Day 2: Online experiments

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DAY 2: EXPERIMENTS

Tentative plan

1. Experiment logic, motivation, and design
2. R basics for coding: branching, functions, lists
3. Creating a template experiment with jaysire and putting it online
4. Making a more complex experiment

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REMINDER FROM YESTERDAY

Server side

In this case, this is you! You (or your server, which will be Google App Engine) are serving up an experiment to your participant.

Client side

The client's web browser serves up webpages.

As programmer, you are writing code so that the browser on the client side knows what to do

Usually **HTML**: a markup language for displaying all your content

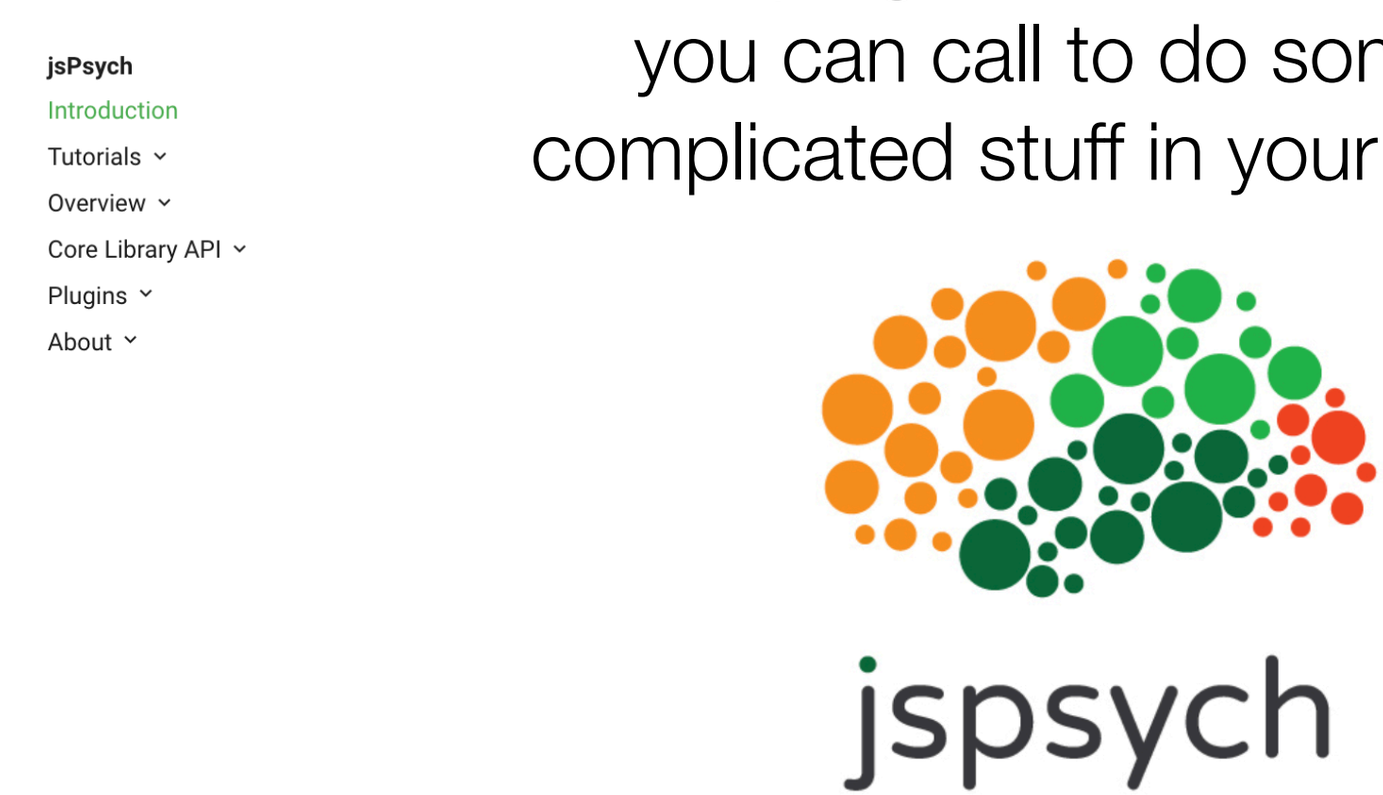
Javascript is a client-side language that lets you do more complex things. It is embedded in html. I'll be talking about a particular library called **jsPsych** used for making online experiments

Jaysire is a **R package** consisting of wrapper functions for javascript. It means you can write the code in R and it will translate to javascript for you

