

## Software for your own computer: **R, RStudio, LaTeX, PsychoPy**

You need to be able to use Zoom in order to attend lectures and labs. All the specialized software for the course is free and is install on the remote-access lab computes. If you want to use your own computer for homework and lab assignments, there are four software packages that you **must** install on it. They will allow you to work on the various class assignments away from the computing laboratory. The programs are: R, RStudio, LaTeX, and PsychoPy. All four are free.

- **R** is a free, powerful, open source statistical platform that offers state-of-the-art statistical analyses and graphing of data (R Core Team, 2020).
- **RStudio** (Team, 2020) is a user interface to R that is powerful, easy to use and overall better than the standard user interface that comes with R itself. RStudio is free. RStudio requires R to be installed on your computer.
- **LaTeX** is one oldest the typesetting systems for making beautiful documents from plain text. It is the de facto standard for publication of scientific documents in many fields and it is free. RStudio has popularized a simple way to produce nicely-formatted documents from plain text that allows you to produce formatted documents as pdf files (among other formats) using R Markdown (Xie, 2014). R Markdown documents can contain formatted text intermixed with R code. In this course we will use R Markdown for homework and lab reports. In order to create pdf files from R Markdown with your own computer you will need to install LaTeX on it.
- **PsychoPy** is a free, open-source program that allows you to design and run experiments that use visual and auditory stimuli (Peirce, 2007, 2009; Peirce & MacAskill, 2018). PsychoPy presents your stimuli, collects your data, and writes them into files that can then be analyzed by statistical programs, like R.

**If you have R and RStudio installed on your computer, update them to the latest versions (see next pages).**

## How to install R on your computer

1. Go to the R web site: <https://www.r-project.org>
2. Click on the CRAN link in the upper left part of the R page
3. You will probably be asked to choose a site from which to download R. You might see a long list of mirror sites (identical content). Choose <https://cloud.r-project.org>, and R will use a mirror site that is close to you and is not overloaded.
4. At the top of the download page you have three choices for precompiled binary versions: one for Windows, one for Mac, and one for Linux. Double click on the version appropriate for your computer to start the download.

After the download has finished, double click on the package to run the installer. Simply follow the instructions and the latest version of R will be installed: R version 4.0.2 (2020-06-22) -- "Taking Off Again" is the latest as of this writing (25.Aug.2020).

### Add-on Packages in R:

One of the many advantages of R is that it is extendable. On this date, there are 16,158 add-on packages for extending the power and capabilities of the basic R system! You can download and install the packages you need when you need them from RStudio. Packages, and their dependencies, that you will certainly need for the class are easily installed using the R script entitled “**R Package Installer for Students.R**” that you can download from the course web page. Run the script in RStudio: it will install additional packages that you will need for the course.

## How to install RStudio on your computer

**RStudio** (Team, 2020) is a free, powerful and flexible interface to R than is the simple console interface that comes with the R installation. It makes R easier to use and greatly expands its capability. You can use R-Markdown language to prepare elegant documents and reports that include the results of R calculations. You should always use RStudio instead of the R interface. You will need to use RStudio to prepare your own homework and lab reports. After you install R (see above) follow these steps to install RStudio:

1. Go to the RStudio web site: <https://www.rstudio.com> <https://www.rstudio.com>
2. Click on the large Download button
3. Choose the free version and download the file for RStudio Desktop
4. Open the downloaded file and drag the RStudio application to your Applications folder. The current version as of this writing is v 1.3.1073

R seems intimidating for beginners but really, all kidding aside, it is not complicated to use. You have all used R and RStudio in PSYC 2111 and in PSYC 3111 and it is normal to forget a lot when you don't use it every day. We will help you: please don't despair. Once you have R and RStudio installed on your computer, follow this free Introduction to R. You will learn most of the basic skills needed to move on to do the actual course work.

<https://www.datacamp.com/courses/free-introduction-to-r/>

## How to install LaTeX on your computer

RStudio has popularized a simple way to produce nicely formatted documents from plain text that allows you to produce documents in html, pdf, Microsoft Word and other formats, using R Markdown. In this class we will use R Markdown for homework and lab reports. You will need to install LaTeX on your computer because RStudio uses LaTeX to create pdf documents from R-Markdown. You do not need to know how to use LaTeX; RStudio takes care of that for you! These instructions are the same for Mac, Windows, and Linux computers.

