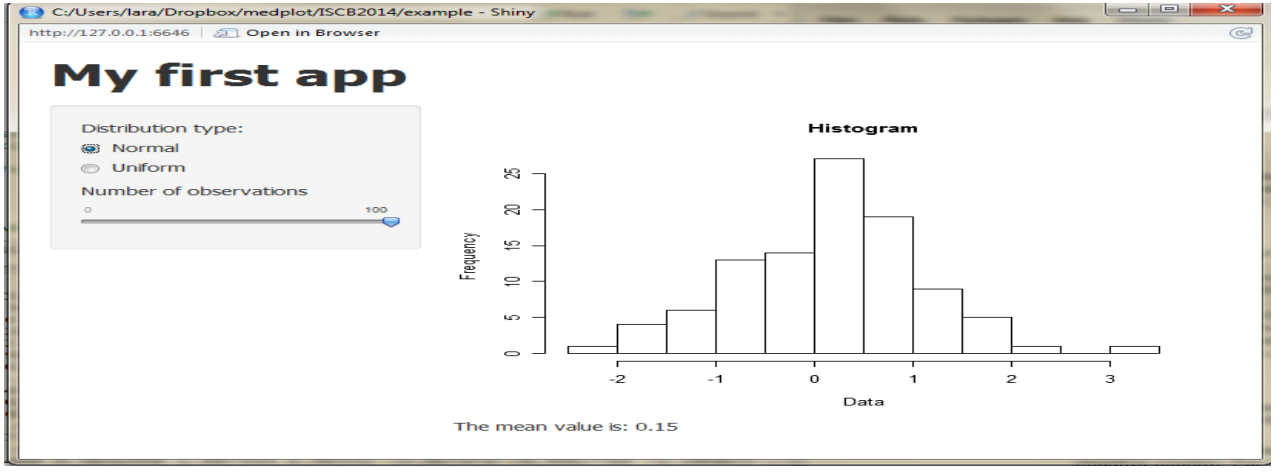
# (My) Motivation



# (My) Motivation

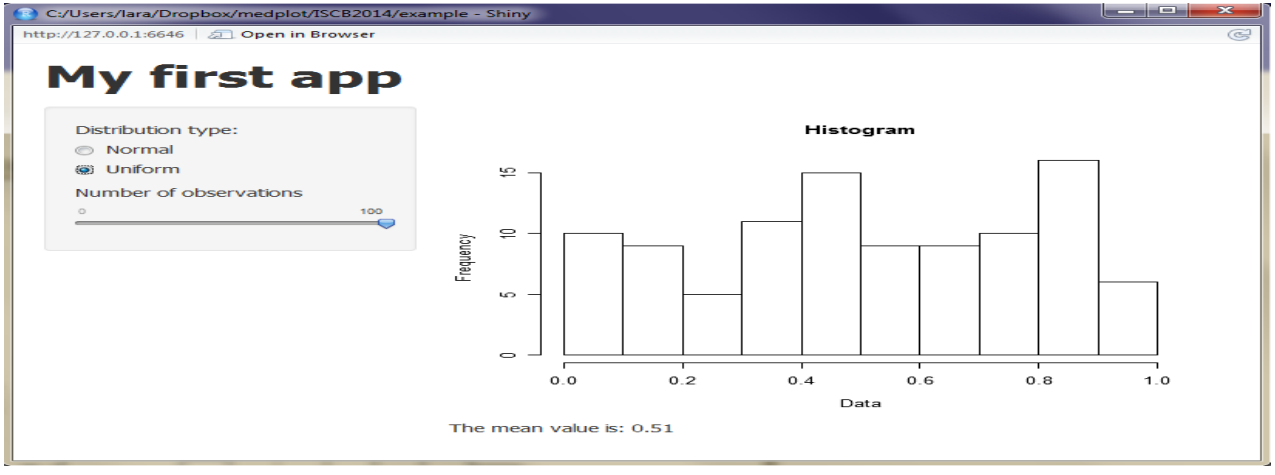
# A first example using R and shiny : example0

Inputs: distribution (string), number of observations (integer).
Outputs: histogram (plot), text (reporting the average value).



