

02 computing infrastructure

**teaching
data
science**

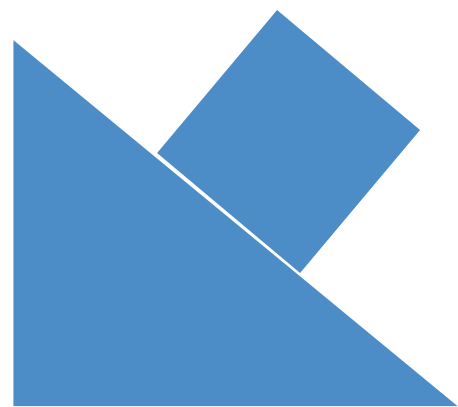
don't start like this

- Install R
- Install RStudio
- Install the following packages
 - rmarkdown
 - tidyverse
 - git
- Load these packages
- install git

start like this

- Go to rstudio.cloud
 - Log in
- > hello R!

why RStudio in the cloud?



reduce friction at first exposure to R



avoid local installation



install R and RStudio on a server and provide access to students:

- Centralized RStudio server
- Dockerized RStudio server
- RStudio Cloud

Çetinkaya-Rundel, Mine, and Rundel, Colin. "Infrastructure and tools for teaching computing throughout the statistical curriculum." The American Statistician (2018). Part of the Practical Data Science for Stats collection.

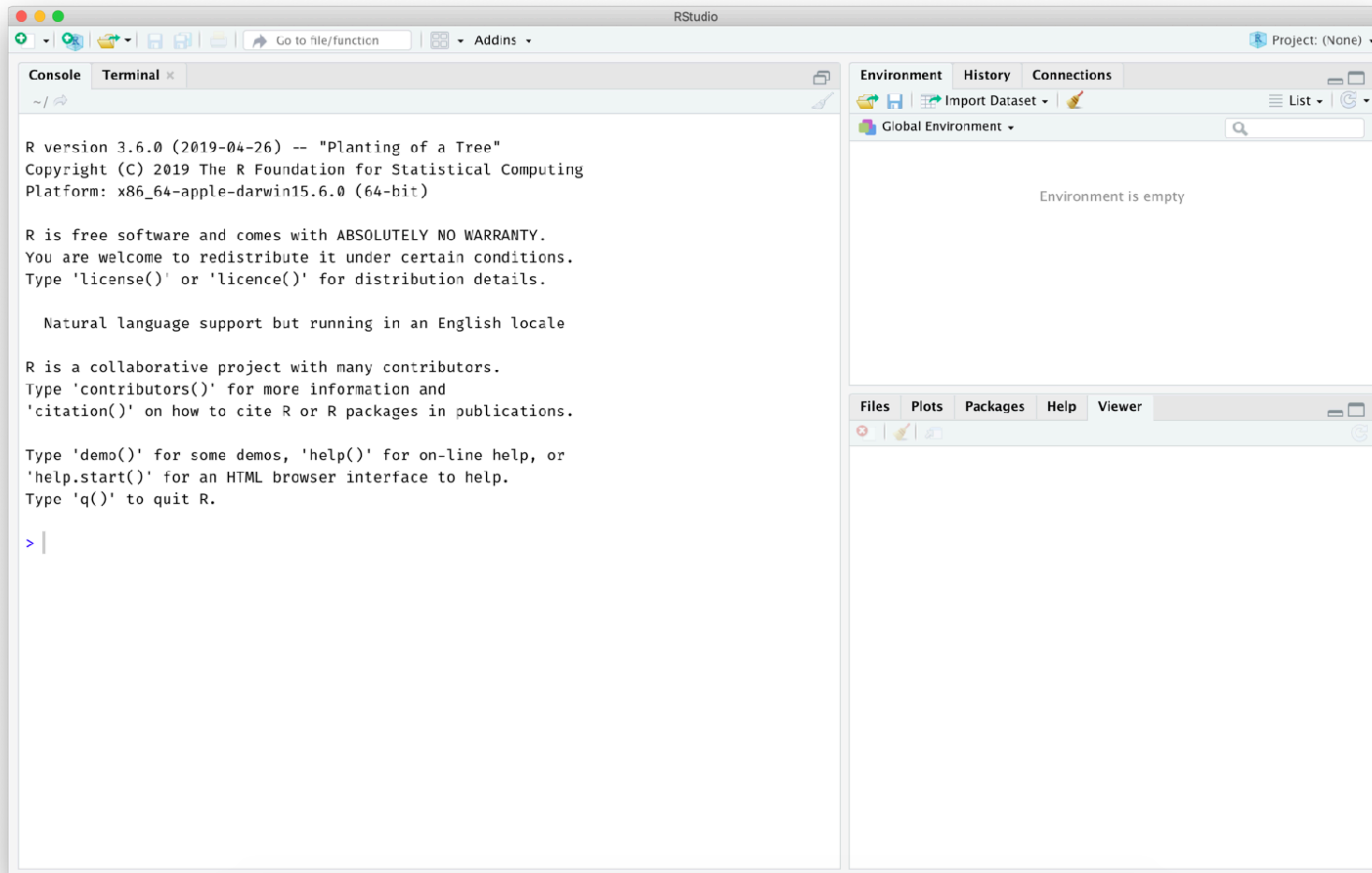
this workshop 😊



what is RStudio Cloud?



We created **RStudio Cloud** to make it easy for professionals, hobbyists, trainers, teachers, and students to do, share, teach, and learn data science using R.



Browser tab: RStudio Cloud
Address bar: <https://rstudio.cloud/project/374294>

Header: Your Workspace / Untitled Project + Click to name your project

Menu: File · Edit · Code · View · Plots · Session · Build · Debug · Profile · Tools · Help

Toolbar: Go to file/function | Addins | R 3.6.0

Console: /cloud/project/

```
R version 3.6.0 (2019-04-26) -- "Planting of a Tree"
Copyright (C) 2019 The R Foundation for Statistical Computing
Platform: x86_64-pc-linux-gnu (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

> |
```

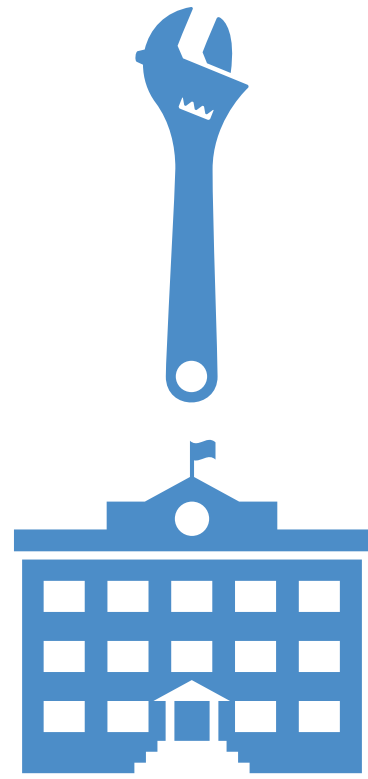
Environment: Global Environment

Files: New Folder | Upload | Delete | Rename | More

	Name	Size	Modified
	..		
<input type="checkbox"/>	.Rhistory	0 B	Jun 5, 2019, 8:32 AM
<input type="checkbox"/>	project.Rproj	205 B	Jun 5, 2019, 8:32 AM



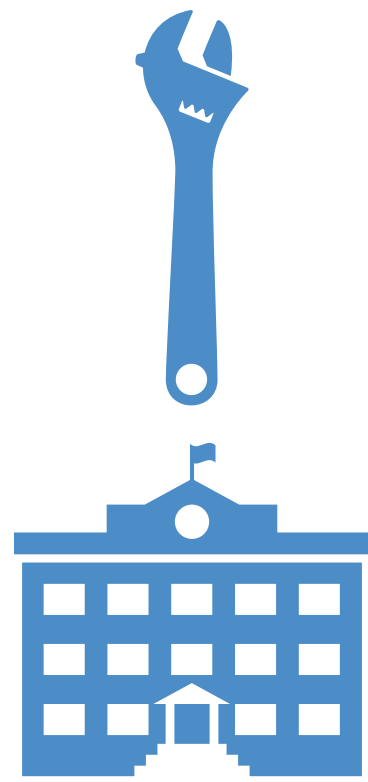
why RStudio Cloud?



does not require IT support

features designed for instructors:

why RStudio Cloud?