REMINDER: JSPSYCH

Remember from yesterday how we learned a little about how experiments work, and the structure of jsPsych

The way jsPsych works is by creating a bunch of plugins that are Javascript code you can call to do some of the complicated stuff in your experiment



jspsych

REMINDER: JSPSYCH

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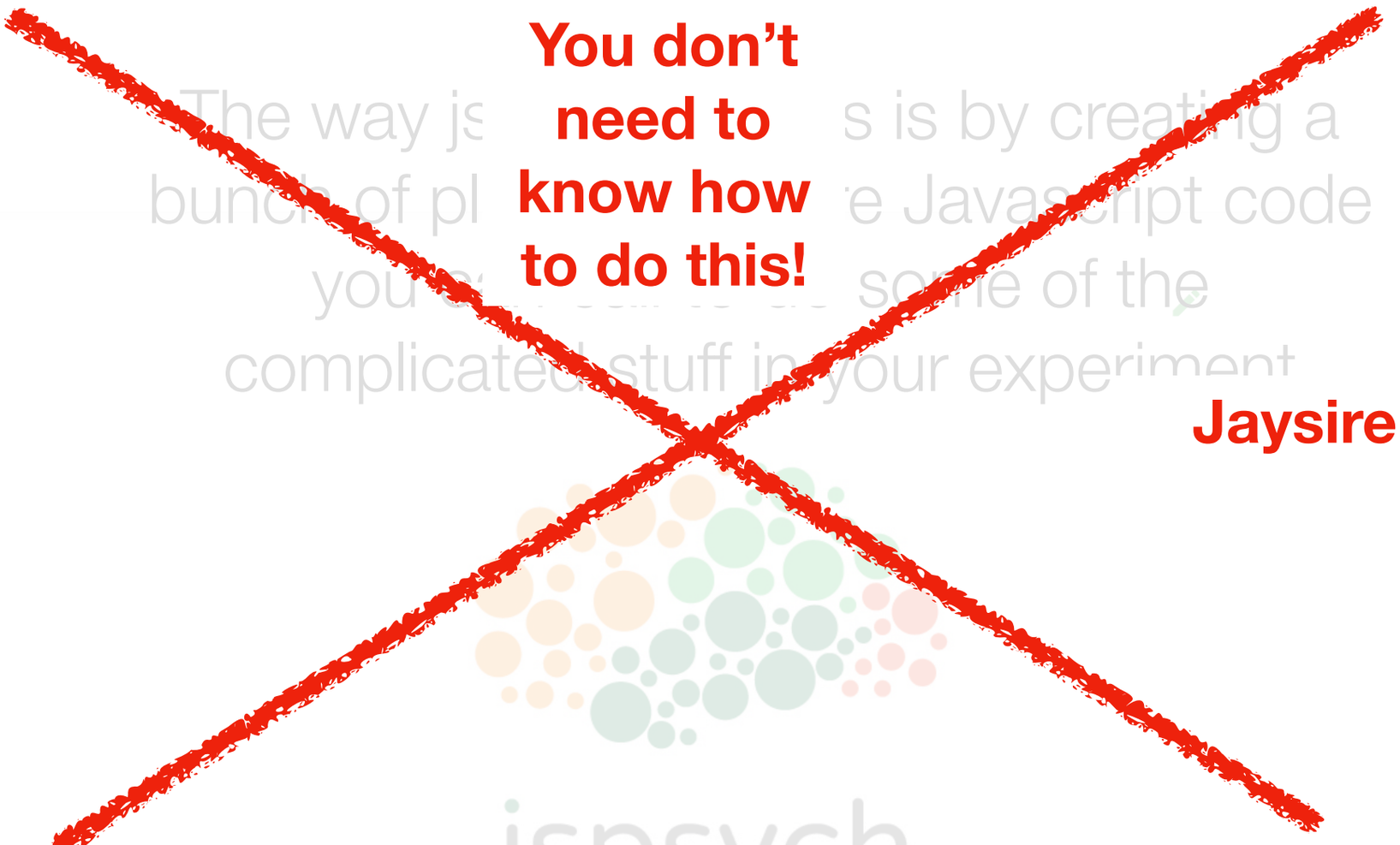
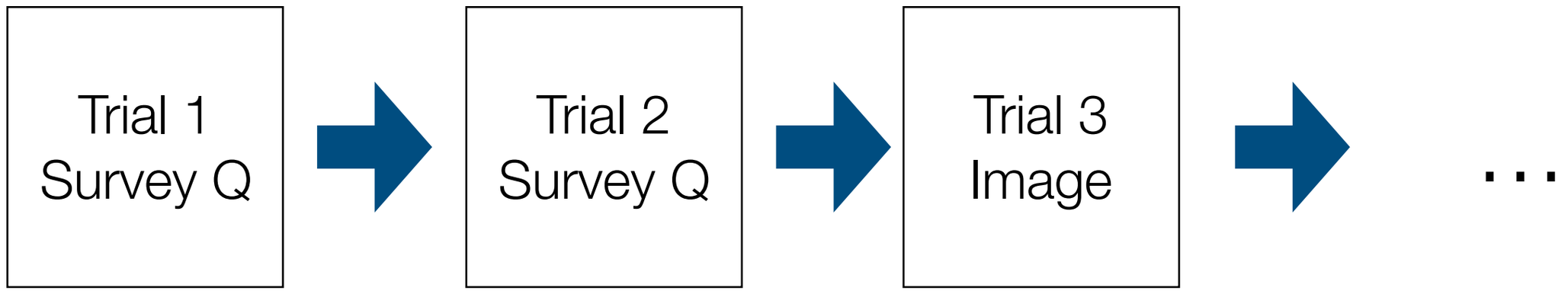


