Data Visualization Tools, Gapminder Demo: Tableau vs R

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What we'll talk about

- Data Visualization Tools
- Tool #1 : Tableau
- Tool #2 : Shiny (R)

A comment on "*How should we visualize data*"

There are two aspects of visualizations to think about:

How do you make a visualization?

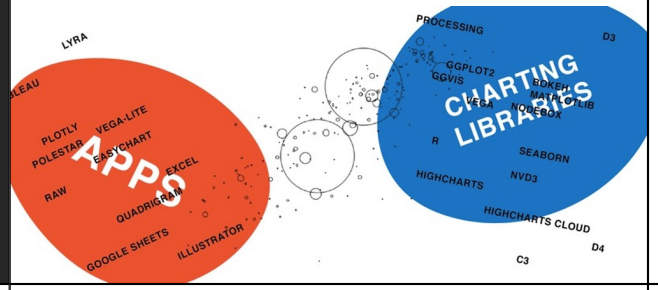
Is it the right visualization?

Data Visualization Tools

Tools & Libraries : An Overview

See this excellent post by Lisa Charlotte Rost : *http://bit.ly/2gRGx1J*

(figures taken from her post)



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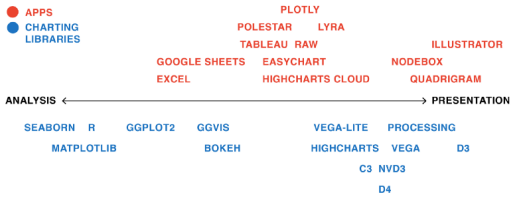
Analysis vs Presentation



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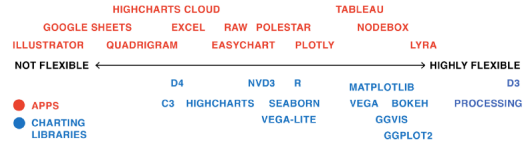
Extent of Flexibility

How easy/hard it is to make data visualizations (including custom/novel visualizations)



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Static vs Interactive

	STATIC	WEB - INTERACTIVE
APPS	ILLUSTRATOR, NODEBOX, EXCEL, POLESTAR, RAW	HIGHCHARTS CLOUD, QUADRIGRAM, EASYCHRT, DATAWRAPPER, TABLEAU, PLOTLY, GOOGLE SHEETS
CHARTING LIBRARIES	GGPLOT2, MATPLOTLIB, R, SEABORN, BOKEH, PROCESSING	D3, D4, C3, NVD3, GGVIS, HIGHCHARTS, SHINY, VEGA, VEGA-LITE

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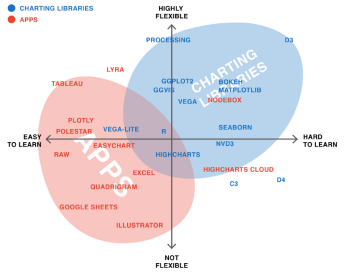

"There are no perfect tools, just good tools for people with certain goals"

See a detailed table here: http://bit.ly/2DeWPwV

Tools & Libraries : An Overview

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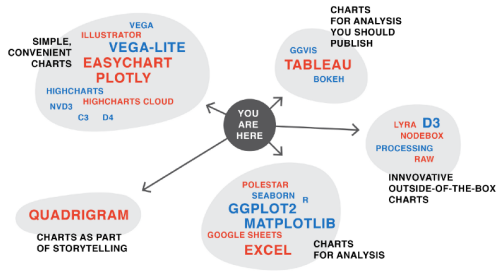


Tableau

Important Details on Tableau Public

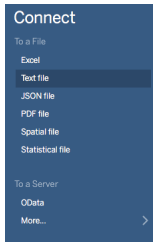
- **I am not a Tableau Expert**
  - There are plenty of great training videos & tutorials online
  - I mainly use R, and rarely need to use Tableau
  - I do, however, find Tableau pretty easy to use
- **I'll be demonstrating using Tableau Public**
  - Some features are different than the version of Tableau you pay for
- **YOU CANNOT PRIVATELY SAVE WORKBOOKS USING TABLEAU PUBLIC**
  - Please don't use Tableau *Public* for sensitive data, because anything you save will be publicly posted!
  - Tableau Desktop that you pay for *does* allow you to privately save workbooks