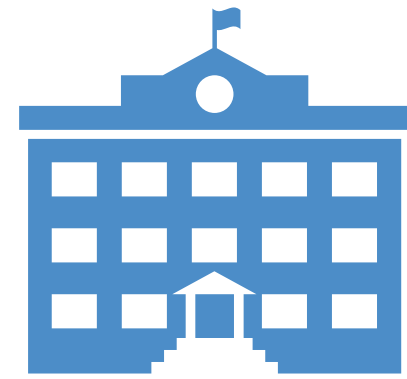


does not require IT support

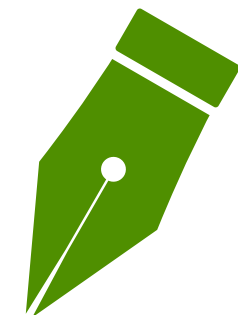
features designed for instructors:

- classes can be organized in workspaces
- members can be assigned different roles: instructor, TA, student
- projects can be public or private
- projects can be made into assignments
- students can make copies of projects created by instructor
- instructor can peek into student projects
- a base project template can ensure same packages in each new project created in the workspace
- git works out of the box

contexts

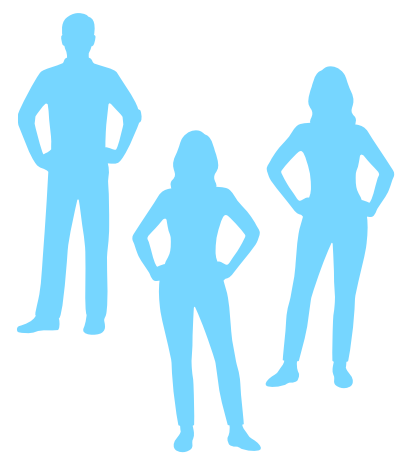
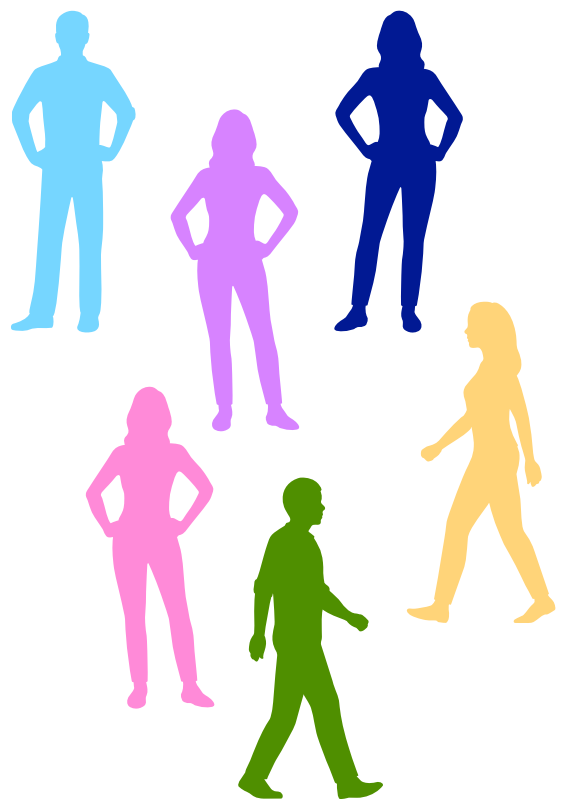