TIMELINES

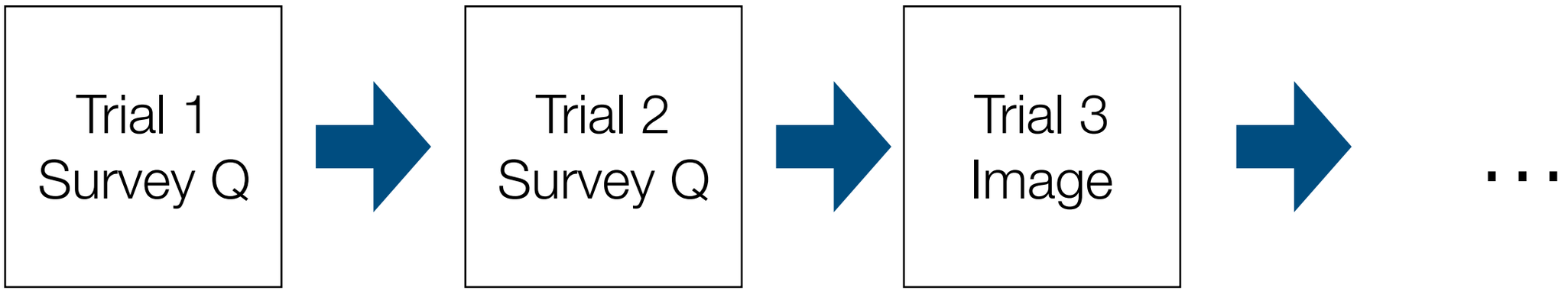
The way jsPsych and jaysire both work is by building a description of an experiment known as a **`timeline`**, which is basically a series of variables defining each step (trial).



Timeline

TIMELINES

The way jsPsych and jaysire both work is by building a description of an experiment known as a **`timeline`**, which is basically a series of variables defining each step (trial).



Timeline

You can create and randomise variables, nest timelines within one another, present audio / visual / text / images, create lots of different kinds of questions, etc.

JAYSIRE: STRUCTURE

Collections of functions that do different things:
https://djnavarro.github.io/jaysire/reference/

`build_`	Builds the experiment in javascript
`trial_`	Functions for creating lots of different kinds of trials
`tl_`	Functions for putting trials together into a timeline
`run_`	Functions for running the experiment
`fn_`	Manipulates javascript functions (advanced)

JAYSIRE: INSTALLATION

```
insall.packages("remotes")
```

```
remotes::install_github("djnavarro/jaysire")
```

loads it onto your machine

```
> remotes::install_github("djnavarro/jaysire")
Downloading GitHub repo djnavarro/jaysire@master
These packages have more recent versions available.
Which would you like to update?

1: All
2: CRAN packages only
3: None
4: rlang  (0.4.1  -> 0.4.2 ) [CRAN]
5: digest (0.6.22 -> 0.6.23) [CRAN]

Enter one or more numbers, or an empty line to skip updates:
1
rlang  (0.4.1  -> 0.4.2 ) [CRAN]
digest (0.6.22 -> 0.6.23) [CRAN]
Installing 2 packages: rlang, digest

  There are binary versions available but the source versions are later:
       binary source needs_compilation
rlang   0.3.1  0.4.2              TRUE
digest 0.6.18 0.6.23              TRUE

Do you want to install from sources the packages which need compilation?
y/n: y
```

```
library(jaysire)
```

puts it in working memory (need this in every experiment you make)

JAYSIRE: GETTING STARTED

First, let's make sure we're all up-to-date on the day2 content. Go to your `CHDSS/chdss2019_content` folder in the terminal.