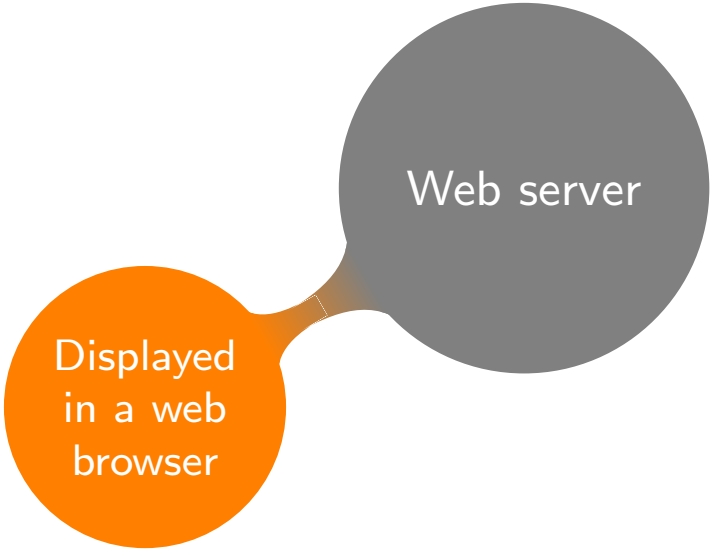
# A first example using R and shiny : example0

Inputs: distribution (string), number of observations (integer).
Outputs: histogram (plot), text (reporting the average value).