intro stat /
data science

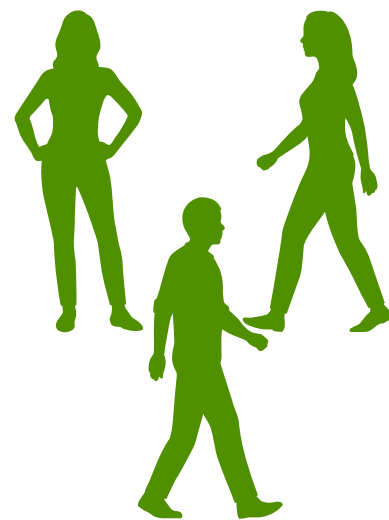


upper level stats / data
science / programming

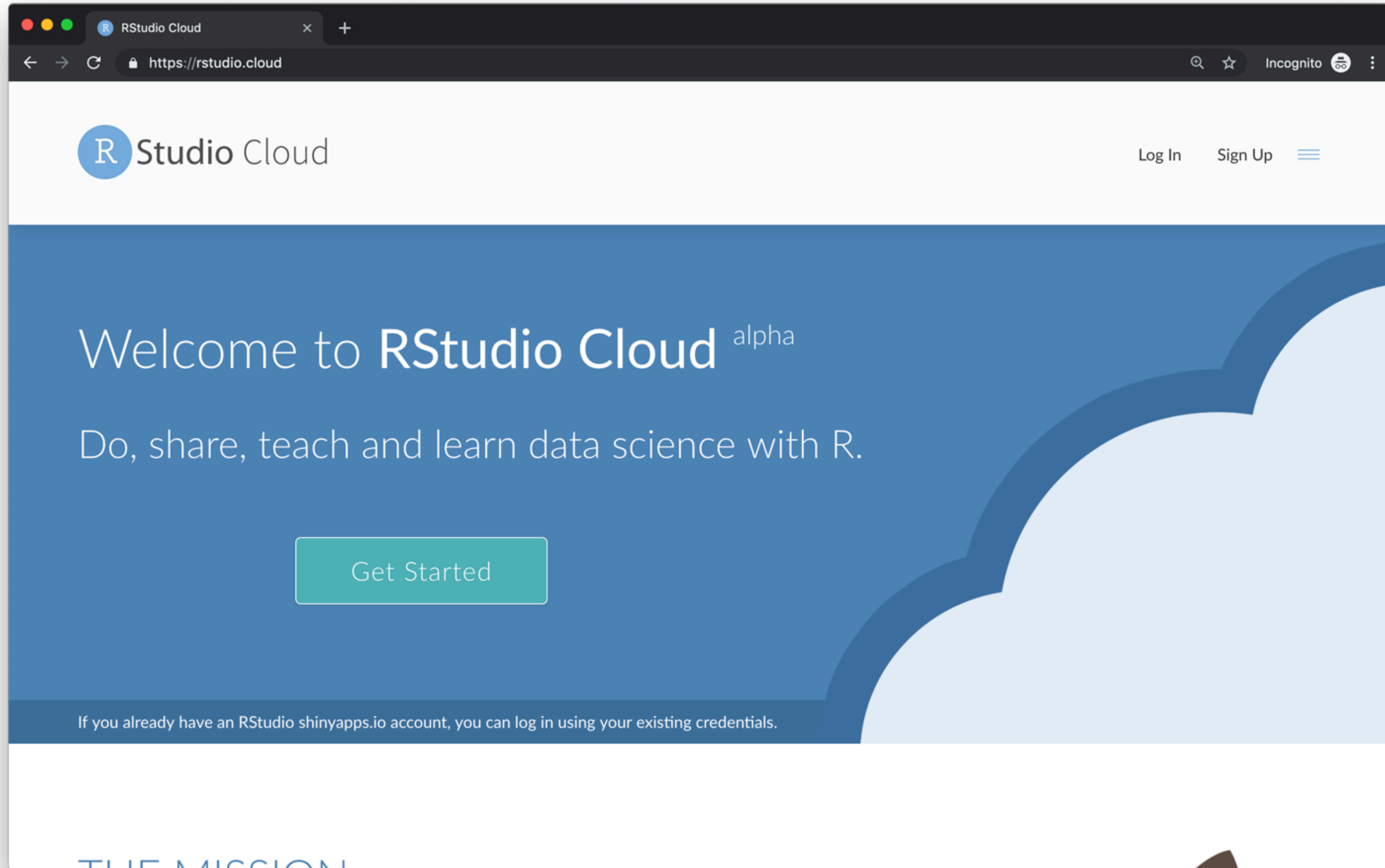
workshops

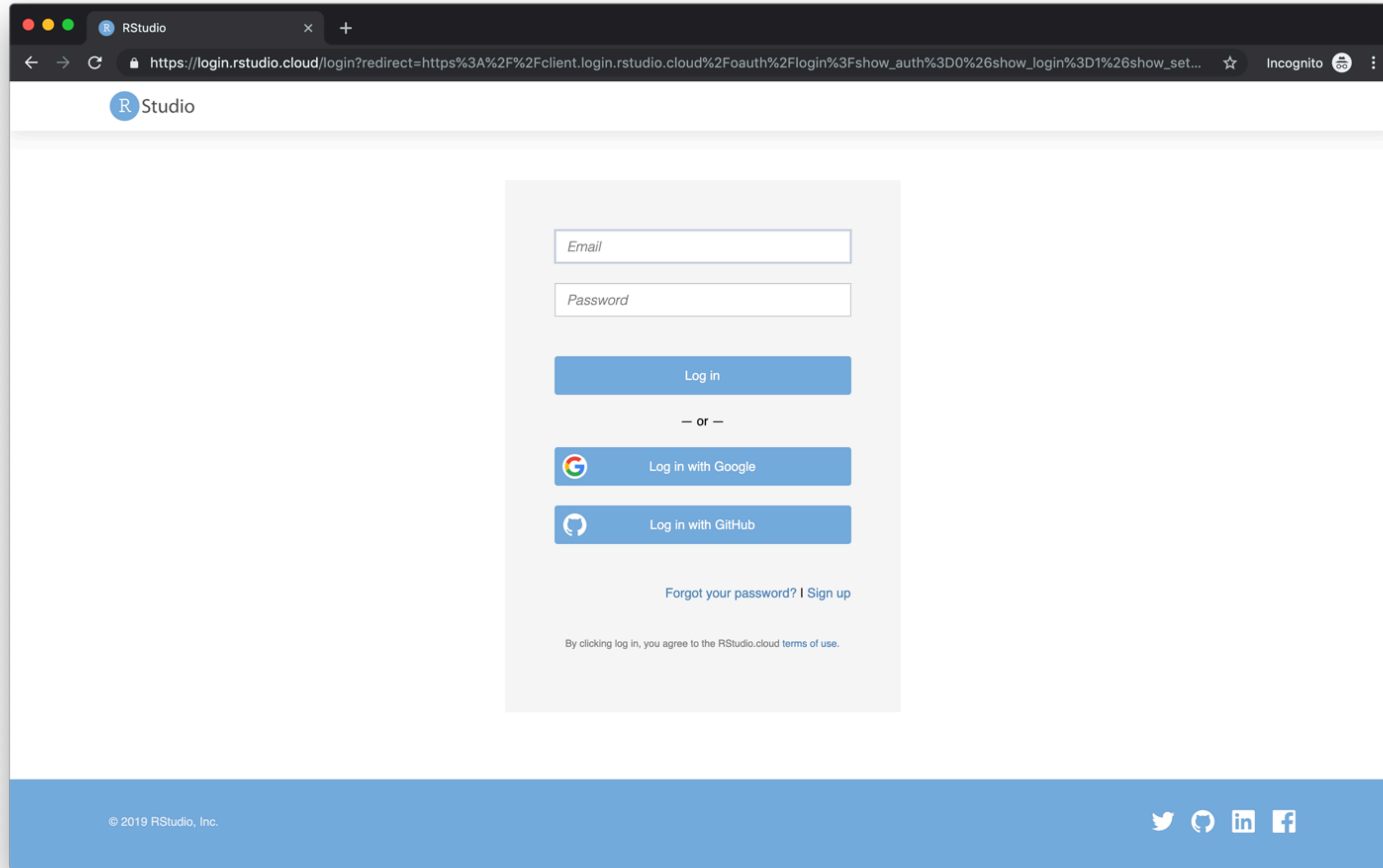


little to no background in
stats, data science,
programming



varied computing
background and different
computer setups



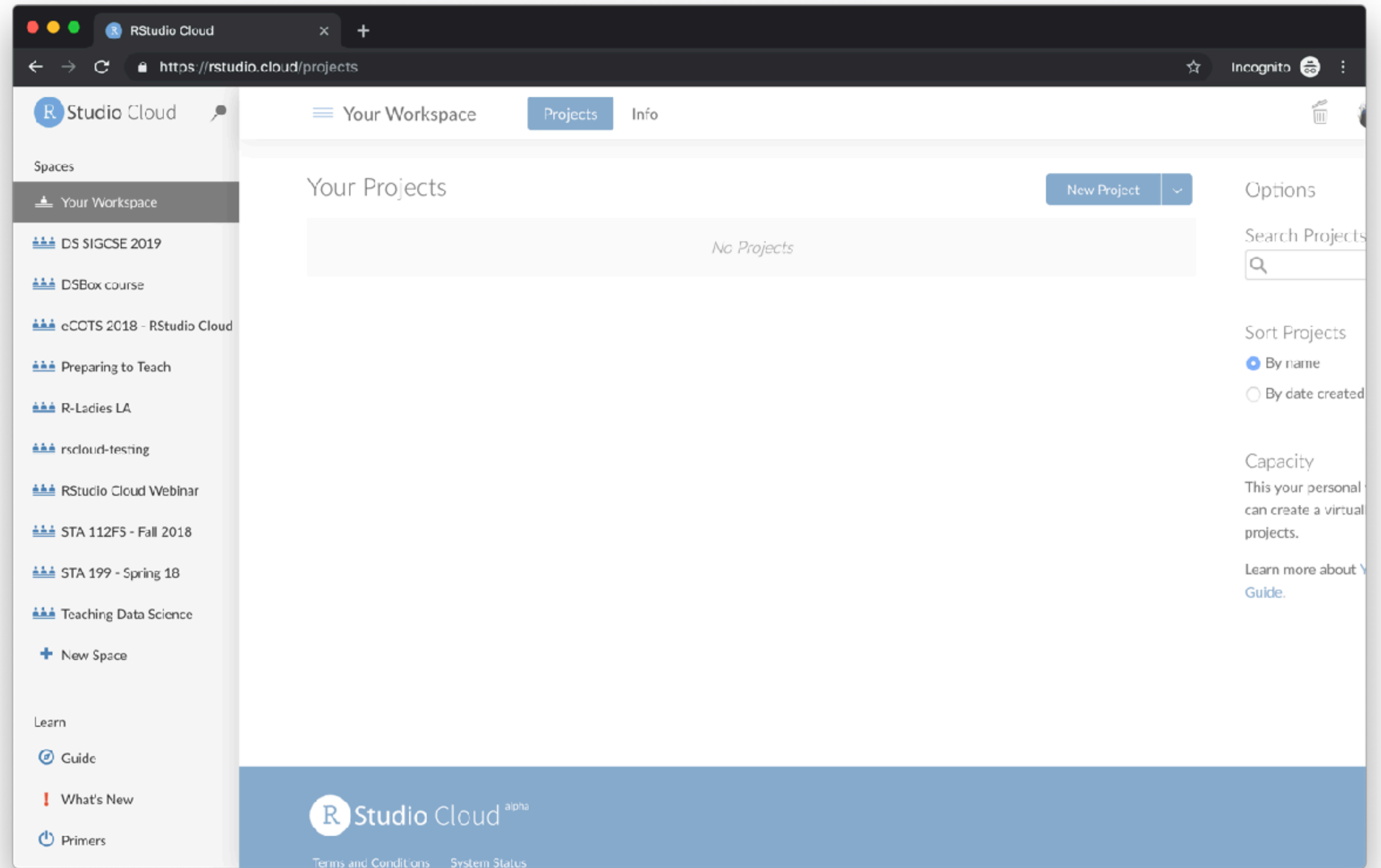


log in with Google,
GitHub, or
shinyapps.io

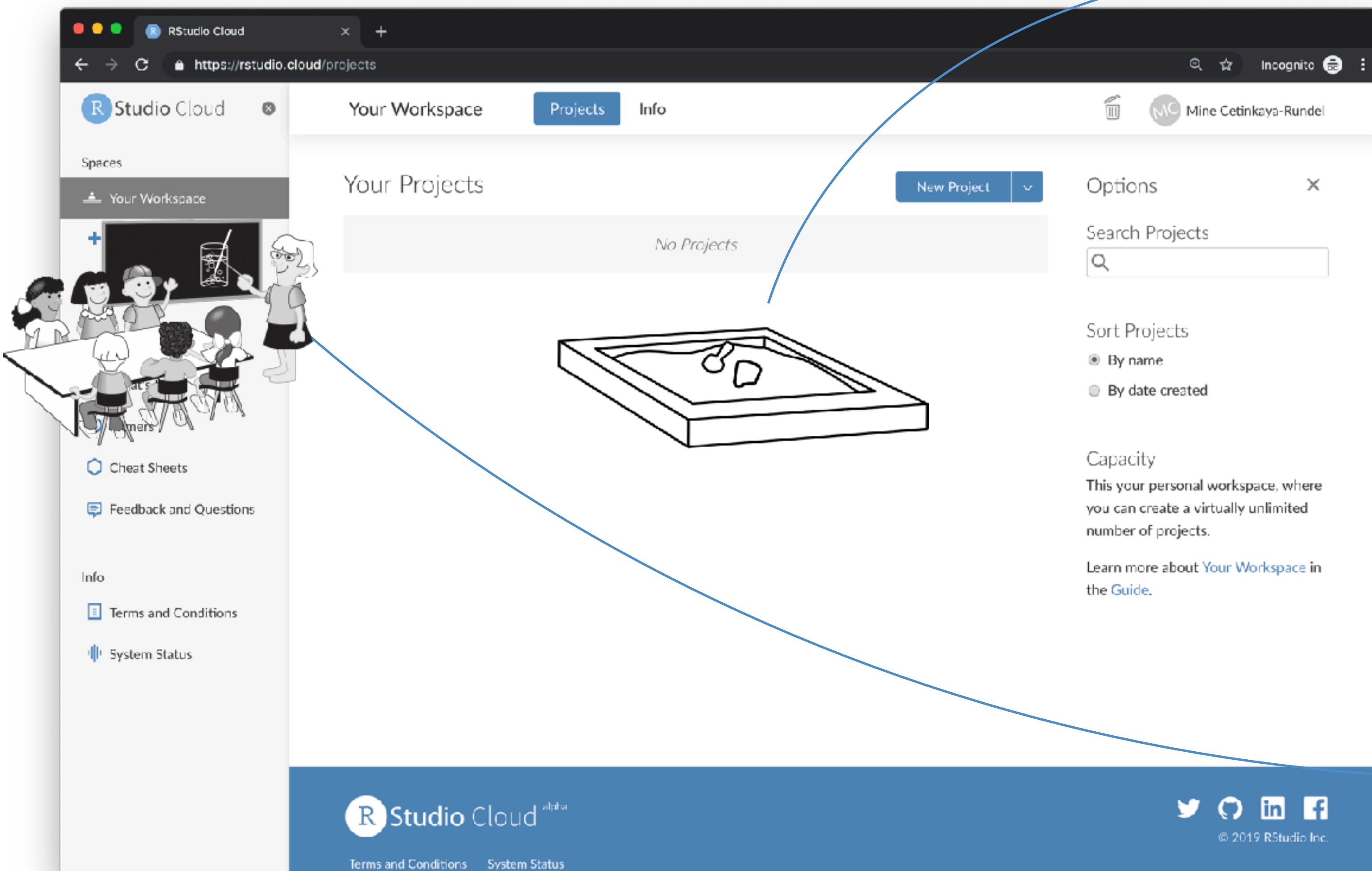
or create a new
account

> Your turn!

