

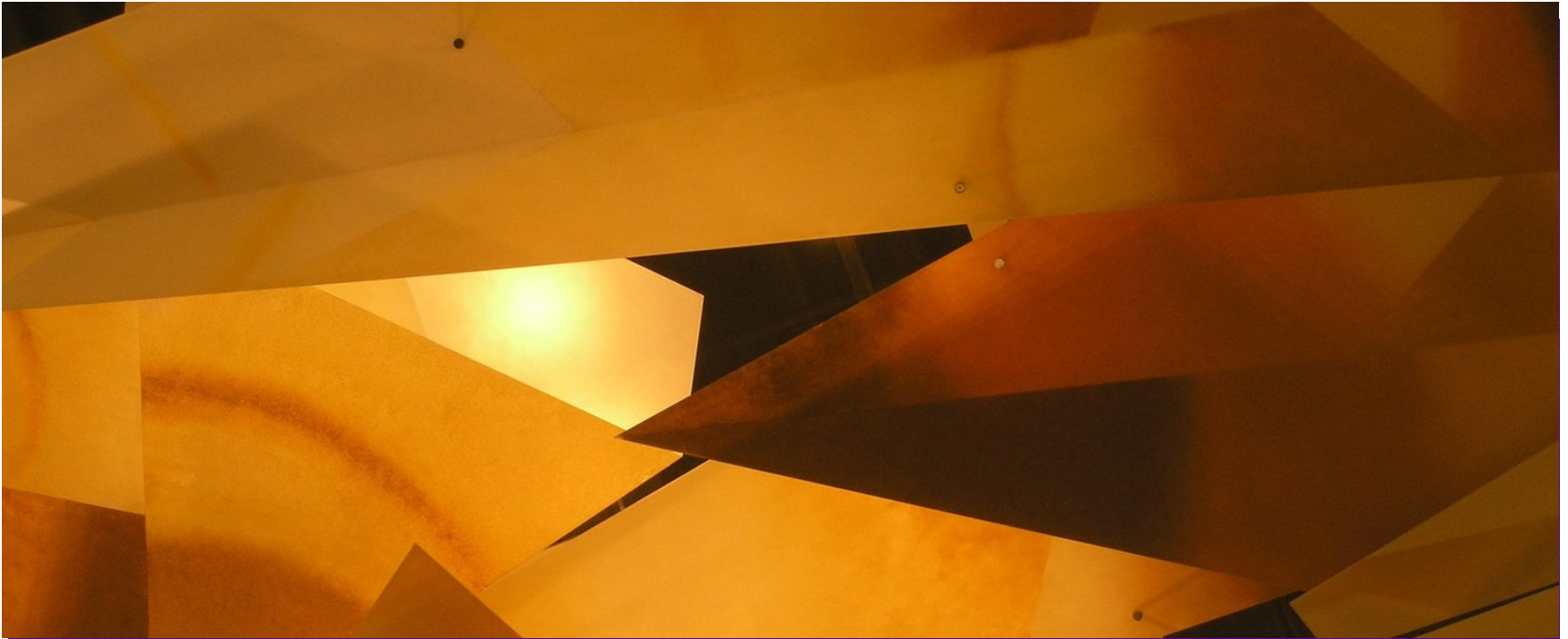


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Installation of R & RStudio

Week #1 – Spring 2018



Learning Objectives

- The objective of this lecture is to introduce you to **R** and **RStudio**, which you'll be using throughout the course both to learn the concepts discussed in the textbook/class and also to analyze real data and come to informed conclusions.
- To straighten out which is which: **R** is the name of the programming language itself and **RStudio** is a convenient interface.



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R IN CONTEXT



What is R

- R is an open source programming language released in 1995 by [Ross Ihaka](#) and [Robert Gentleman](#) to improve the visualization and data analysis features of a prior syntax such as [S](#).
- R is named partly after the first names of the first two R authors and partly as a play on the name of S

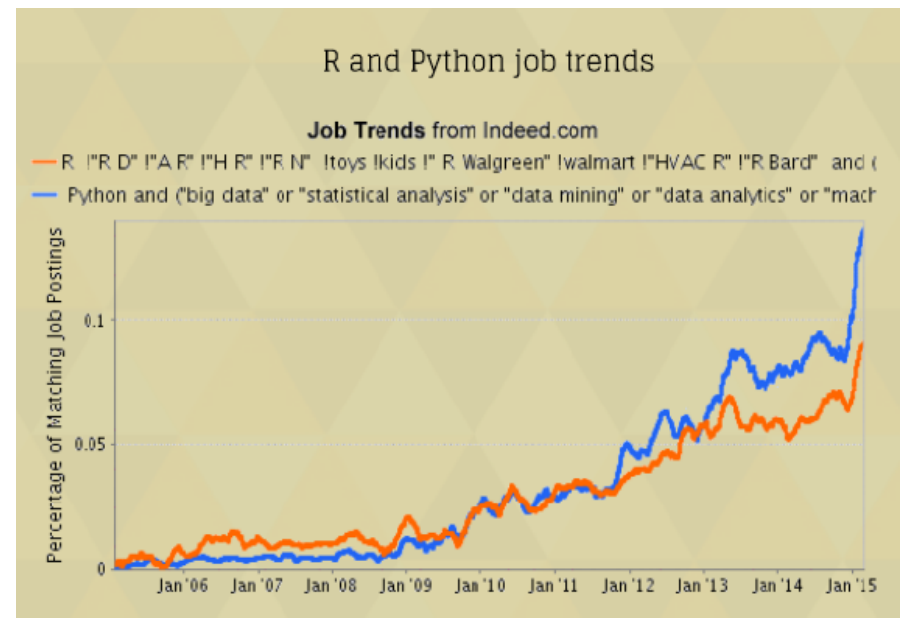
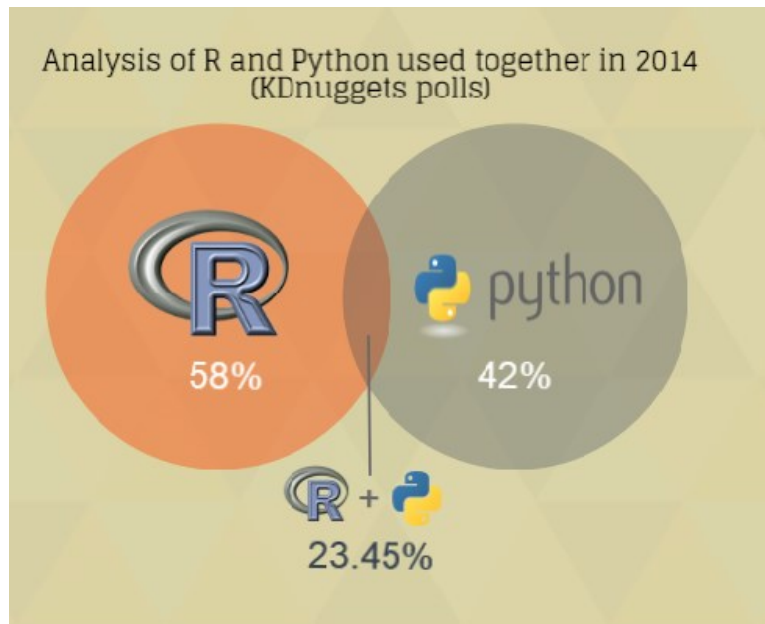


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R vs Python

- R is mainly used for data analysis, while Python is used for general-purpose programming.