Type `git status` at the prompt to see if you're up to date. If you are, great!

If not, pull the newer content: `git pull`

And then check that you're up-to-date with `git status`

JAYSIRE: GETTING STARTED

Navigate to the `day2` folder (remember the `cd` command).
You should see folders that look like the following:

`slides`
`experiments`

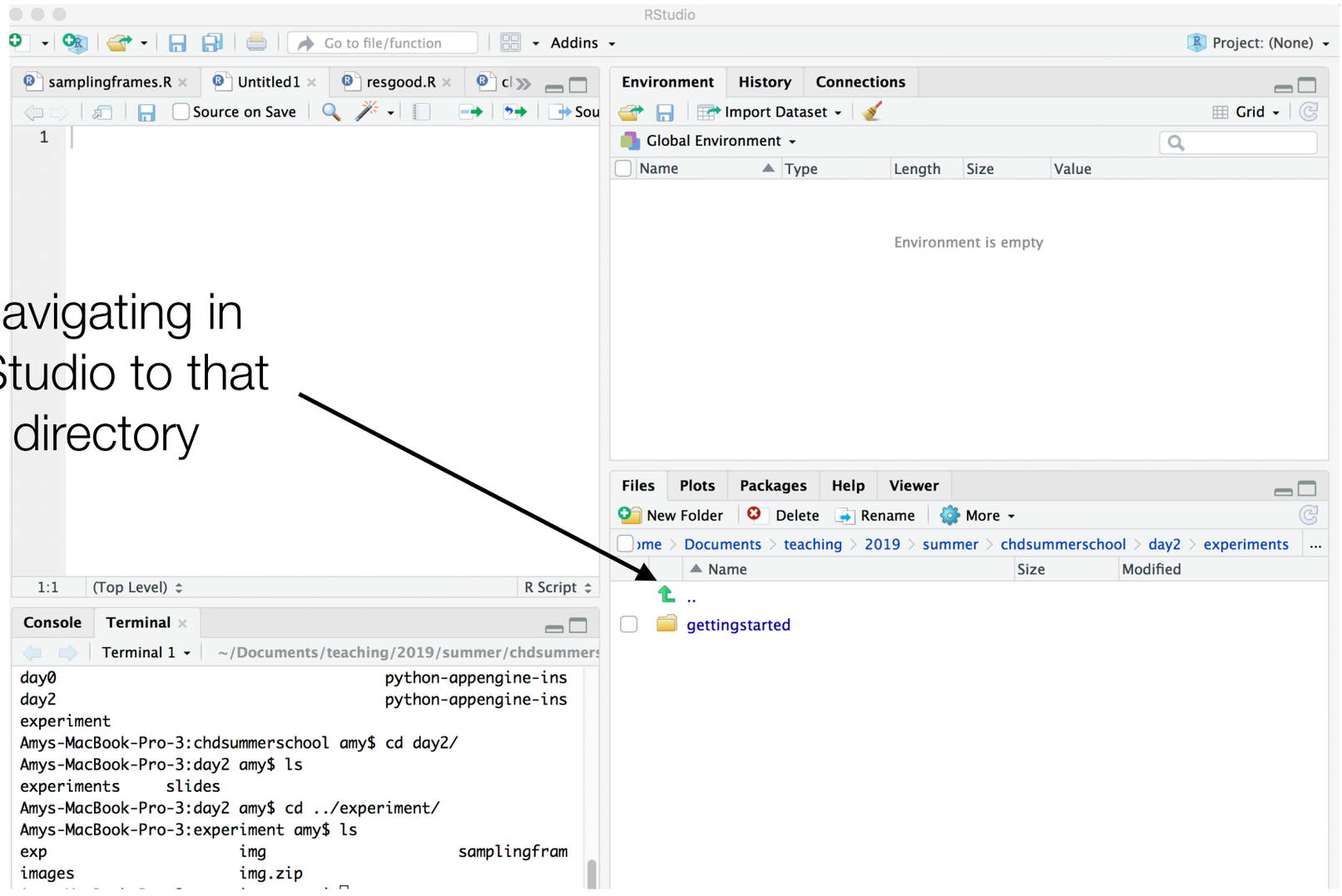
We want you to copy all of day2 into your summerschool folder, so that we don't have 70+ people all trying to change the actual `chdss2019_content` repository