Log out of RStudio Cloud and log back in.



workspaces



when you create an account on RStudio Cloud you get a workspace of your own - projects you create here are can be public or private

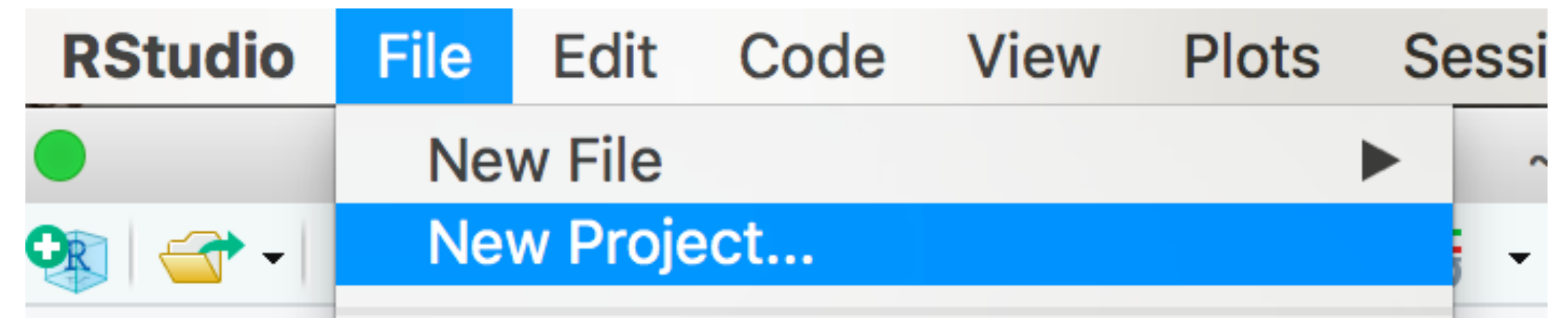
you can add a new workspace and control its permissions - projects you create here can also be public or private

projects

a new project in RStudio Cloud



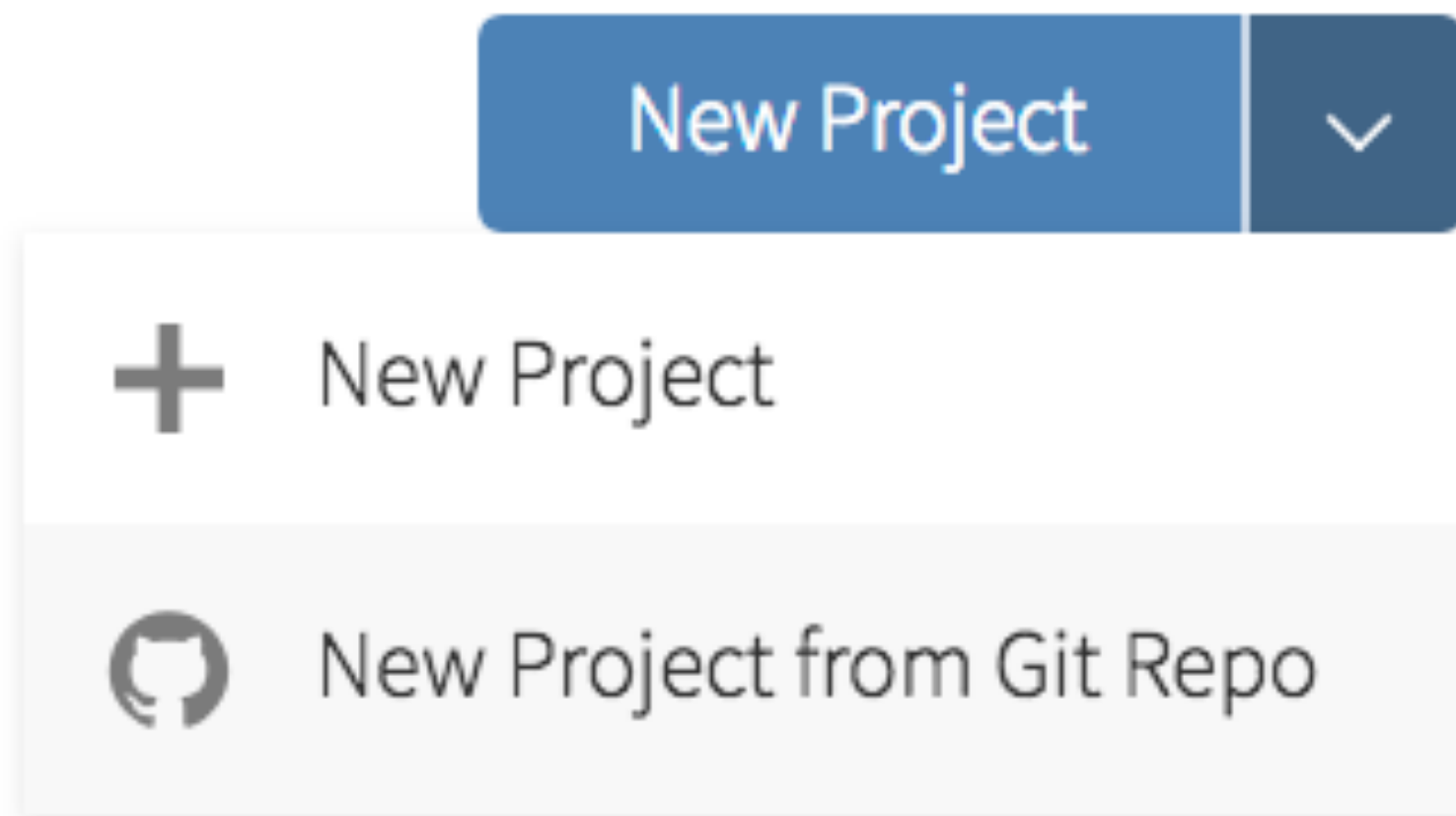
is a new project in RStudio



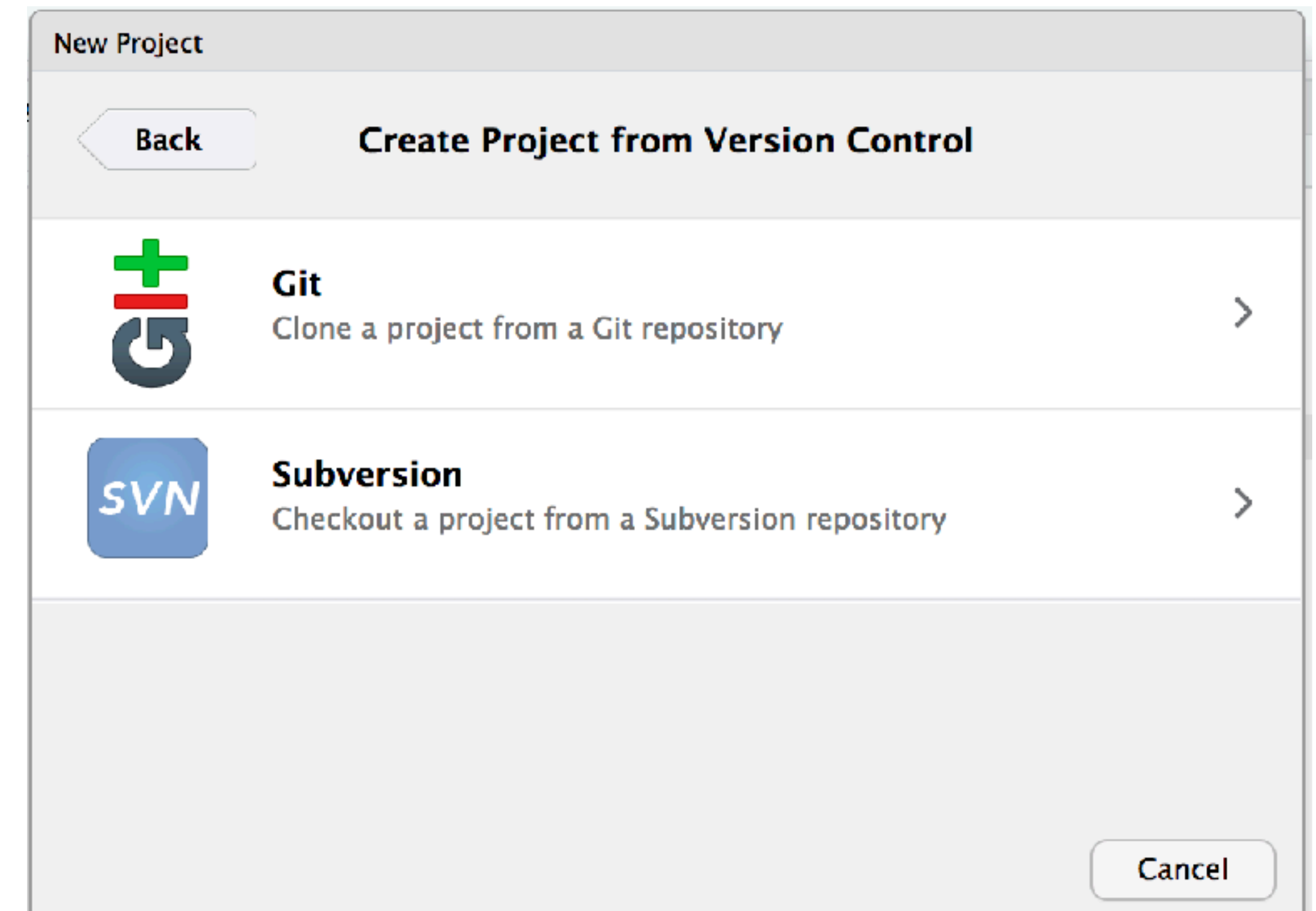
If you use RStudio, use projects! Trust me, you won't regret it. Find out more at r4ds.had.co.nz/workflow-projects.html.