Reference: <https://www.datacamp.com/community/tutorials/r-or-python-for-data-analysis#gs.5uCBxM>



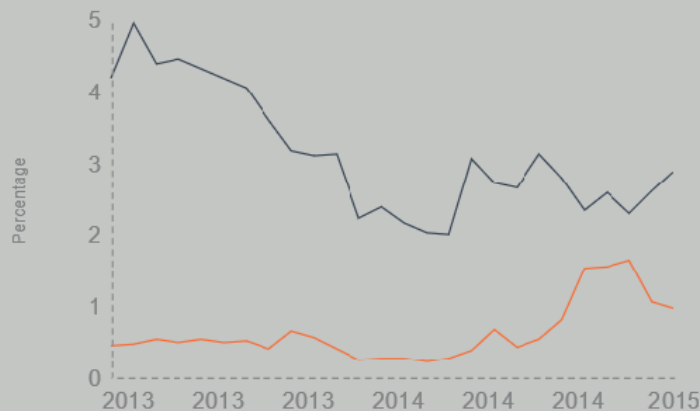
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R vs Python

Popularity Rankings

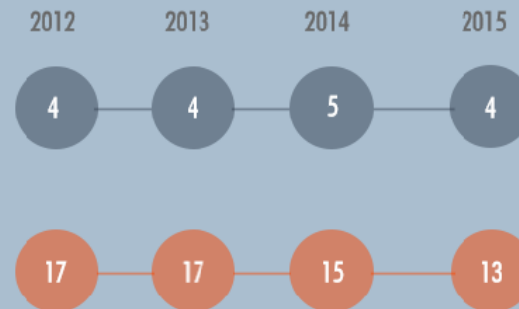
R and Python's popularity between 2013 and February 2015 (Tiobe Index)



Python

R

Redmonk ranking, comparing the relative performance of programming languages on GitHub and Stack Overflow (September 2012 and January 2013, 2014, 2015)



Jobs And Salary?

2014 Dice Tech Salary Survey:
Average Salary For High Paying Skills and Experience



\$115,531



\$94,139

Reference: <https://www.datacamp.com/community/tutorials/r-or-python-for-data-analysis#gs.5C6X3M>



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INSTALLATION OF R



Installing R

- R is available for free on the Comprehensive R Archive Network (CRAN) website
 - Step 1: Open the R Project Homepage: www.r-project.org
 - Step 2: Click on the “CRAN” link on the menu on the left-hand side of the page. Pick the server that is (geographically) closest to you.
 - Step 3: Find your operating system (Windows, Macintosh, Linux, etc.) under “Precompiled Binary Distributions”. These are the ready-to-install files containing the base R package, and are the easiest way to get R up and running on your machine.



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Installing R

- Windows:
 - Click [Download R for Windows](#).
 - Click [base](#).
 - Click [Download R 3.3.2 for Windows](#). Save it to a file on your hard drive. (Note: the installation file is about 52 Megabytes. If you have a slow Internet connection, download the installation file on a machine with a fast connection.)
 - Find the installation file “R-3.3.2-win.exe” on your hard drive.
 - Close all other programs before beginning the installation.
 - Run the installation program with administrative privileges.



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Installing R

- Mac OS X :
 - Click [Download R for \(Mac\) OS X](#).
 - Click [R-3.1.2.pkg](#).
 - Older version for old Mac OS X systems are also available.
 - To install R, simply double-click on the icon of the package file.

- Linux

- Follow the instruction to install appropriate package



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Installing R - Demo

← → ↻ www.r-project.org



About R
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[Contributors](#)
[Screenshots](#)
[What's new?](#)
Download, Packages
[CRAN](#)

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[Foundation](#)
[Members & Donors](#)
[Mailing Lists](#)
[Bug Tracking](#)
[Developer Page](#)
[Conferences](#)
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[FAQs](#)
[The R Journal](#)
[Wiki](#)
[Books](#)
[Certification](#)
[Other](#)

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[Links](#)

<http://cran.mirror.ac.za/>
Spain
<http://cran.es.r-project.org/>
Sweden
<http://ftp.sunet.se/pub/lang/CRAN/>
Switzerland
<http://stat.ethz.ch/CRAN/>
Taiwan
<http://cran.cs.pu.edu.tw/>
<http://cran.csie.ntu.edu.tw/>
Thailand
<http://mirrors.psu.ac.th/pub/cran/>
Turkey
<http://cran.pau.edu.tr>
UK
<http://www.stats.bris.ac.uk/R/>
<http://cran.ma.imperial.ac.uk/>
<http://mirror.mdx.ac.uk/R/>
<http://star-www.st-andrews.ac.uk/cran/>
USA
<http://cran.cnr.Berkeley.edu>
<http://cran.stat.ucla.edu/>
<http://streaming.stat.iastate.edu/CRAN/>
<http://ftp.ussg.iu.edu/CRAN/>
<http://rweb.quant.ku.edu/cran/>
http://watson.nci.nih.gov/cran_mirror/
<http://cran.mtu.edu/>
<http://cran.wustl.edu/>
<http://cran.case.edu/>
<http://ftp.osuosl.org/pub/cran/>
<http://lib.stat.cmu.edu/R/CRAN/>
<http://cran.mirrors.hoobly.com>
<http://mirrors.nics.utk.edu/cran/>
<http://cran.revolutionanalytics.com>
<http://cran.fhcrc.org/>
<http://cran.cs.wvu.edu/>
Venezuela
<http://camoruco.ing.uc.ve.edu/ve/cran/>
Vietnam
<http://cran.vinastat.com/>

TEENET, Johannesburg
Spanish National Research Network, Madrid
Swedish University Computer Network, Uppsala
ETH Zuerich
Providence University, Taichung
National Taiwan University, Taipei
Prince of Songkla University, Hatyai
Pamukkale University, Denizli
University of Bristol
Imperial College London
Middlesex University London
St Andrews University
University of California, Berkeley, CA
University of California, Los Angeles, CA
Iowa State University, Ames, IA
Indiana University
University of Kansas, Lawrence, KS
National Cancer Institute, Bethesda, MD
Michigan Technological University, Houghton, MI
Washington University, St. Louis, MO
Case Western Reserve University, Cleveland, OH
Oregon State University
Statlib, Carnegie Mellon University, Pittsburgh, PA
Hoobly Classifieds, Pittsburgh, PA
National Institute for Computational Sciences, Oak Ridge, TN
Revolution Analytics, Dallas, TX
Fred Hutchinson Cancer Research Center, Seattle, WA
Western Washington University, Bellingham, WA
Universidad de Carabobo Venezuela
VinaStat.com

Many of these sites can also be accessed using FTP. In addition, several [StatLib](#) mirrors around the world provide a complete CRAN mirror.