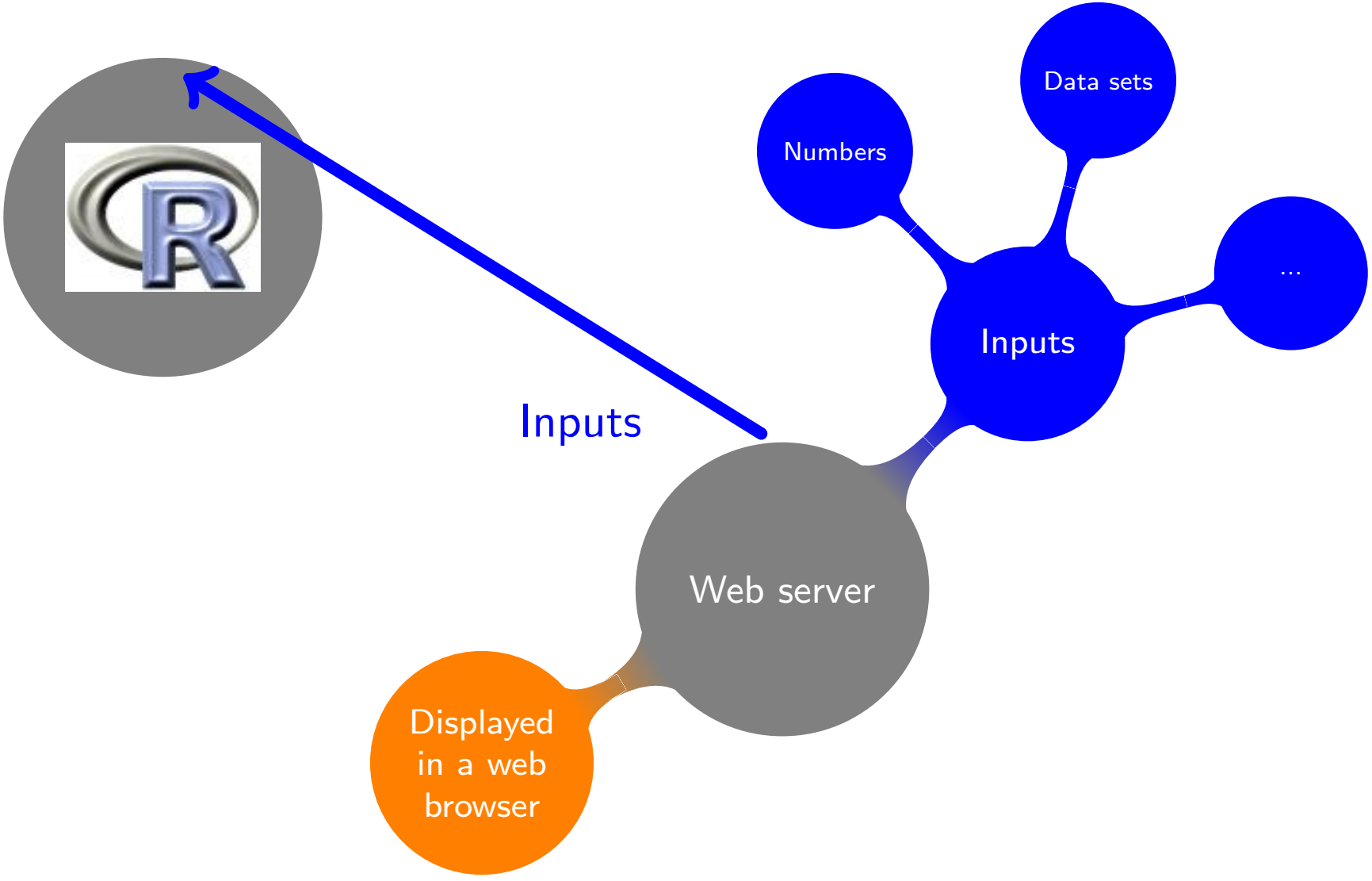



`http://shiny.rstudio.com/`

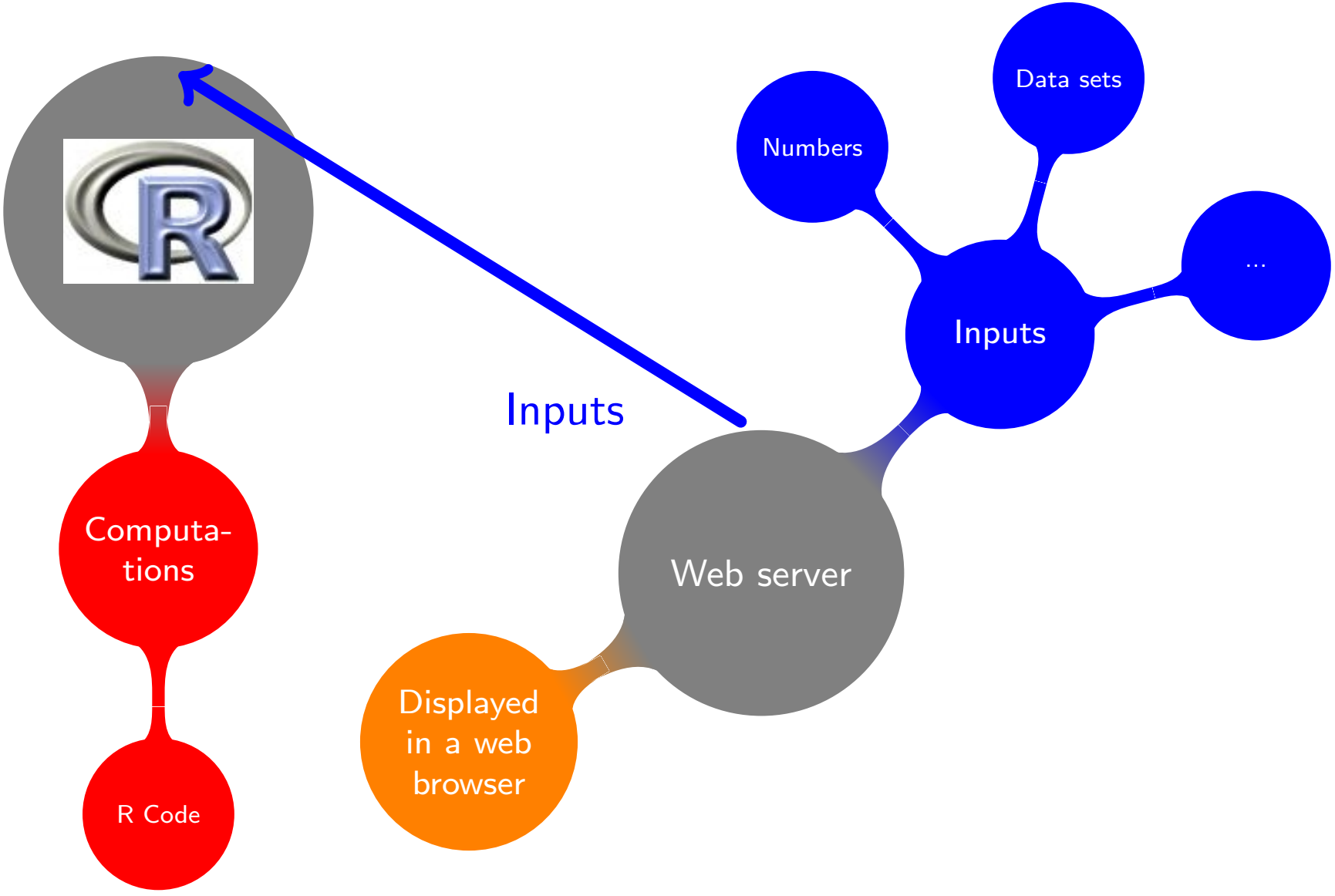
# Web applications: R and shiny



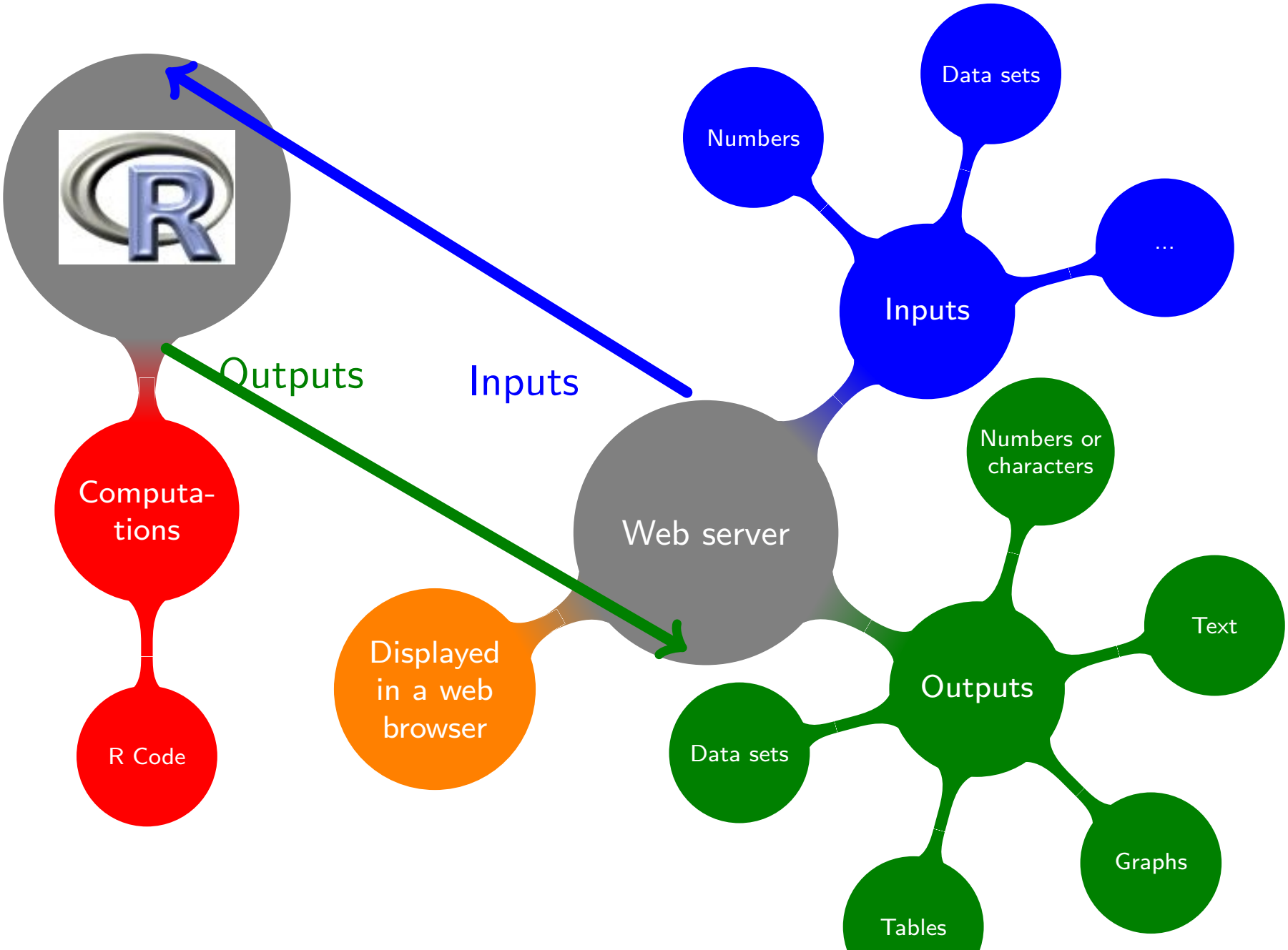