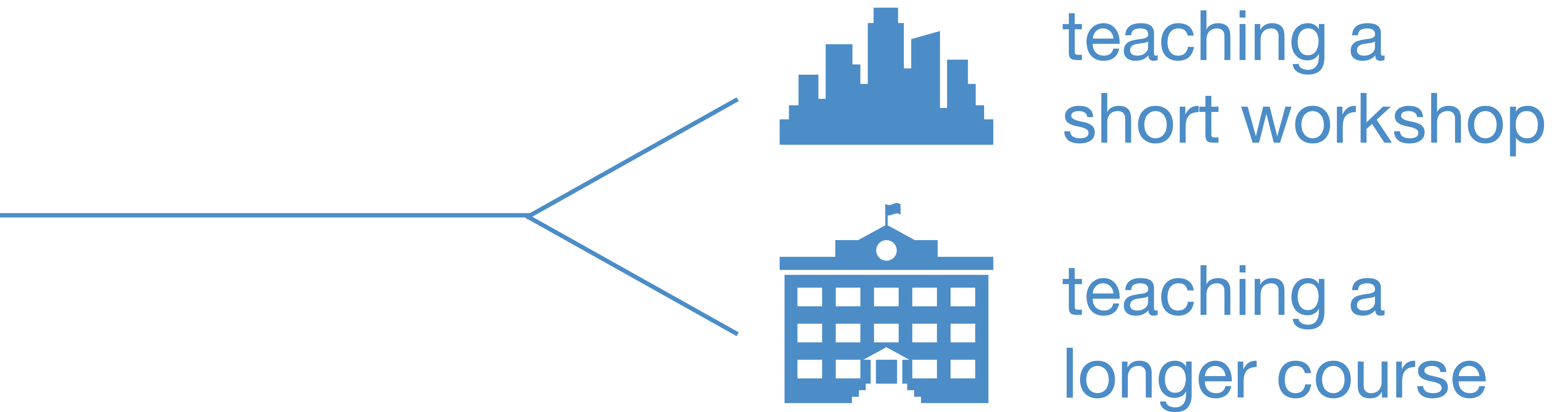
projects from git

a new project from Git Repo
in RStudio Cloud



is creating (cloning) a project
from a Git repository RStudio







teaching a
short workshop



teaching a
longer course



Mine CetinkayaRundel

@minebocek



Replying to @noamross @rstudio

Easy peasy, it'll even fit in a tweet:

- Go to rstudio.cloud -> Login -> New Project
- Install packages, add scripts, Rmds etc.
- Gear icon -> Access -> Everyone
- Copy URL and share

3:06 PM - 29 May 2019



instructor



student

Your Workspace

Projects

Info



Mine Cetinkaya-Rundel

Your Projects

New Project



No Projects

Options



Search Projects



Sort Projects

☒ By name

☐ By date created

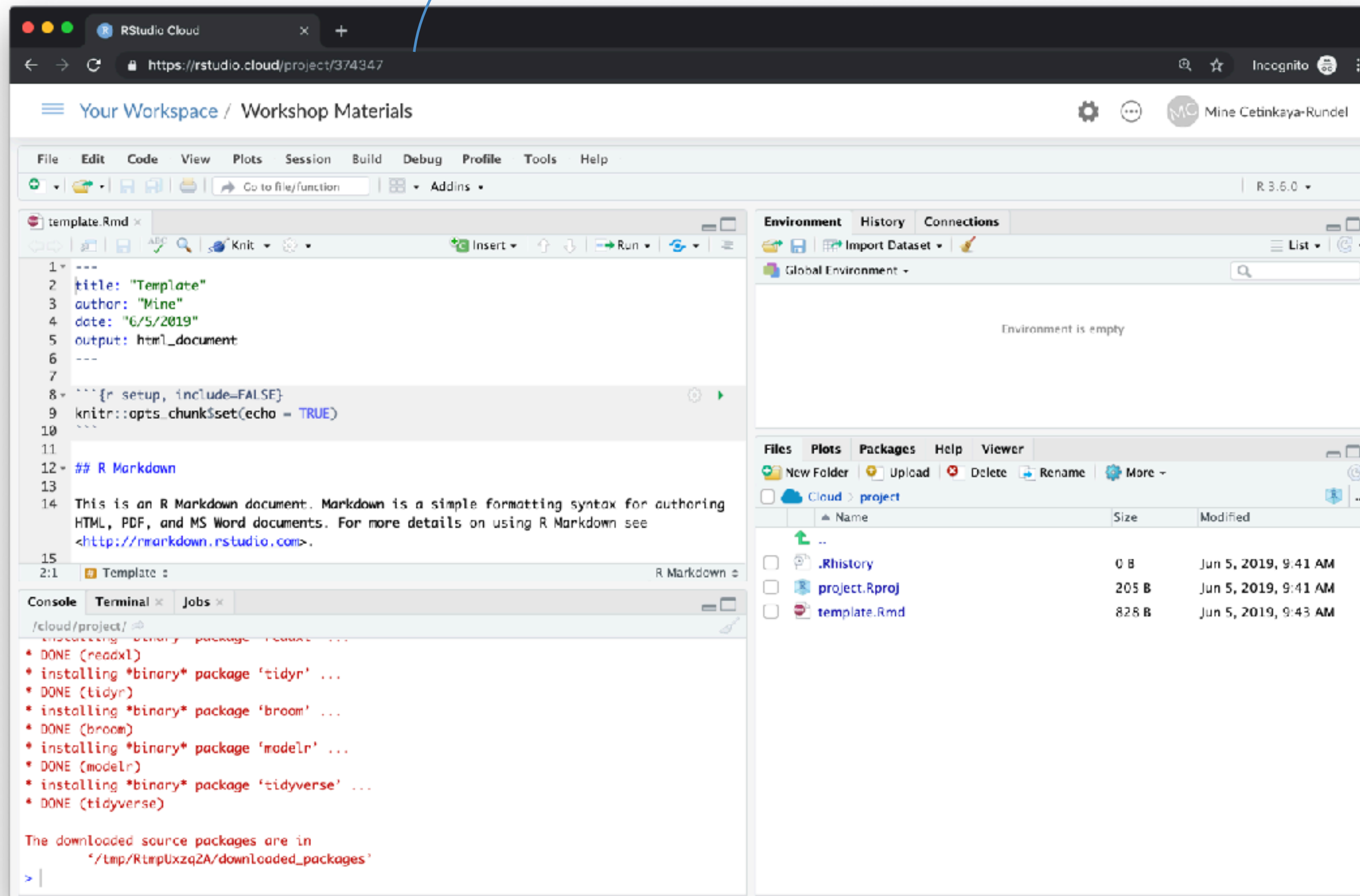
Capacity

This your personal workspace, where you can create a virtually unlimited number of projects.

Learn more about [Your Workspace](#) in the [Guide](#).



rstd.io/cloud-workshop-project



The screenshot displays the RStudio Cloud web interface in a browser window. The address bar shows the URL <https://rstudio.cloud/project/374347>. The page title is "Your Workspace / Workshop Materials". The user's name, "Mine Cetinkaya-Rundel", is visible in the top right corner.

The interface is divided into several panes:

- Code Editor:** Displays a file named "template.Rmd" with the following content:

```
1 ---  
2 title: "Template"  
3 author: "Mine"  
4 date: "6/5/2019"  
5 output: html_document  
6 ---  
7  
8 {r_setup, include=FALSE}  
9 knitr::opts_chunk$set(echo = TRUE)  
10  
11  
12 ## R Markdown  
13  
14 This is an R Markdown document. Markdown is a simple formatting syntax for authoring  
15 HTML, PDF, and MS Word documents. For more details on using R Markdown see  
16 <http://rmarkdown.rstudio.com>.
```
- Environment Pane:** Shows the "Global Environment" which is currently empty.
- Files Pane:** Displays a list of files in the "project" directory:

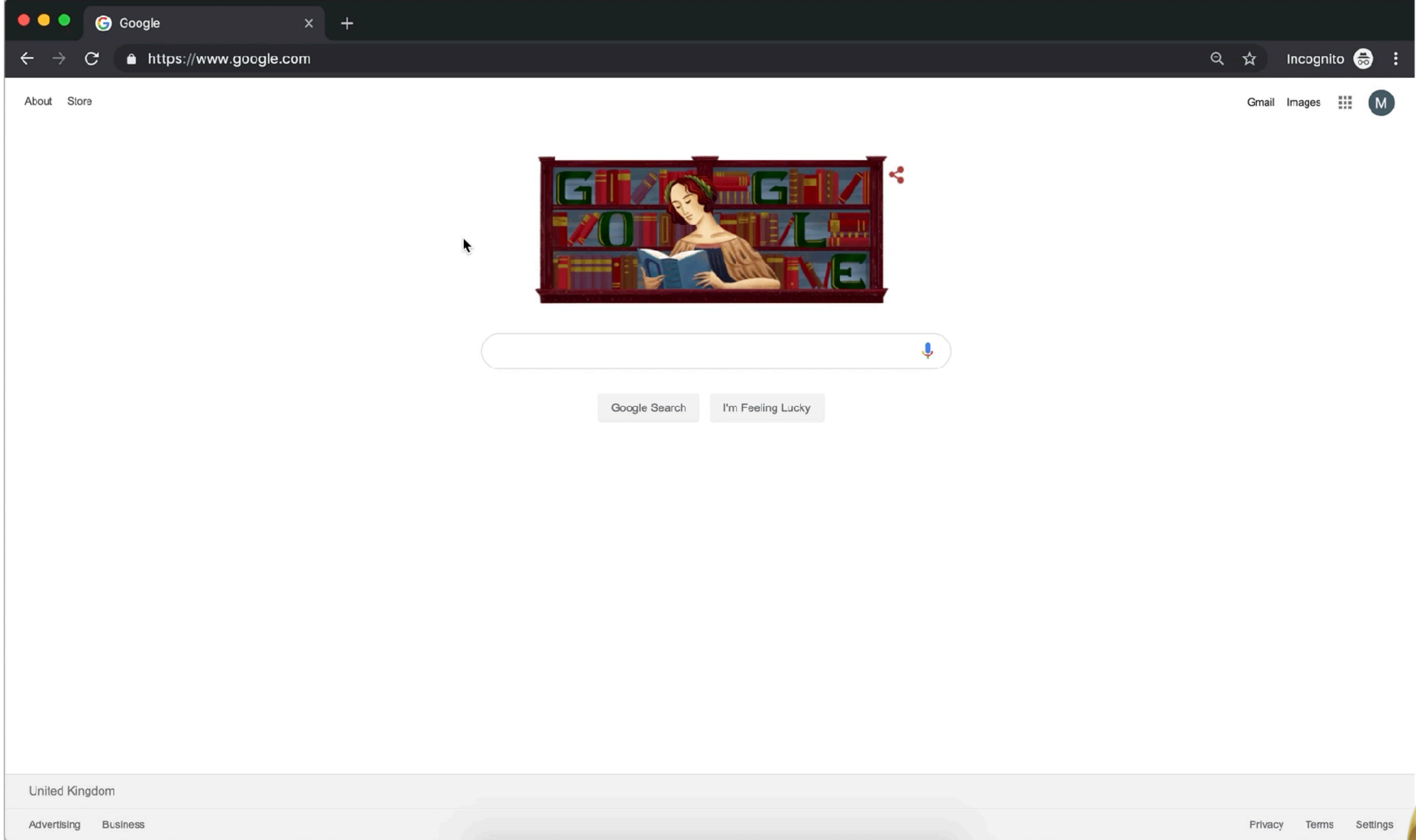
Name	Size	Modified
..		
.Rhistory	0 B	Jun 5, 2019, 9:41 AM
project.Rproj	205 B	Jun 5, 2019, 9:41 AM
template.Rmd	828 B	Jun 5, 2019, 9:43 AM
- Console:** Shows the output of the R session, including package installation status:

```
/cloud/project/  
* DONE (readxl)  
* installing *binary* package 'tidyr' ...  
* DONE (tidyr)  
* installing *binary* package 'broom' ...  
* DONE (broom)  
* installing *binary* package 'modelr' ...  
* DONE (modelr)  
* installing *binary* package 'tidyverse' ...  
* DONE (tidyverse)  
  
The downloaded source packages are in  
  '/tmp/RtmpUxzq2A/downloaded_packages'
```



rstd.io/teach-ds-latwR





sharing an individual project

✓ students land directly in a project upon login

✓ works well for workshops where all work will be completed in a single project

✓ also great for sharing code in general, e.g. collaboration, repxes, etc.

! students need to remember to make a copy of the project (which means you need to remember to remind them!)

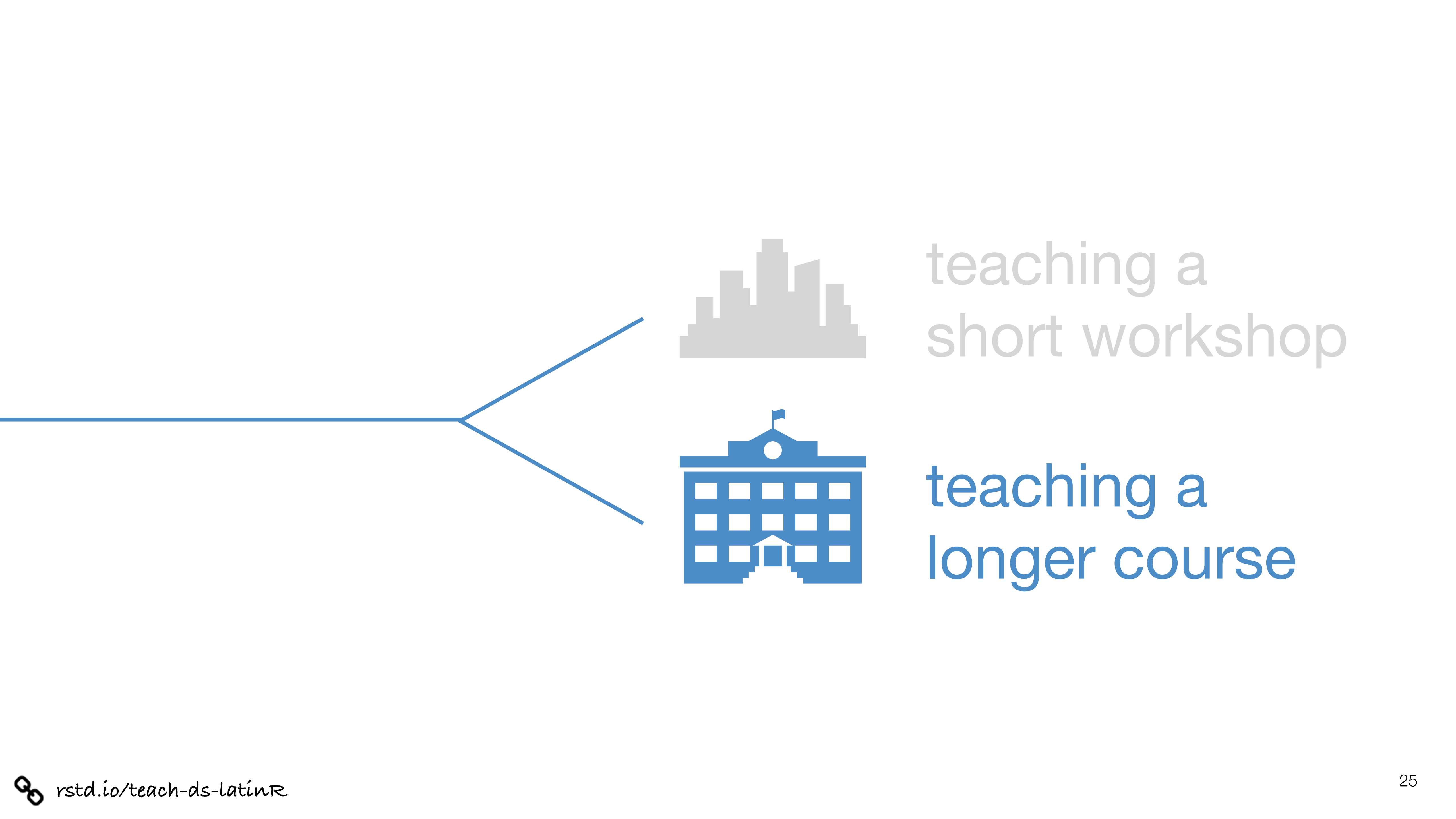
! changes you make after student launches the project won't propagate to their project

> Your turn!

You're the instructor:

- Create a new **project** and give it a name.
- Create a template R Markdown document in the project.
- Change the access level of the project so others can see it as well.
- Grab the project URL and share it with your neighbor:
 - *Tip:* You can create a short link for the URL at bitly.com.

Now you're the student: Access your neighbor's project as if you're the student and they're the instructor.



RStudio Cloud

https://rstudio.cloud/projects

Incognito

Studio Cloud

Your Workspace Projects Info

MC Mine Cetinkaya-Rundel

Spaces

Your Workspace

+ New Space

Learn

Guide

What's New

Primers

Cheat Sheets

Feedback and Questions

Info

Terms and Conditions

System Status

Your Projects

Workshop Materials

Created Jun 5, 2019 9:40 AM

New Project

Delete

Options

Search Projects

Sort Projects

By name

By date created

Capacity

This your personal workspace, where you can create a virtually unlimited number of projects.

Learn more about [Your Workspace](#) in the [Guide](#).



> Your turn!

You're the instructor:

- Create a new **workspace** and give it a name.
 - *Tip:* Check in with your neighbor and use a different name.
- Add a short description.

getting students into class workspace

Access

- ☐ Invitation required
Add specific members to the space by sending invitations.
- ☒ Shared
Anyone with the sharing link can access the space.

Initial Role



Contributor



Copy Sharing Link

after drop/add switch over to this access level, use invitations for visitors added mid-semester

make workspace shared for a short period of time, share link with students, enroll them as contributors



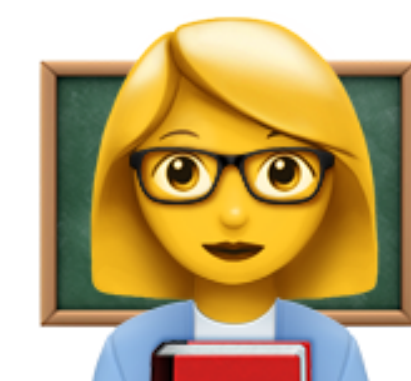
permission levels

admin manage users, view, edit and manage all projects **instructor**

moderator view, edit and manage all projects **TA**

contributor create, edit and manage their own projects **student**

viewer view projects shared with everyone **auditor**



permissions

Permissions

- ☒ Contributors can see the members list
- ☐ Contributors can make their projects visible to all members
- ☐ Viewers can see the members list

students can see each others' names, but cannot change the visibility of their projects

auditors / visitors can't see students' names



capacity

Capacity

This space can have up to 9 more members.