If you want to host a new mirror at your institution, please have a look at the [CRAN Mirror HOWTO](#).

To "submit" to CRAN, simply upload to <ftp://cran.r-project.org/incoming> and send email to cran@r-project.org. Please indicate the copyright situation (GPL, ...) in your submission.

Installing R - Demo

← → G cran.cnr.berkeley.edu



The Comprehensive R Archive Network

Download and Install R

Precompiled binary distributions of the base system and contributed packages, **Windows and Mac** users most likely want one of these versions of R:

- [Download R for Linux](#)
- [Download R for \(Mac\) OS X](#)
- [Download R for Windows](#)

R is part of many Linux distributions, you should check with your Linux package management system in addition to the link above.

Source Code for all Platforms

Windows and Mac users most likely want to download the precompiled binaries listed in the upper box, not the source code. The sources have to be compiled before you can use them. If you do not know what this means, you probably do not want to do it!

- The latest release (2014-10-31, Pumpkin Helmet) [R-3.1.2.tar.gz](#), read [what's new](#) in the latest version.
- Sources of [R alpha and beta releases](#) (daily snapshots, created only in time periods before a planned release).
- Daily snapshots of current patched and development versions are [available here](#). Please read about [new features and bug fixes](#) before filing corresponding feature requests or bug reports.
- Source code of older versions of R is [available here](#).
- Contributed extension [packages](#)

Questions About R

- If you have questions about R like how to download and install the software, or what the license terms are, please read our [answers to frequently asked questions](#) before you send an email.

What are R and CRAN?

R is 'GNU S', a freely available language and environment for statistical computing and graphics which provides a wide variety of statistical and graphical techniques: linear and nonlinear modelling, statistical tests, time series analysis, classification, clustering, etc. Please consult the [R project homepage](#) for further information.

CRAN is a network of ftp and web servers around the world that store identical, up-to-date, versions of code and documentation for R. Please use the CRAN [mirror](#) nearest to you to minimize network load.

Submitting to CRAN

To "submit" a package to CRAN, check that your submission meets the [CRAN Repository Policy](#) and then use the [web form](#).

If this fails, upload to <http://CRAN.R-project.org/incoming/> and send an email to CRAN@R-project.org following the policy. Please do not attach submissions to emails, because this will clutter up the mailboxes of half a dozen people.

Note that we generally do not accept submissions of precompiled binaries due to security reasons. All binary distribution listed above are compiled by selected maintainers, who are in charge for all binaries of their platform, respectively.

This server is hosted by [The College of Natural Resources](#) at [University of California, Berkeley](#)

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cran.cnr.berkeley.edu/bin/windows/



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Installing R - Demo

cran.cnr.berkeley.edu



R for Windows

Subdirectories:

[base](#)

Binaries for base distribution (managed by Duncan Murdoch). This is what you want to [install R for the first time](#).

[contrib](#)

Binaries of contributed packages (managed by Uwe Ligges). There is also information on [third party software](#) available for CRAN Windows services and corresponding environment and make variables.

[Rtools](#)

Tools to build R and R packages (managed by Duncan Murdoch). This is what you want to build your own packages on Windows, or to build R itself.

Please do not submit binaries to CRAN. Package developers might want to contact Duncan Murdoch or Uwe Ligges directly in case of questions / suggestions related to Windows binaries.

You may also want to read the [R FAQ](#) and [R for Windows FAQ](#).

Note: CRAN does some checks on these binaries for viruses, but cannot give guarantees. Use the normal precautions with downloaded executables.

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R-3.1.2 for Windows (32/64 bit)

[Download R 3.1.2 for Windows](#) (54 megabytes, 32/64 bit)

[Installation and other instructions](#)

[New features in this version](#)

If you want to double-check that the package you have downloaded exactly matches the package distributed by R, you can compare the [md5sum](#) of the .exe to the [true fingerprint](#). You will need a version of md5sum for windows: both [graphical](#) and [command line versions](#) are available.

Frequently asked questions

- [How do I install R when using Windows Vista?](#)
- [How do I update packages in my previous version of R?](#)
- [Should I run 32-bit or 64-bit R?](#)

Please see the [R FAQ](#) for general information about R and the [R Windows FAQ](#) for Windows-specific information.

Other builds

- Patches to this release are incorporated in the [r-patched snapshot build](#).
- A build of the development version (which will eventually become the next major release of R) is available in the [r-devel snapshot build](#).
- [Previous releases](#)

Note to webmasters: A stable link which will redirect to the current Windows binary release is [<CRAN MIRROR>/bin/windows/base/release.htm](#).

Last change: 2014-10-31, by Duncan Murdoch

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cran.cnr.berkeley.edu/bin/windows/base/



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INSTALLATION OF RSTUDIO



RStudio

- RStudio IDE is a powerful and productive user interface for R. It's free and open source, and works great on Windows, Mac, and Linux.
- Download: www.rstudio.com



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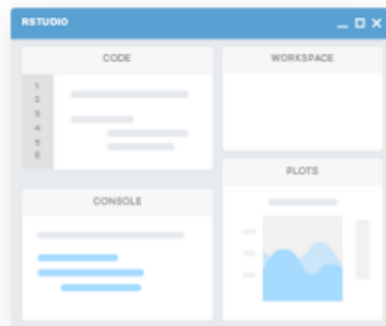
RStudio

[rstudio::conf](#)[Products](#)[Resources](#)[Pricing](#)[About Us](#)[Blogs](#)

professional software for R

[shinyapps.io](#) Login

Discover RStudio Connect

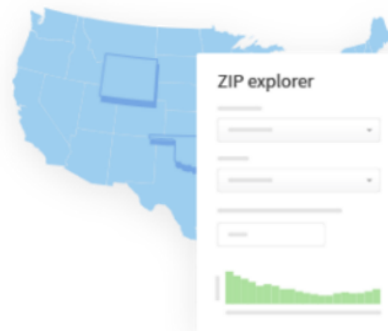


RStudio

RStudio makes R easier to use. It includes a code editor, debugging & visualization tools.

[Download](#)

[Learn More](#)



Shiny

Shiny helps you make interactive web applications for visualizing data. Bring R data analysis to life.

[Learn More](#)



R Packages

Our developers create popular packages to expand the features of R. Includes ggplot2, dplyr, R Markdown & more.

[Learn More](#)



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RStudio

	RStudio Desktop Open Source License	RStudio Desktop Commercial License	RStudio Server Open Source License	RStudio Server Pro Commercial License
	FREE	\$995 per year	FREE	\$9,995 per year
Integrated Tools for R	●	●	●	●
Priority Support		●		●
Access via Web Browser			●	●
Enterprise Security				●
Project Sharing				●
Manage Multiple R Sessions & Versions				●
Admin Dashboard				●
Load Balancing				●
License	AGPL	Commercial	AGPL	Commercial
Pricing	FREE	\$995/yr	FREE	\$9,995/yr
	Download	Buy Now	Download	Download
	Learn More	Learn More	Learn More	Learn More



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RStudio

RStudio Desktop 1.0.136 — [Release Notes](#)

RStudio requires R 2.11.1+. If you don't already have R, download it [here](#).