Today I'll demonstrate the following

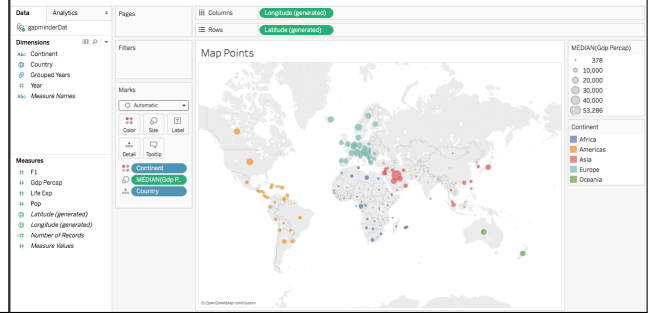
- Loading data
- Creating two types of maps
- Creating a scatter plot
- Exploring alternative visual designs with "Show Me"
- Putting it all together into a dashboard

I've put together some screen shots to help you reconstruct the Tableau analysis

Step 1: Load Gapminder CSV into Tableau



Step 2: Create a map with median gdp per capita as dots



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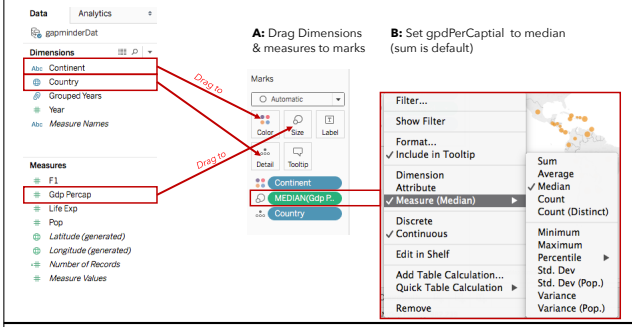
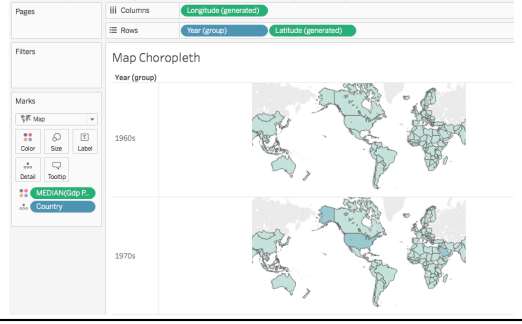


Step 3: Create a small multiples choropleth map



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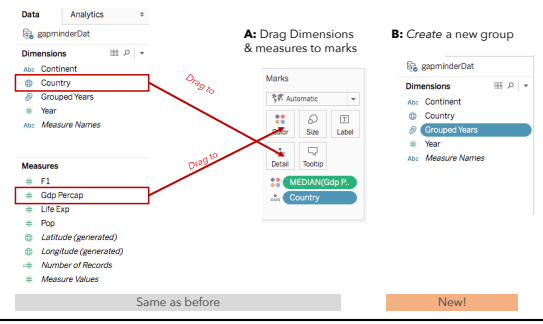

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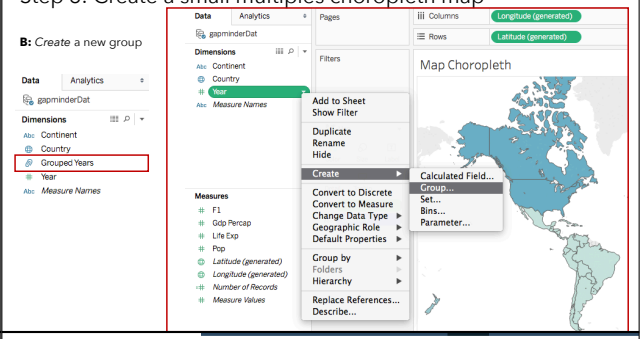
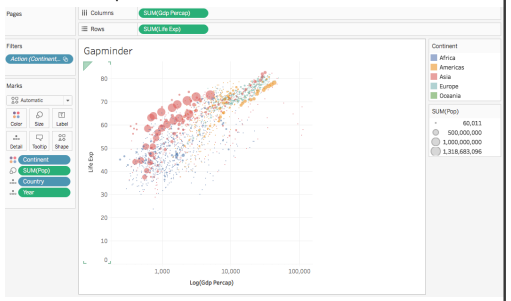