Request More Members



Request More Members



Total number of members you'd like in this space (approximate)

20



What you're using this space for

You should hear from us via our support system within 24 hours.

Thanks,
The RStudio Cloud Team

Request More Members



> Your turn!

You're the instructor:

- Change the settings of your workspace to Shared.
- Change the permissions so that contributors or viewers can't see the list of members and can't change the visibility of their projects.

RStudio Cloud

https://rstudio.cloud/spaces/18838/projects

Incognito

RStudio Cloud Webinar

Projects

Members

Info

MC Mine Cetinkaya-Rundel

All Projects

New Project

No Projects

Options

Search Projects

List Projects

All

Shared with everyone

Yours

Sort Projects

By name

By date created

Capacity

This space can have up to 25 more projects.

Request More Projects

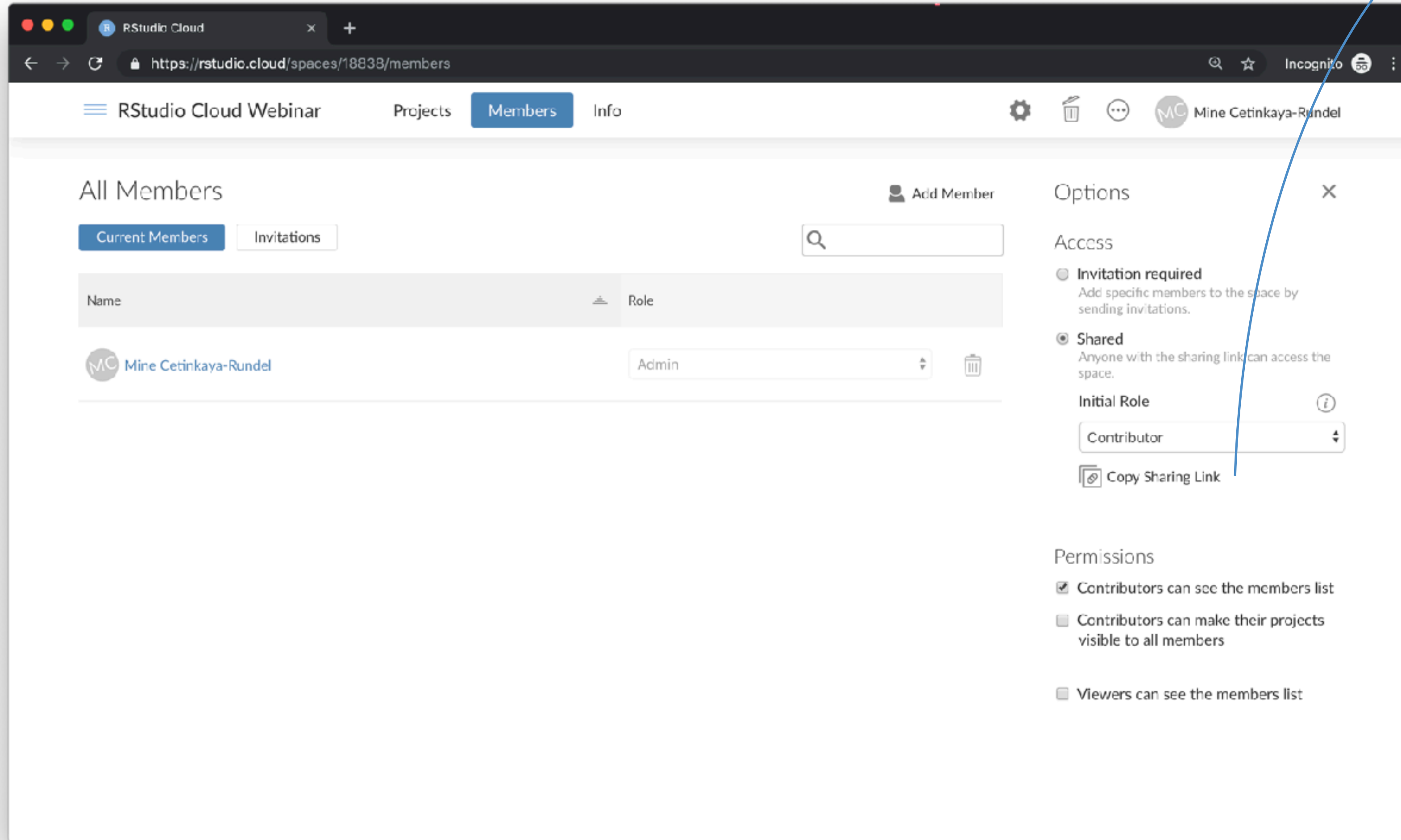


> Your turn!

You're the instructor:

- Add a base project to your workspace:
 - Install one or two of your favorite packages.
 - Start an R Markdown document so necessary packages get installed.
 - Add a `code-of-conduct.md`.
 - Make this project visible to everyone.
- In the settings menu, set this project as the base project.
- Create a new assignment: **hw-01**.

rstd.io/cloud-course-workspace



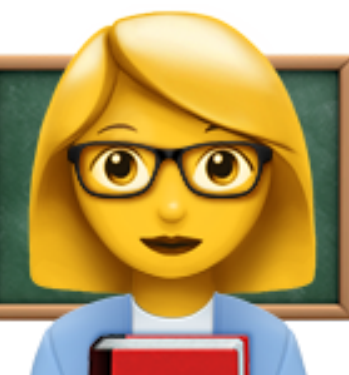
The screenshot shows the RStudio Cloud interface for managing workspace members. The browser address bar displays `https://rstudio.cloud/spaces/18833/members`. The page title is "RStudio Cloud Webinar". The navigation bar includes "Projects", "Members" (active), and "Info". The user profile "Mine Cetinkaya-Rundel" is visible in the top right.

The main content area is titled "All Members" and includes an "Add Member" button. Below this is a table of current members:

Name	Role
Mine Cetinkaya-Rundel	Admin

To the right of the table is a search bar and an "Options" sidebar. The "Options" sidebar contains the following settings:

- Access:** ☐ Invitation required (Add specific members to the space by sending invitations.) and ☒ Shared (Anyone with the sharing link can access the space.)
- Initial Role:** A dropdown menu currently set to "Contributor".
- Copy Sharing Link:** A button to copy the workspace's sharing link.
- Permissions:** A list of checkboxes:
 - ☒ Contributors can see the members list
 - ☐ Contributors can make their projects visible to all members
 - ☐ Viewers can see the members list



About Store

Gmail Images  Sign in



Google Search

I'm Feeling Lucky



A privacy reminder from Google

REMIND ME LATER

REVIEW NOW

United Kingdom

Advertising Business

Privacy Terms Settings



> Your turn!

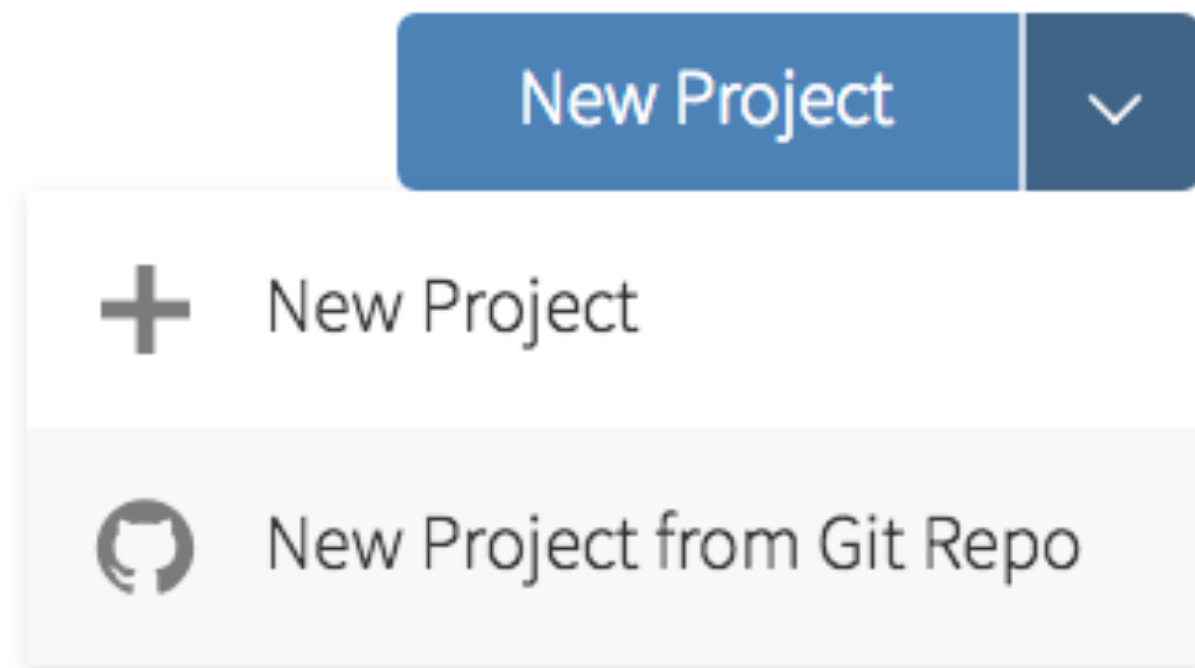
You're the instructor:

- Grab the sharing link for your workspace.
- Optional: Make a short link for it.
- Share it with your neighbor.