Installers for Supported Platforms

Installers	Size	Date	MD5
RStudio 1.0.136 - Windows Vista/7/8/10	81.9 MB	2016-12-21	93b3f307f567c33f7a4db4c114099b3e
RStudio 1.0.136 - Mac OS X 10.6+ (64-bit)	71.2 MB	2016-12-21	12d6d6ade0203a2fcef6fe3dea65c1ae
RStudio 1.0.136 - Ubuntu 12.04+/Debian 8+ (32-bit)	85.5 MB	2016-12-21	0a20fb89d8aaeb39b329a640ddadd2c5
RStudio 1.0.136 - Ubuntu 12.04+/Debian 8+ (64-bit)	92.1 MB	2016-12-21	2a73b88a12a9fbaf96251cecf8b41340
RStudio 1.0.136 - Fedora 19+/RedHat 7+/openSUSE 13.1+ (32-bit)	84.7 MB	2016-12-21	fa6179a7855bff0f939a34c169da45fd
RStudio 1.0.136 - Fedora 19+/RedHat 7+/openSUSE 13.1+ (64-bit)	85.7 MB	2016-12-21	2b3a148ded380b704e58496befb55545

Zip/Tarballs

Zip/tar archives	Size	Date	MD5
RStudio 1.0.136 - Windows Vista/7/8/10	117.5 MB	2016-12-21	f415939bf5012c0ab127c7cfbc9600be
RStudio 1.0.136 - Ubuntu 12.04+/Debian 8+ (32-bit)	86.2 MB	2016-12-21	fca75f953dd425694b7fd4335bd29165
RStudio 1.0.136 - Ubuntu 12.04+/Debian 8+ (64-bit)	93.2 MB	2016-12-21	7cf0092653aa44fc76325a8f1325fb1f
RStudio 1.0.136 - Fedora 19+/RedHat 7+/openSUSE 13.1+ (32-bit)	85.4 MB	2016-12-21	30c89299d30ec03b38098e51e9bf49b8
RStudio 1.0.136 - Fedora 19+/RedHat 7+/openSUSE 13.1+ (64-bit)	86.6 MB	2016-12-21	ea2a262f650e92f568f48edc1c093902

Source Code

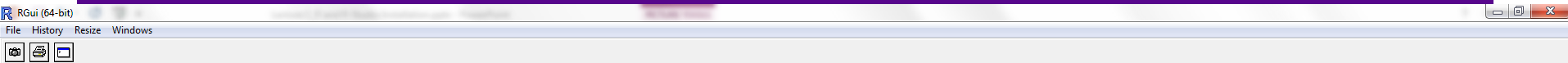
A tarball containing source code for RStudio v1.0.136 can be downloaded from [here](#)



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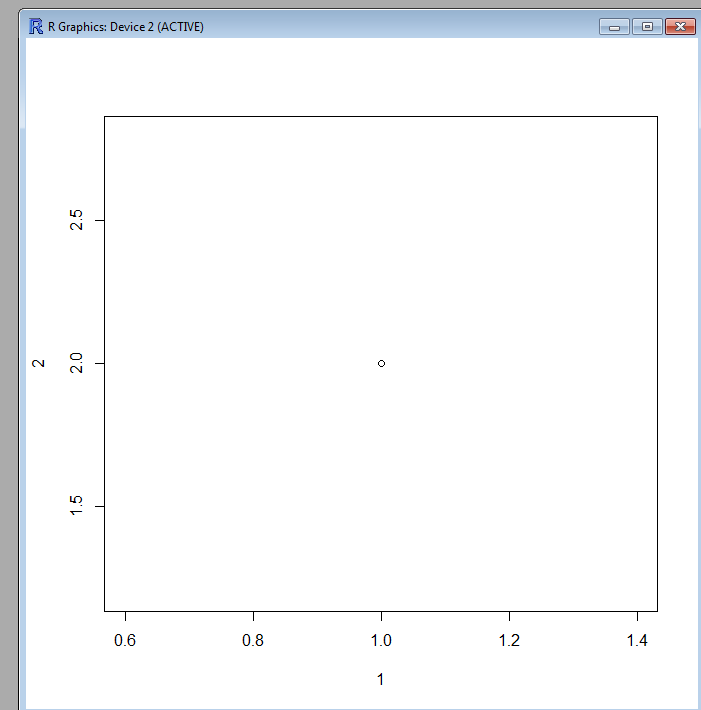
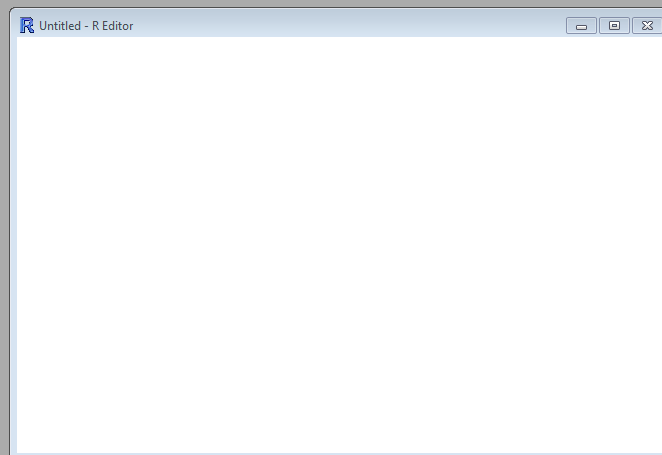
R Interface



```
R Console

Version 1.5.2 installed in C:/Users/Traffic/Documents/R/win-library/3.0
Version 1.6.1 available at http://cran.cs.wvu.edu
Update (y/N/c)? y
R.oo :
Version 1.15.8 installed in C:/Users/Traffic/Documents/R/win-library/3.0
Version 1.17.0 available at http://cran.cs.wvu.edu
Update (y/N/c)? y
R.utils :
Version 1.27.1 installed in C:/Users/Traffic/Documents/R/win-library/3.0
Version 1.28.4 available at http://cran.cs.wvu.edu
Update (y/N/c)? y
RODBC :
Version 1.3-9 installed in C:/Users/Traffic/Documents/R/win-library/3.0
Version 1.3-10 available at http://cran.cs.wvu.edu
Update (y/N/c)? y
foreign :
Version 0.8-55 installed in C:/Program Files/R/R-3.0.2/library
Version 0.8-59 available at http://cran.cs.wvu.edu

Update (y/N/c)? >
> plot(1,2)
> |
```



RStudio Interface

The screenshot displays the RStudio application window. The top menu bar includes File, Edit, Code, View, Plots, Session, Project, Build, Tools, and Help. Below the menu is a toolbar with icons for running code, saving, and navigating. The main workspace is divided into four panes: Source (left), Workspace (top right), History (bottom right), and Console (bottom left). The Source pane shows an R script with a function `manipulate` and a plot. The Workspace pane shows the active objects in the environment. The History pane shows a list of commands used so far. The Console pane shows the output of the R session, including the R version and platform information.