# Web applications: R and shiny



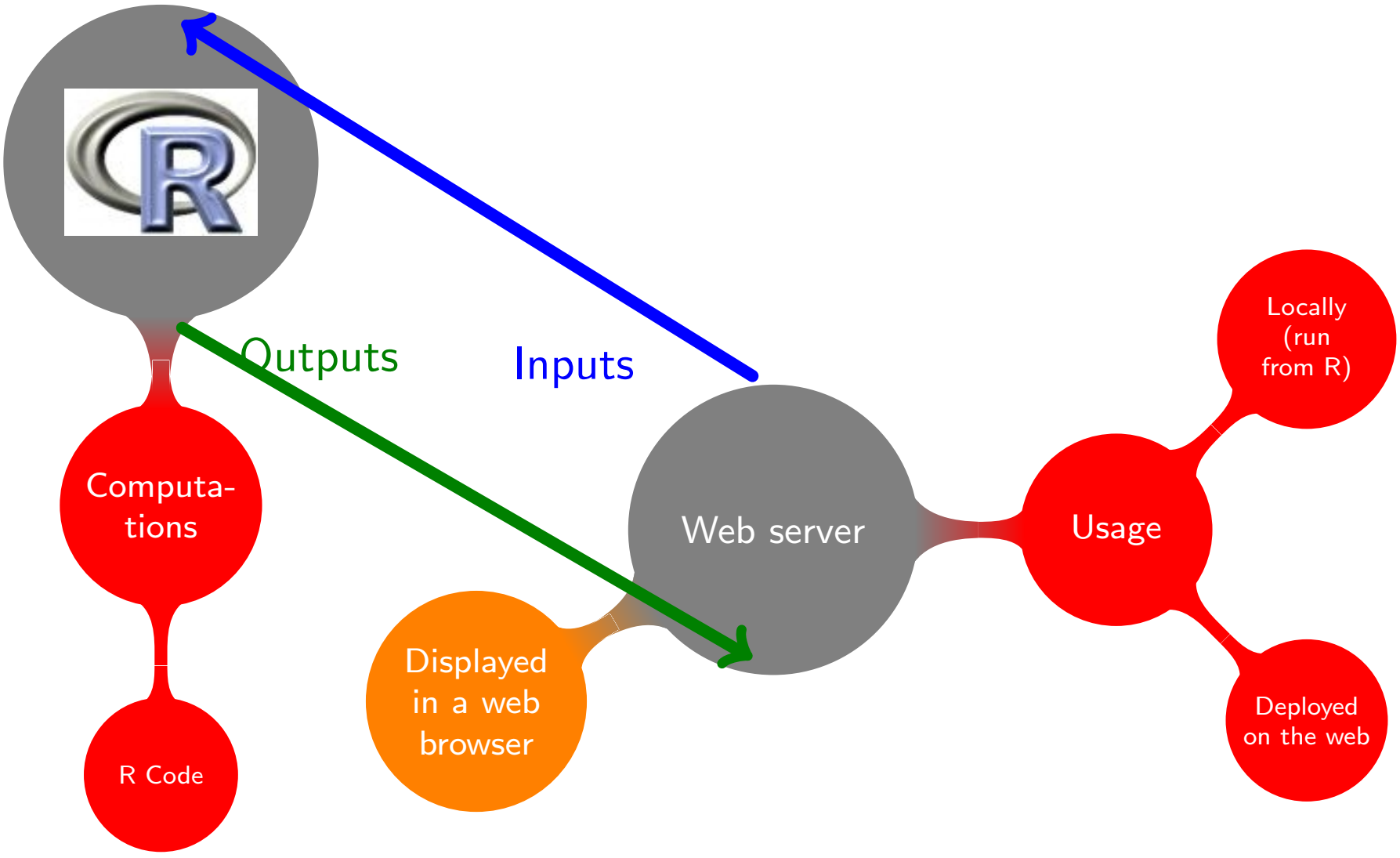
# Web applications: R and shiny



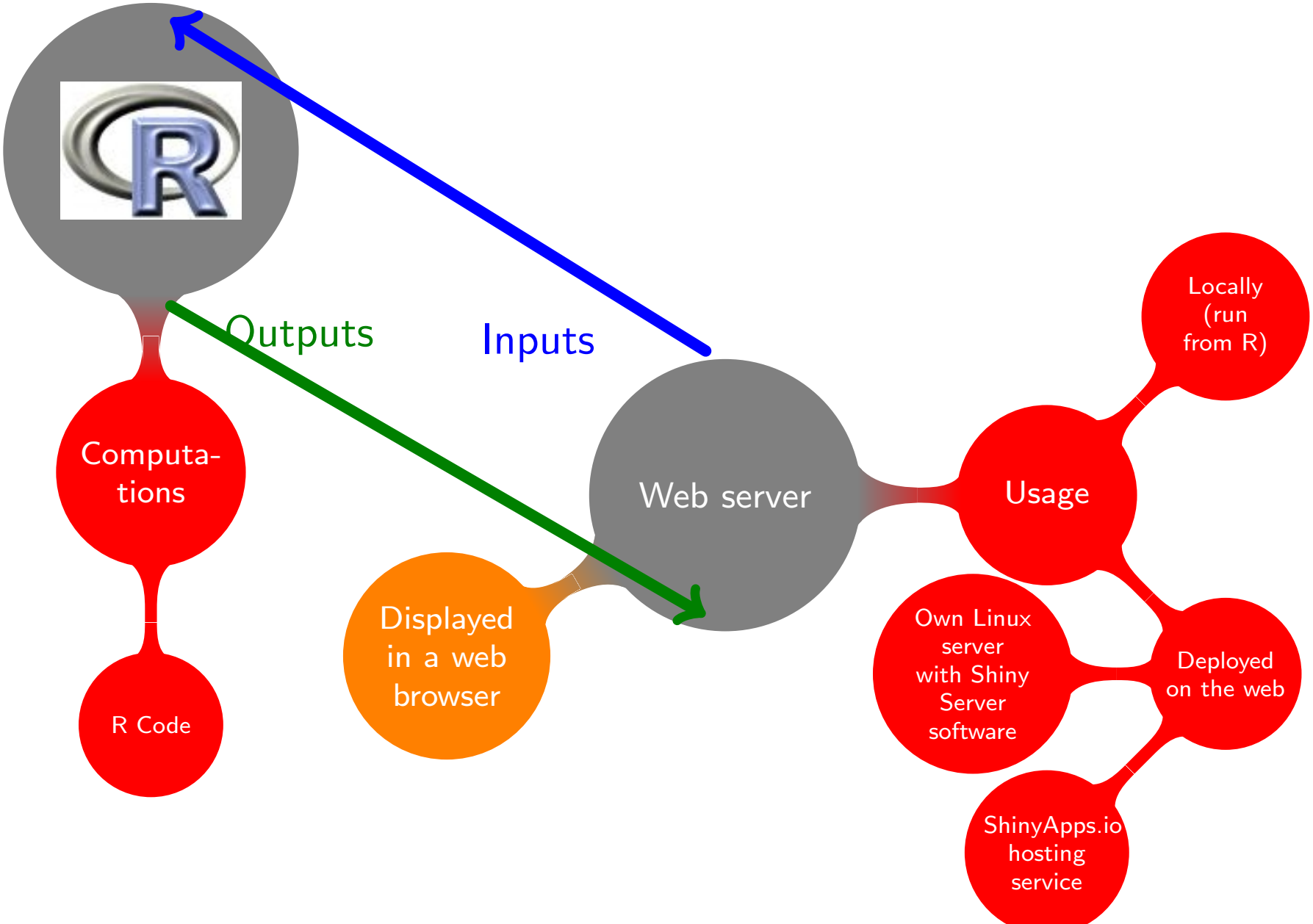
# Web applications: R and shiny



# Web applications: R and shiny



# Web applications: R and shiny



# Is the knowledge of R enough to develop an app?

An r source file (app.r) contains the code of the application, which reads inputs and displays outputs

- library(shiny)
- ui $<-$ function() ...
- server $<-$ function(input, output) ...
- shinyApp(ui $=$ ui, server $=$ server)

Previously: the ui and server functions were stored in two separate files (ui.r and server.r) within the same directory (still supported).