You can do this manually or in the command line:
`cp -rf ../day2/ ../../summerschool/`

Now move to the day2 folder there:
`cd ../../summerschool/day2` where you should see the same folders

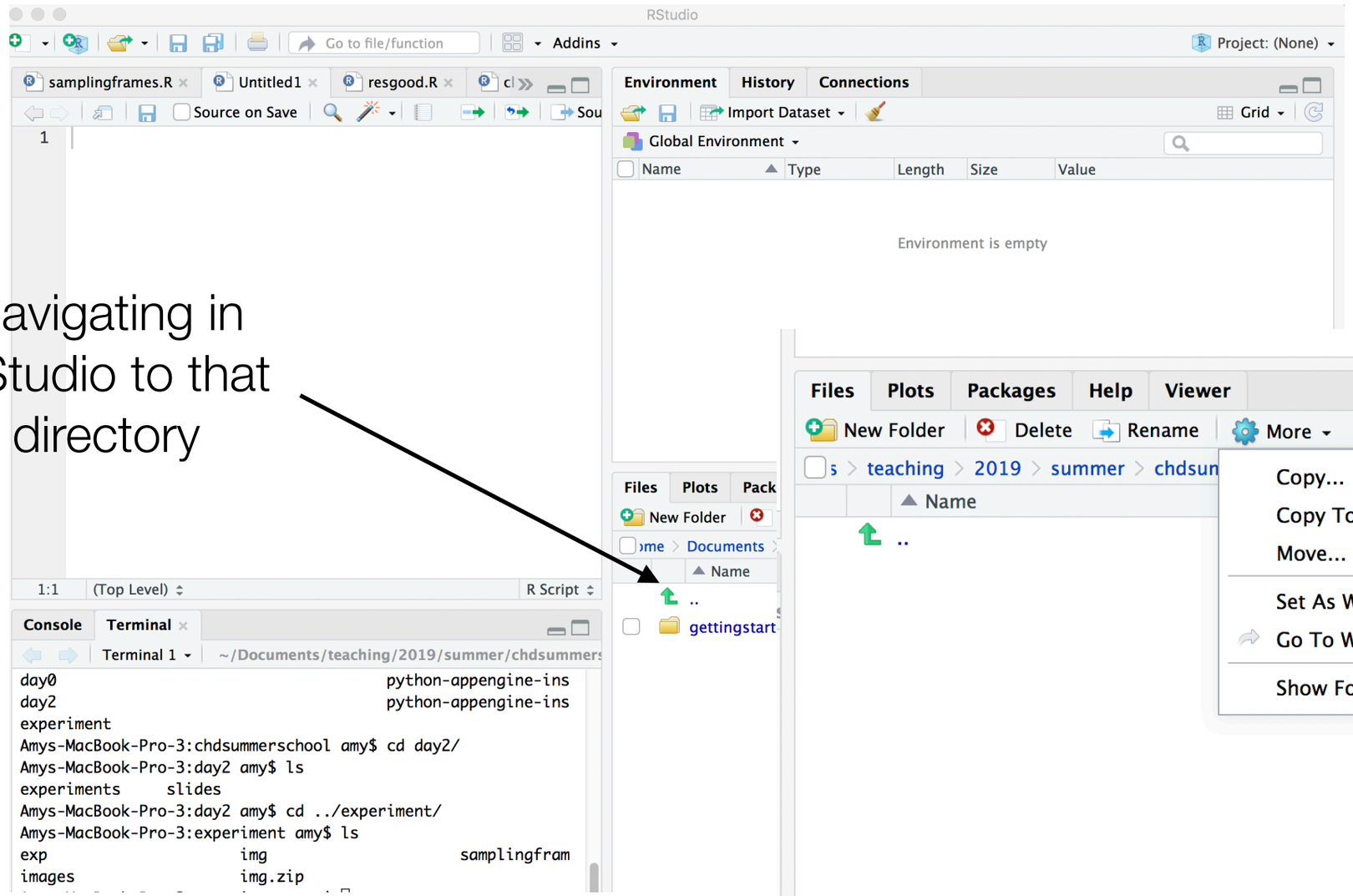
JAYSIRE: GETTING STARTED

Navigate into the `experiments/gettingstarted` folder which should be empty. Set this as your working directory so that RStudio knows you're there too.