Step 4: Create a scatter plot

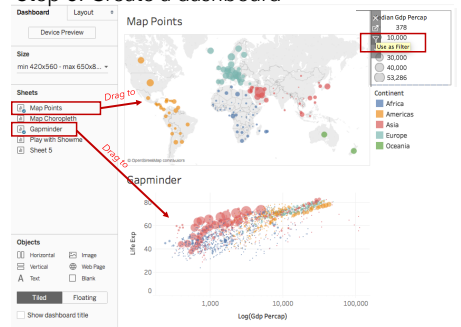
Try it on your own



Step 5: Explore the ShowMe panel

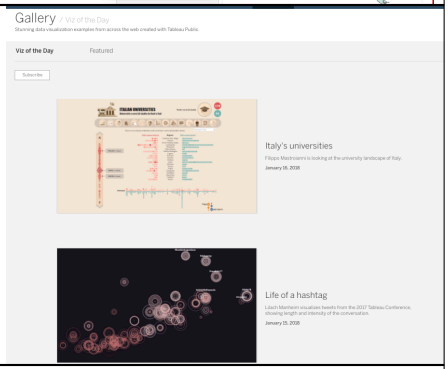
Try it on your own

Step 6: Create a dashboard



See more online at the Tableau Public gallery!

https://public.tableau.com/en-us/s/gallery

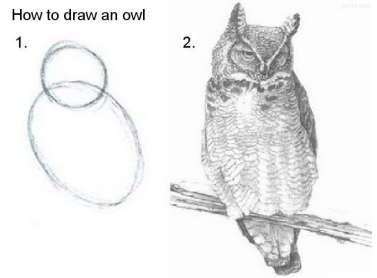


Shiny

Important Details on R and Shiny

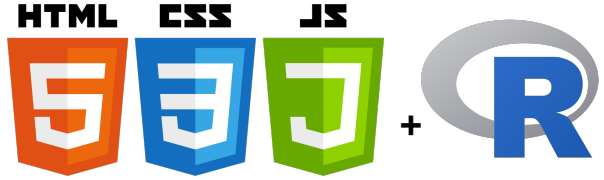
- **To introduce shiny, I am using selected slide content from several presentations developed for the "Shiny quick start guide" available here:**
  - **Part 1:** bit.ly/shiny-quickstart-1
  - **Part 2:** bit.ly/shiny-quickstart-2
- **These quick start slides are also presented as a video on the Shiny website**
  - https://shiny.rstudio.com/tutorial/

The Challenges of Briefly Introducing Shiny



- Shiny is powerful and somewhat simpler than web languages - but it still takes some time to learn it
- I want to show you some basic info, and give you a sense of what Shiny can do - but there is a lot of in between I won't cover

What is Shiny?



How Does Shiny Work?

Every Shiny app is maintained by a computer running R

Basic Structure of a Shiny Application

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

server <- function(input, output) {}

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


Basic Structure of a Shiny Application

An entire application can be a single file, or broken down into a ui.R & server.R files

```
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)
```

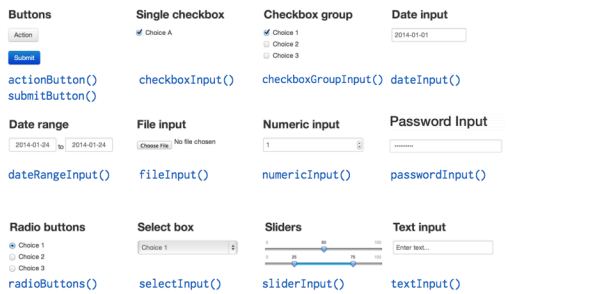
```
# ui.R
library(shiny)
fluidPage(
  sliderInput(inputId = "num",
    label = "Choose a number",
    value = 25, min = 1, max = 100),
  plotOutput("hist")
)
```

```
# server.R
library(shiny)
function(input, output) {
  output$hist <- renderPlot({
    hist(rnorm(input$num))
  })
}
```

You **must** use **app.r** (single file); or **ui.r** and **server.r** names, or your application won't run

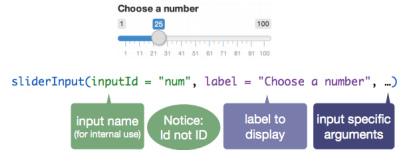
The user interface (ui.r) houses inputs & outputs

Example of inputs



The user interface (ui.r) houses inputs & outputs

Example of inputs



Changing the slider number (i.e. dragging the circle left to right) causes R to automatically initiate an action to update all outputs that use the slider number.