# Is the knowledge of R enough to develop an app?

## ui function (reads inputs and displays outputs)

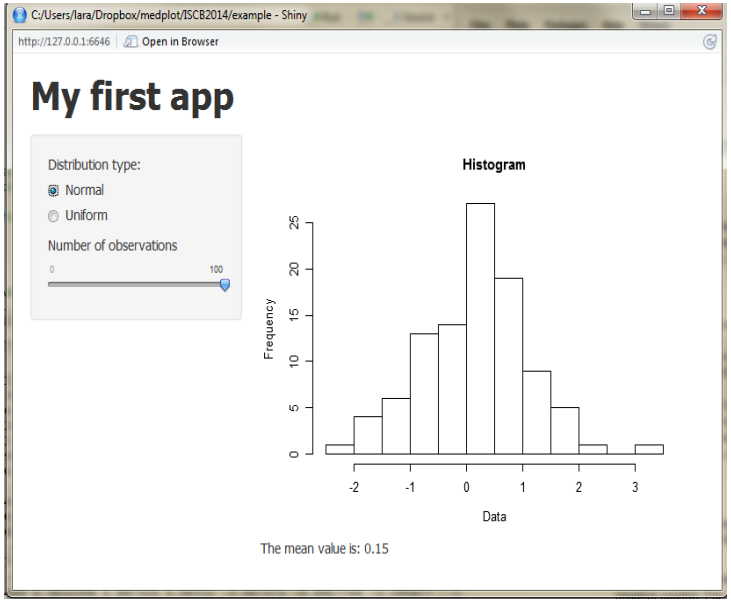
- Contains the code that defines the user interface.
- Defines how the web-page with the app will look.
- Usually it defines the inputs for the app.

## server function (prepares outputs)

- Contains the code that defines the server script, which is used for data manipulation and preparation of the results.
- It can contain
  - reactive values: values that can change over time;
  - reactive expressions: expressions that can access the reactive values; they are re-executed each time that a reactive value changes.
  - rendering expressions: returning output values evaluated by the executed functions (graphs, texts, numbers, ...), ready to be displayed on the user interface.

# Is the knowledge of R enough to develop an app?

File with the code: Example0.pdf



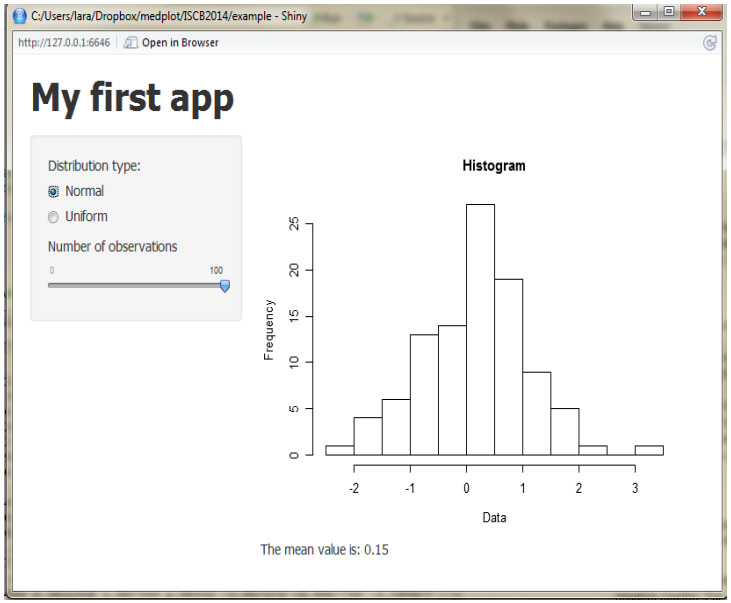

## R in shiny (ui)

```
#select the type of distribution
radioButtons("distribution", "Distribution
      type:", list("Normal" = "norm", "
      Uniform" = "unif"))

#select the number of observations
sliderInput("obs", "Number of observations",
       min=0, max=100, value=50)
```

# Is the knowledge of R enough to develop an app?

File with the code: Example0.pdf




## R in shiny (ui)

```
#select the type of distribution
radioButtons("distribution", "Distribution
      type:", list("Normal" = "norm", "
      Uniform" = "unif"))

#select the number of observations
sliderInput("obs", "Number of observations",
       min=0, max=100, value=50)
```