1. First make sure that the R *tinytex* package is installed in your copy of R. It should have been installed if you used the “**R Package Installer for Students.R**” script described in the R section above.
  - 1.1. In RStudio, click on the Packages tab (RStudio lower right pane) and check if *tinytex* is installed;
  - 1.2. If not installed, install it. Click on the Install tab and type *tinytex* and then click on the Install button
2. After *tinytex* is installed in R, in the console window of RStudio (lower left pane) type this R command: **tinytex::install\_tinytex()**. Then *tinytex* should install the version of LaTeX appropriate for your computer. It will take a couple of minutes, depending on the speed of your internet connection.
3. After the *tinytex* installation has finished type this R command in the console: **tinytex::tlmgr\_update()** and wait for it to finish doing its updating.
4. When all is done restart RStudio or simply reboot your computer. Now you should be good to go for knitting R-Markdown to pdf files.
5. Later, when you are rendering R markdown files to pdf, you might be asked to install additional LaTeX packages. Always agree.
6. Sometimes, for reasons that are obscure, *tinytex* does not succeed in installing LaTeX or when you try to knit a pdf file you get an error message saying that LaTeX is not installed. If this happens to you, go to the LaTeX web page and follow their instructions for installing it on your computer and install MikTeX (Windows) or MacTeX (Mac): <https://www.latex-project.org/get/>
7. After the LaTeX system is installed on your computer, test it out. Open RStudio and from the File > New File menu choose R Markdown. Save the file on your desktop with a name. The new R Markdown document contains sample R Markdown code. Render the document to pdf using the *knit* tab to see if it works.

## How to install PsychoPy on your computer


**PsychoPy** is a computer program that allows you do design and carry out psychological experiments that use visual and/or auditory stimuli. It was written in Python by Jonathan Peirce at the University of Nottingham, England (Peirce, 2007, 2009; Peirce & MacAskill, 2018). It has a graphical interface that makes it relatively easy to make experiments happen. All the experiments that we have prepared for you in this course have been created in PsychoPy.

1. Go to the PsychoPy website: <https://www.psychopy.org/download.html>
2. The latest version, at this time, is v2020.2.3. Download this version to be compatible with the course software.
3. Click on the “install” tab at the top of the page to download the version for your computer. The web site will show a large blue button to download the version of PsychoPy that is appropriate for your computer. See the screen shot below from my own computer:

### Download

For the easiest installation download and install the Standalone package.

To install PsychoPy on **Mac OS 10.15.6** we recommend

 Standalone PsychoPy 2020.2.3 for MacOS

For all versions see the [PsychoPy releases on github](#)

**If you have problems installing any of the software, consult with Andrew or me.**

## References

- Peirce, J. W. (2007). PsychoPy--Psychophysics software in Python. *Journal of Neuroscience Methods*, 162(1-2), 8-13. <https://doi.org/10.1016/j.jneumeth.2006.11.017>
- Peirce, J. W. (2009, 15 January 2009). Generating stimuli for neuroscience using PsychoPy. *Frontiers in Neuroinformatics*, 2(January), 1-8. <https://doi.org/10.3389/neuro.11.010.2008>
- Peirce, J. W., & MacAskill, M. (2018). *Building Experiments in PsychoPy* (1st edition. ed.). SAGE Publications. <https://study.sagepub.com/psychology/resources/peirce-macaskill-building-experiments-in-psycho>
- R Core Team. (2020). *R: A language and environment for statistical computing*. In R Foundation for Statistical Computing. <https://www.R-project.org/>
- Team, R. (2020). *RStudio: Integrated development environment for R*. In (Version 1.2.5042) RStudio, Inc. <https://www.rstudio.org>
- Xie, Y. (2014). knitr: A Comprehensive Tool for Reproducible Research in {R}. In V. Stodden, F. Leisch, & R. D. Peng (Eds.), *Implementing Reproducible Computational Research* (pp. 3-32). Chapman and Hall/CRC. <http://www.crcpress.com/product/isbn/9781466561595>