The user interface (ui.r) houses inputs & outputs

Example of outputs

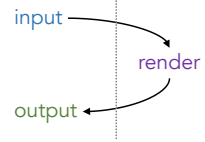
Function	Inserts
dataTableOutput()	an interactive table
htmlOutput()	raw HTML
imageOutput()	image
plotOutput()	plot
tableOutput()	table
textOutput()	text
uiOutput()	a Shiny UI element
verbatimTextOutput()	text

Function = command telling R & shiny to do some particular task

server.r stiches inputs & outputs together

ui.r
Shiny widgets
Interface elements

server.r
ggplot code
dataset manipulation



Output & render functions are complimentary

output function	render function
plotOutput( )	renderPlot( )
tableOutput( )	renderTable( )

A simple worked example

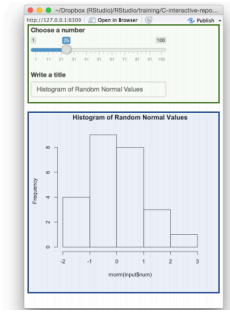
```
# 01-two-inputs

library(shiny)

ui <- fluidPage(
  sliderInput(inputId = "num",
    label = "Choose a number",
    value = 25, min = 1, max = 100),
  textInput(inputId = "title",
    label = "Write a title",
    value = "Histogram of Random Normal Values"),
  plotOutput("hist")
)

server <- function(input, output) {
  output$hist <- renderPlot({
    hist(rnorm(input$num), main = input$title)
  })
}

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



Reactivity in Shiny – a Very Brief Introduction

```
# 01-two-inputs

library(shiny)

ui <- fluidPage(
  sliderInput(inputId = "num",
    label = "Choose a number",
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  plotOutput("hist")
)

server <- function(input, output) {
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    hist(rnorm(input$num), main = input$title)
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}

shinyApp(ui = ui, server = server)
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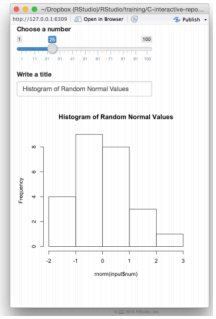
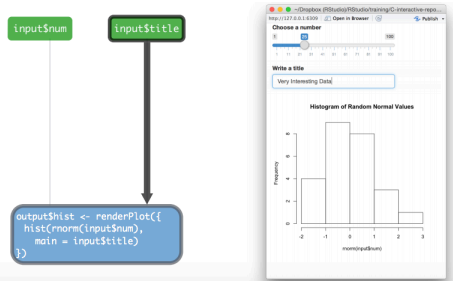
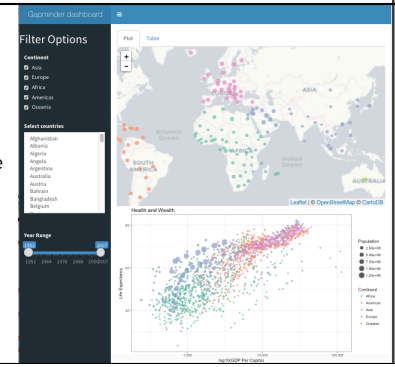
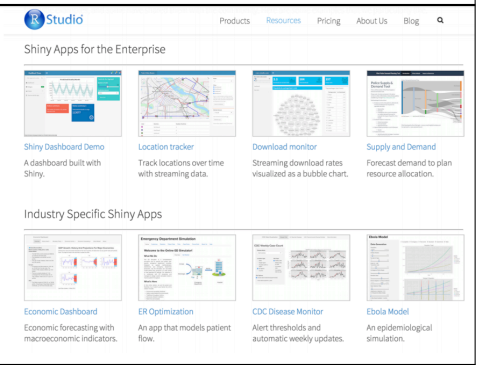


Reactivity in Shiny – a Very Brief Introduction



Let's go through a more complex example



See more online at the Shiny Gallery!

https://www.rstudio.com/products/shiny/shiny-user-showcase/