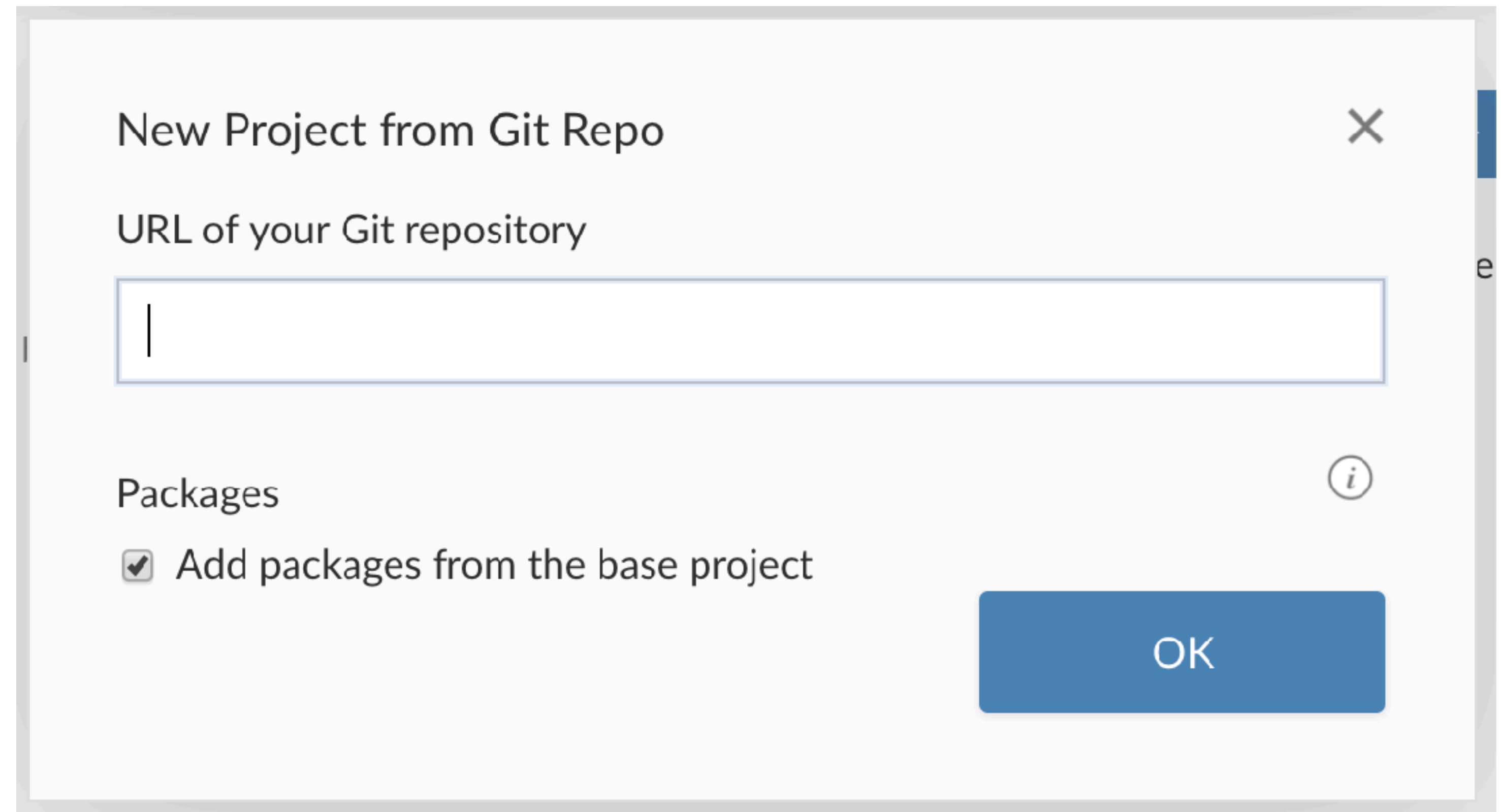
Now you're the student:

- Access your neighbor's workspace and start the assignment.

git integration



+ base project template can be used, so new project from git also has the right packages installed!



sharing a workspace

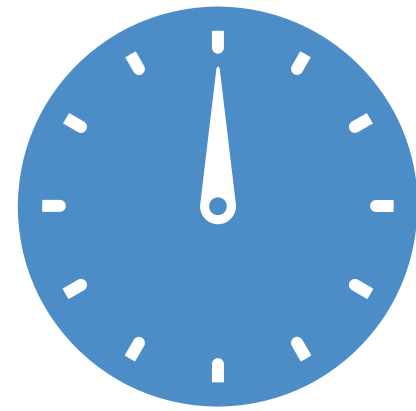
- ✓ various permission levels
- ✓ base projects with desired packages installed
- ✓ assignments, which remove the need to remind students to make a copy of the project before starting work
- ✓ ability to peek into students' projects

! students land in the workspace, may need to provide instructions for the next steps

! you can update the base project throughout the course, but it will only be applied to projects created going forward

parting remarks

tips



each project is allocated 1GB of RAM



test things out before assignments
involving large datasets



what your students see is not always what
you see



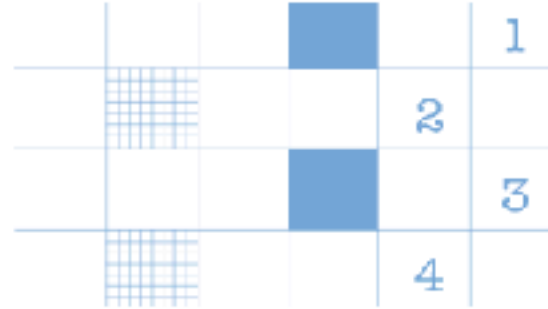
create a secondary account and add as a
student

The Basics



Start here to learn the skills that you will rely on in every analysis (and every primer that follows): how to inspect, visualize, subset, and transform your data, as well as how to run code.

Work with Data



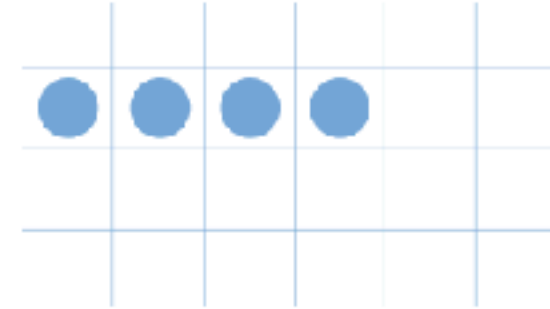
Learn the most important data handling skills in R: how to extract values from a table, subset tables, calculate summary statistics, and derive new variables.

Visualize Data



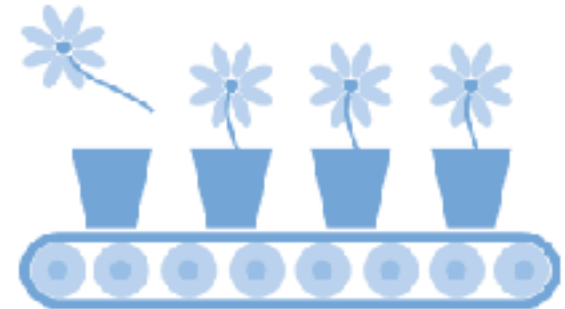
Learn how to use ggplot2 to make any type of plot with your data. Then learn the best ways to visualize patterns within values and relationships between variables.

Tidy Your Data



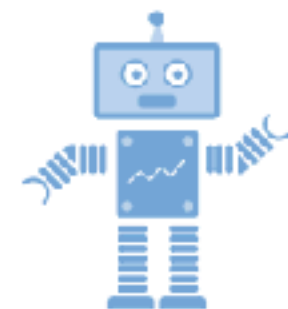
Unlock the tidyverse by learning how to make and use tidy data, the data format designed for R.

Iterate



Master a core programming paradigm with the purrr package: for each ____ do ____.

Write Functions



Functions are the key to programming in R. This primer will teach you how to write and use your own reusable functions.

Report Reproducibly



Learn to report, reproduce, and parameterize your work with the best authoring format for Data Science: R Markdown.

Build Interactive Web Apps



Say hello to Shiny, R's package for building interactive web apps. Learn to turn your analyses into elegant tools to share with others.

Organize Your Work



Become an R guru by mastering all of the tools built into the RStudio IDE. Discover best practices for programming, debugging, version control, package building and more.

primers

WIP

A large, bold, orange lowercase alpha symbol (α) is positioned on the left side of the slide.

WORK IN PROGRESS

We're in alpha and still adding important features and improving performance, reliability and availability.

Please reach out with any questions or feedback at <https://community.rstudio.com/c/rstudio-cloud>.



FREE LUNCH?

RStudio Cloud is currently free to use. As we learn what it costs to operate the service and how it is used by the community, we will offer free and paid plans, as we do with shinyapps.io. We will be asking you for feedback on our ideas along the way.

\$ \$ \$