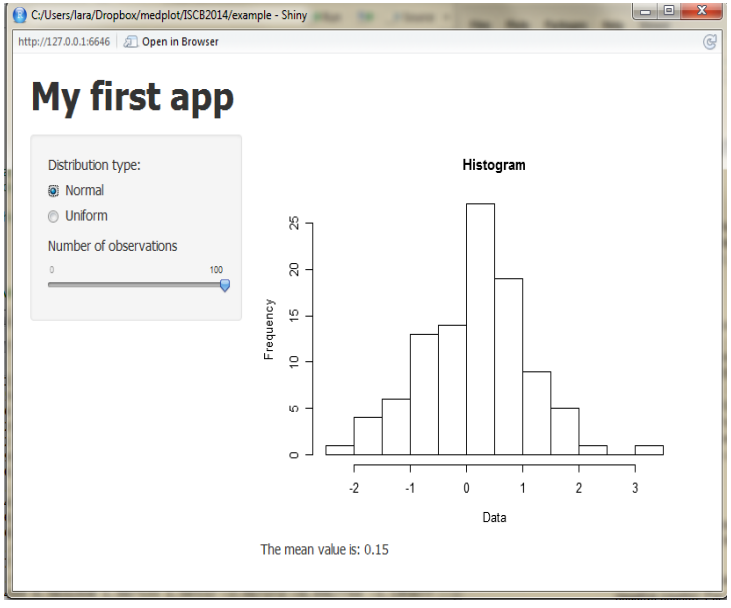
## R language

```
#simulate data
 my.x=function(distribution, obs){
       if(distribution=="norm")
             x=rnorm(obs) else
             x=runif(obs)
      return(x)}
```

## R in shiny (server)

```
#simulate data, reactive expression
my.x=reactive({
     if(input$distribution=="norm")
           x=rnorm(input$obs) else
           x=runif(input$obs)
      return(x)})
```

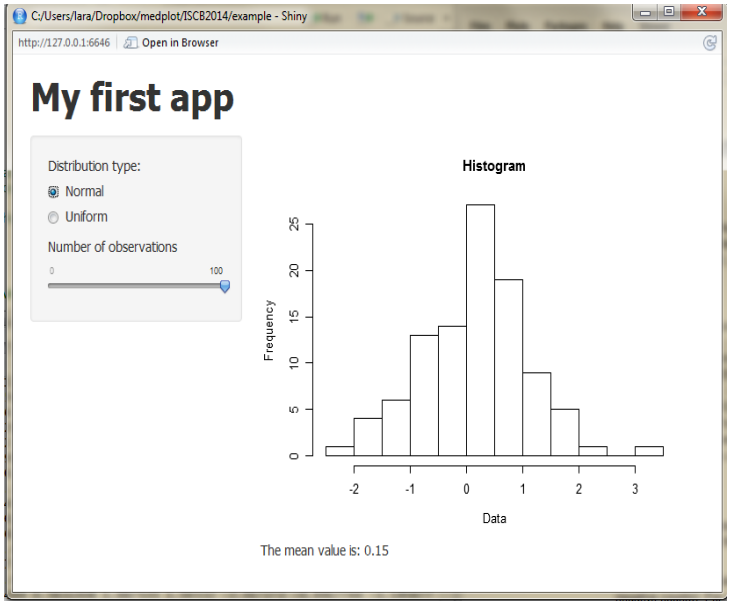
# Is the knowledge of R enough to develop an app?




## R in shiny (ui)

```
#display the outputs
  mainPanel(plotOutput("hist1"),
            textOutput("text1"))
```

# Is the knowledge of R enough to develop an app?




## R in shiny (ui)

```
#display the outputs
  mainPanel(plotOutput("hist1"),
            textOutput("text1"))
```

## R language

```
#calculate the average of my.x
av.my.x=round(mean(my.x), 2)

#draw histogram
  hist1=hist(my.x,
          ylab="Frequency", xlab="Data",
                main="Histogram" )

#prepare string with rounded average
  text1=paste("The mean value is: ", av
        .my.x) )
```

## R in shiny (server)

```
#average, reactive value
av.my.x=reactive(round(mean(my.x()), 2))

#histogram, rendering expression
output$hist1=renderPlot(
                  hist(my.x(),
                  ylab="Frequency", xlab="
                        Data", main="
                        Histogram" ))

#text, rendering expression
output$text1=renderText(
                paste("The mean value is: ",
```