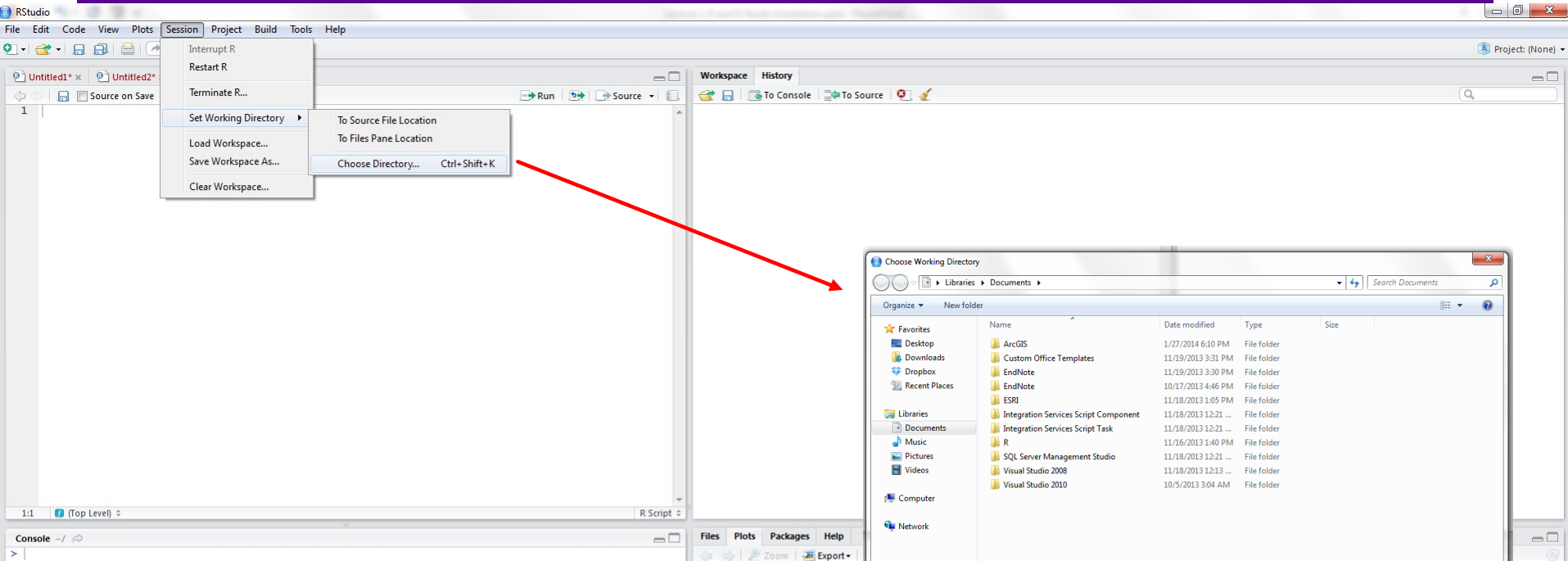
The source is where you write your script.

The workspace tab shows all the active objects (see next slide). The history tab shows a list of commands used so far.

The console is where you can type commands and see output.

The files tab shows all the files and folders in your default workspace as if you were on a PC/Mac window. The plots tab will show all your graphs. The packages tab will list a series of packages or add-ons needed to run certain processes. For additional info see the help tab.

Change Working Directory



If you have different projects you can change the working directory for that session, see above. Or you can type:

```
# Shows the working directory (wd)
getwd()

# Changes the wd
setwd("C:/myfolder/data")
```

Setup a Default Working Directory

The screenshot illustrates the steps to configure the default working directory in RStudio. The **Tools** menu is open, and the **Options...** option is selected. The **Options** dialog box is open, and the **Browse...** button next to the **Default working directory** field is highlighted. The **Choose Directory** dialog box is open, showing the **Libraries/Documents** folder selected in the **Libraries** section. The **Folder:** field at the bottom of the **Choose Directory** dialog is empty.

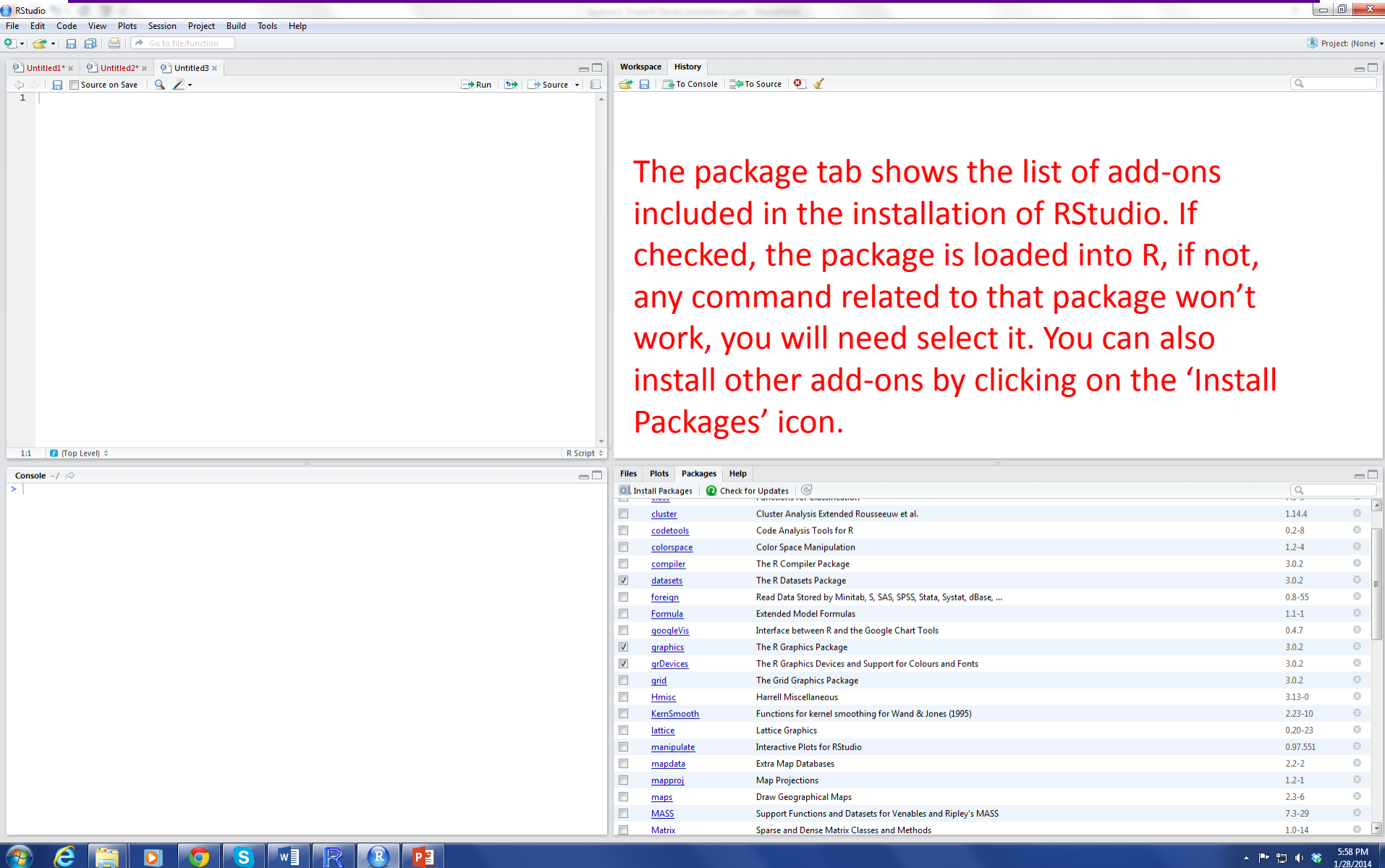
Options Dialog Box:

- General** tab is selected.
- R version:** [Default] [64-bit] C:\Program Files\R\R-3.0.2
- Default working directory (when not in a project):** ~
- Buttons:** Change..., Browse...
- ☒ Restore most recently opened project at startup
- ☒ Restore .RData into workspace at startup
- Save workspace to .RData on exit:** Ask
- ☒ Always save history (even when not saving .RData)
- ☐ Remove duplicate entries in history
- Default text encoding:** [Ask]
- Buttons:** Change..., OK, Cancel, Apply
- Other options:** Code Editing, Appearance, Pane Layout, Packages, Sweave, Spelling, Git/SVN

Choose Directory Dialog Box:

- Libraries/Documents** is selected in the **Libraries** section.
- Folder:** (Empty field)
- Buttons:** Select Folder, Cancel

Installing and Using Packages



The screenshot displays the RStudio application window. The top menu bar includes File, Edit, Code, View, Plots, Session, Project, Build, Tools, and Help. The main workspace area is currently empty, showing a blank R script file named 'Untitled1.R'. The bottom-left pane shows the Console with a prompt '>'. The bottom-right pane is the 'Packages' tab, which lists various R packages. The 'cluster' package is highlighted. The 'Install Packages' button is visible at the top of the package list.

The package list in the 'Packages' tab is as follows:

Package Name	Description	Version	Status
cluster	Cluster Analysis Extended Rousseeuw et al.	1.14.4	Installed
codetools	Code Analysis Tools for R	0.2-8	Installed
colorspace	Color Space Manipulation	1.2-4	Installed
compiler	The R Compiler Package	3.0.2	Installed
<input checked="" type="checkbox"/> datasets	The R Datasets Package	3.0.2	Installed
foreign	Read Data Stored by Minitab, S, SAS, SPSS, Stata, Systat, dBase, ...	0.8-55	Installed
Formula	Extended Model Formulas	1.1-1	Installed
googleVis	Interface between R and the Google Chart Tools	0.4.7	Installed
<input checked="" type="checkbox"/> graphics	The R Graphics Package	3.0.2	Installed
<input checked="" type="checkbox"/> grDevices	The R Graphics Devices and Support for Colours and Fonts	3.0.2	Installed
grid	The Grid Graphics Package	3.0.2	Installed
Hmisc	Harrell Miscellaneous	3.13-0	Installed
KernSmooth	Functions for kernel smoothing for Wand & Jones (1995)	2.23-10	Installed
lattice	Lattice Graphics	0.20-23	Installed
manipulate	Interactive Plots for RStudio	0.97.551	Installed
mapdata	Extra Map Databases	2.2-2	Installed
mapproj	Map Projections	1.2-1	Installed
maps	Draw Geographical Maps	2.3-6	Installed
MASS	Support Functions and Datasets for Venables and Ripley's MASS	7.3-29	Installed
Matrix	Sparse and Dense Matrix Classes and Methods	1.0-14	Installed

Installing and Using Packages

This is how to do it from the command line: i.e.,

```
install.packages('googleVis')
```

In each new R session where you use the package, you will have to load it:

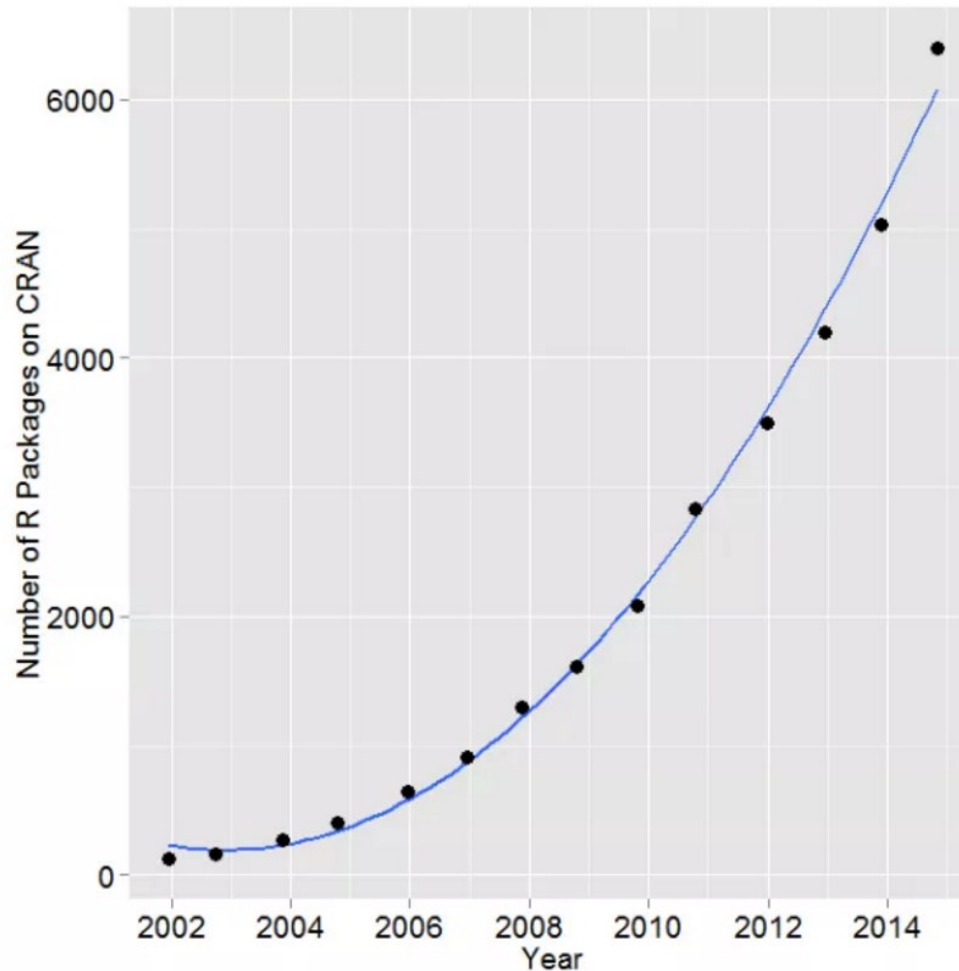
```
library('googleVis')
```



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R's Growth Continues to Accelerate

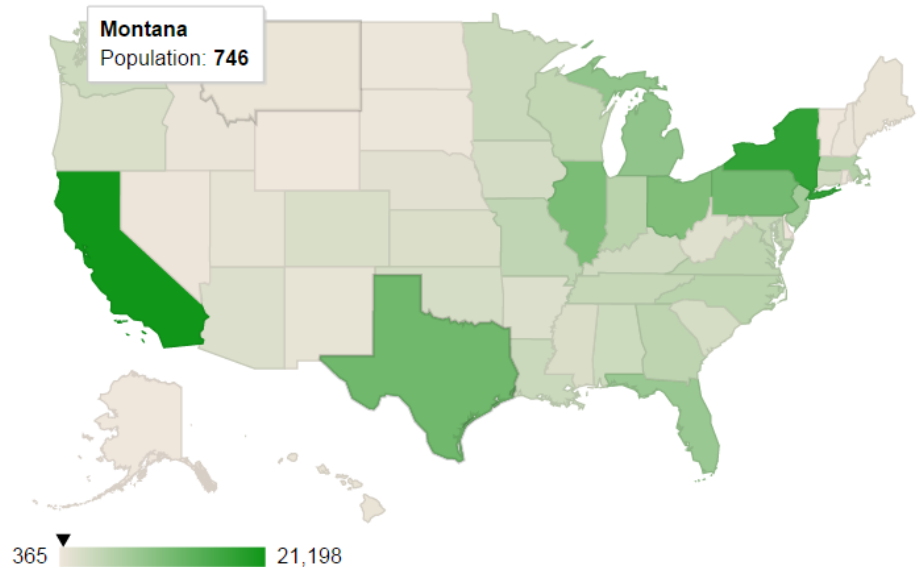


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Example 1: Showing US Data by State

```
install.packages('googleVis')
library(googleVis)
library(datasets)
states <- data.frame(state.name, state.x77)
GeoStates <- gvisGeoChart(states, "state.name",
  "Population",
  options=list(region="US",
    displayMode="regions",
    resolution="provinces",
    width=600, height=400))
plot(GeoStates)
```



Data: states • Chart ID: [GeoChartID216872803e25](#) • [googleVis-0.6.2](#)
R version 3.3.2 (2016-10-31) • [Google Terms of Use](#) • [Documentation and Data Policy](#)

Source: googleVis package

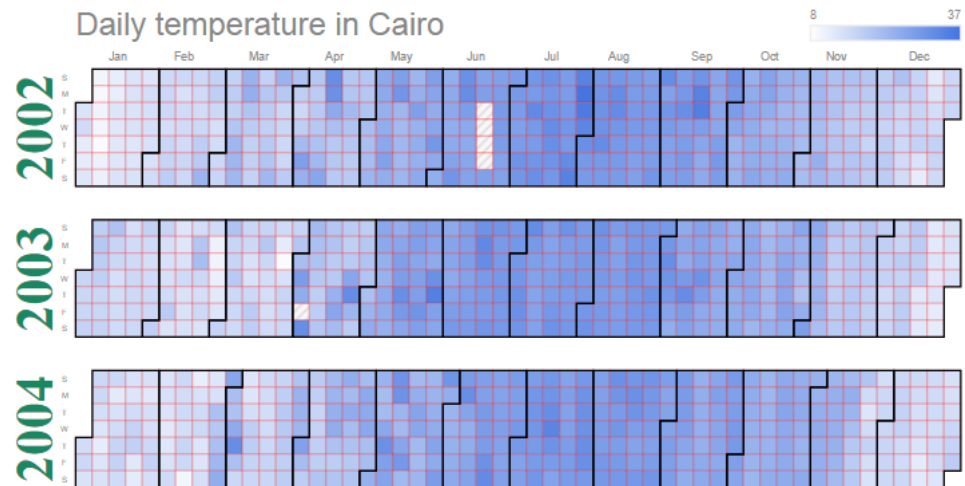


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Example 2: Daily Temperature in Cairo

```
Cal <- gvisCalendar(Cairo,  
  datevar="Date",  
  numvar="Temp",  
  options=list(  
    title="Daily temperature in  
Cairo",  
    height=320,  
    calendar="{yearLabel: {  
fontName: 'Times-Roman',  
fontSize: 32, color: '#1A8763',  
bold: true},  
cellSize: 10,  
cellColor: { stroke: 'red',  
strokeOpacity: 0.2 },  
focusedCellColor:  
{stroke:'red'}}}")  
plot(Cal)
```



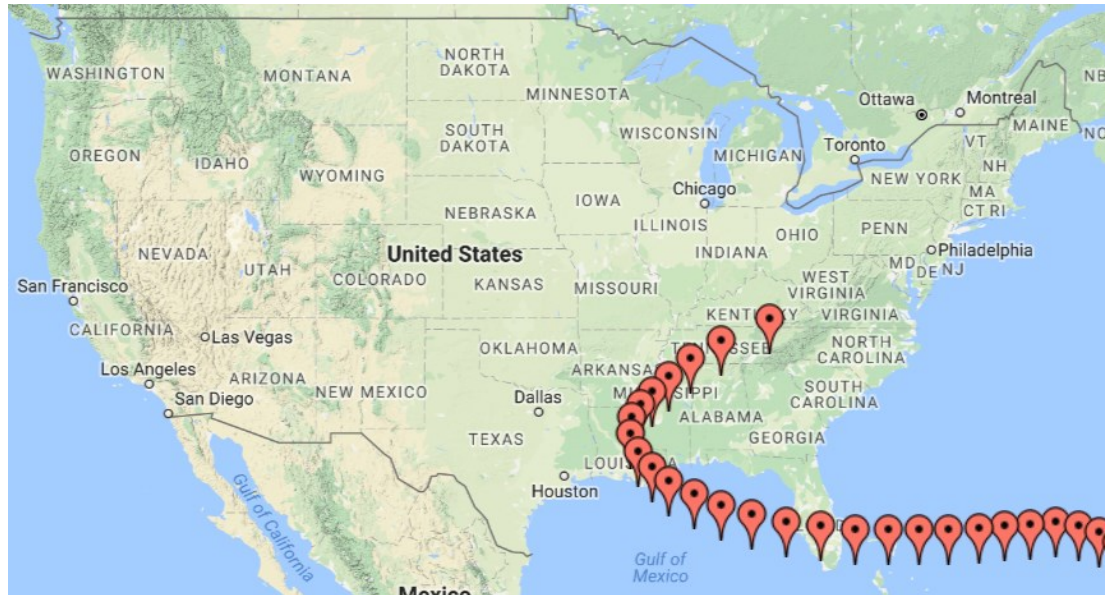
Source: googleVis package



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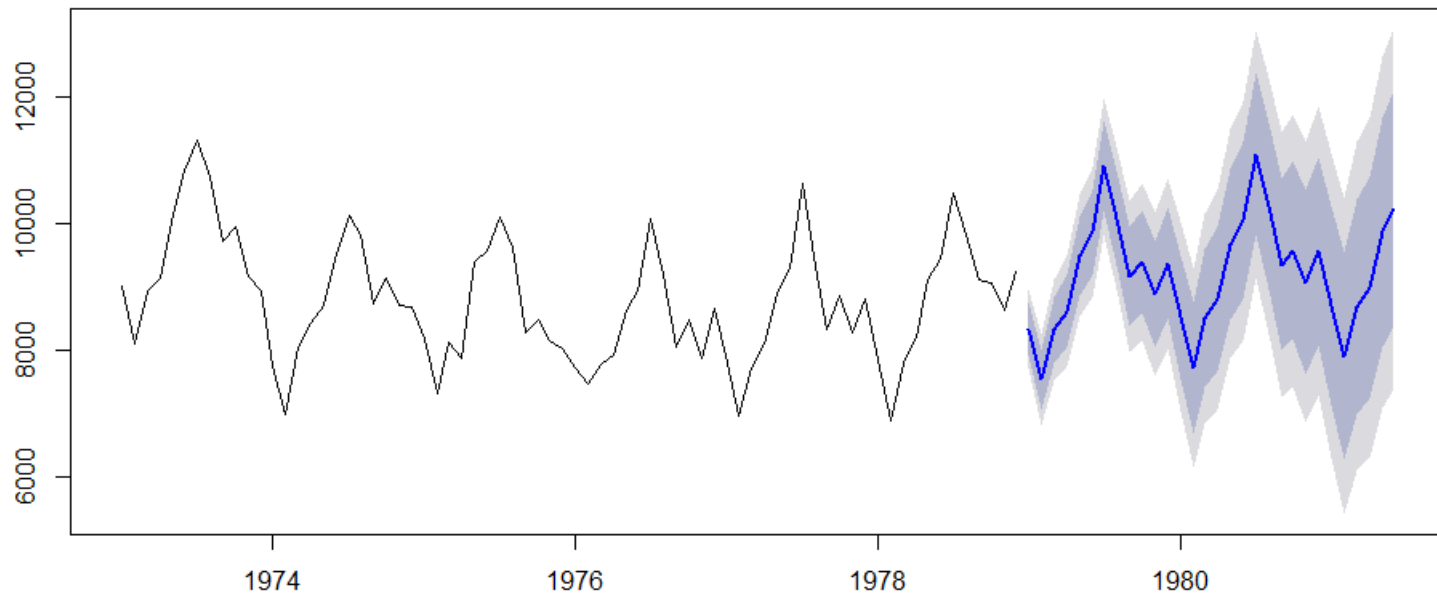
Example 3: Show Storm track with Markers



```
AndrewMap <- gvisMap(Andrew, "LatLong" , "Tip",  
  options=list(showTip=TRUE,  
    showLine=TRUE,  
    enableScrollWheel=TRUE,  
    mapType='terrain',  
    useMapTypeControl=TRUE))  
plot(AndrewMap)
```

Example 4: Modeling US Accident Deaths

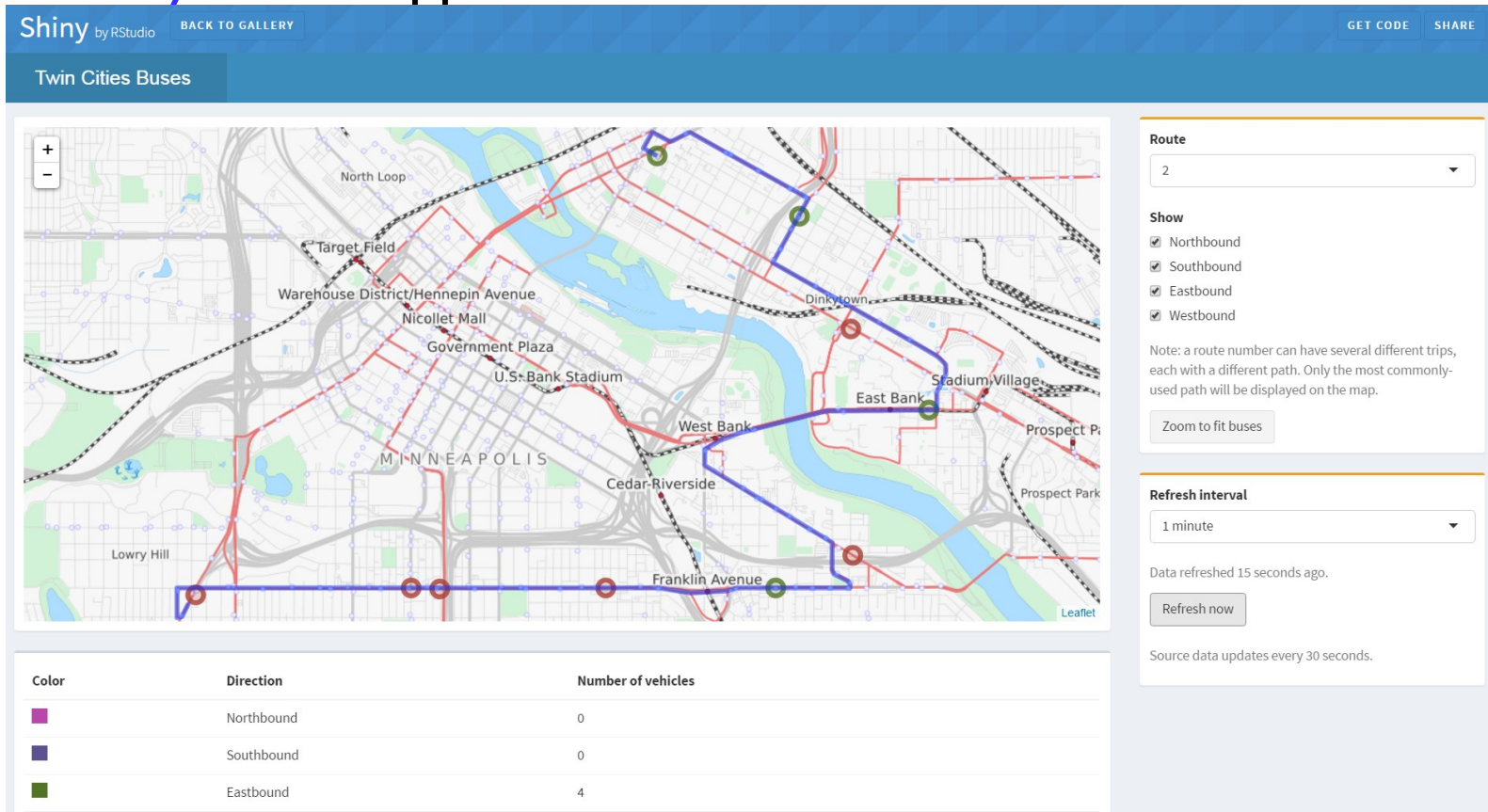
- Package: **forecast** Forecasts from $\text{ARIMA}(0,1,1)(0,1,1)[12]$



```
install.packages("forecast")  
library("forecast")  
fit <- auto.arima(USAccDeaths)  
plot(forecast(fit,h=30))
```

Example 5: Bus Dashboard

■ Shiny: A web application framework for R



Reference: <https://shiny.rstudio.com/gallery/bus-dashboard.html>



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References

- **Cookbook for R:** <http://www.cookbook-r.com/>
- **An Introduction to R:** <http://cran.r-project.org/doc/manuals/R-intro.pdf>
- **Google's R Style Guide:** <https://google.github.io/styleguide/Rguide.xml>



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Homework

- Install R and RStudio in your own laptops before the next class



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Thank You!



<http://engineering.nyu.edu/citysmart/>

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