JAYSIRE: GETTING STARTED

Navigate into the `experiments/gettingstarted` folder which should be empty. Set this as your working directory so that RStudio knows you're there too.

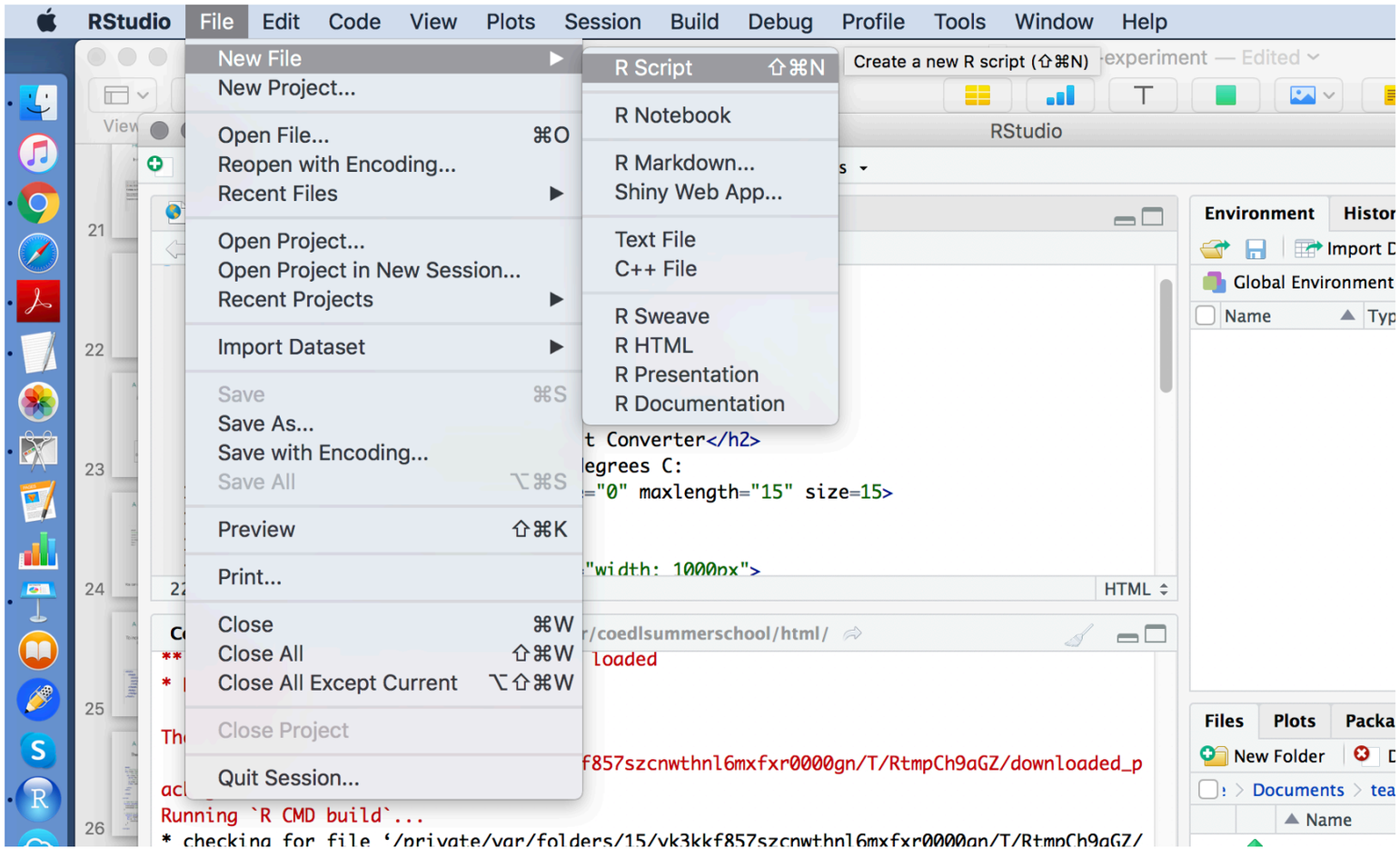


Navigating in RStudio to that directory

Setting as your working directory

JAYSIRE: GETTING STARTED

Now create a script called `gettingstarted.R` and save it in this location (`summerschool/day2/experiments/gettingstarted`)



JAYSIRE: GETTING STARTED

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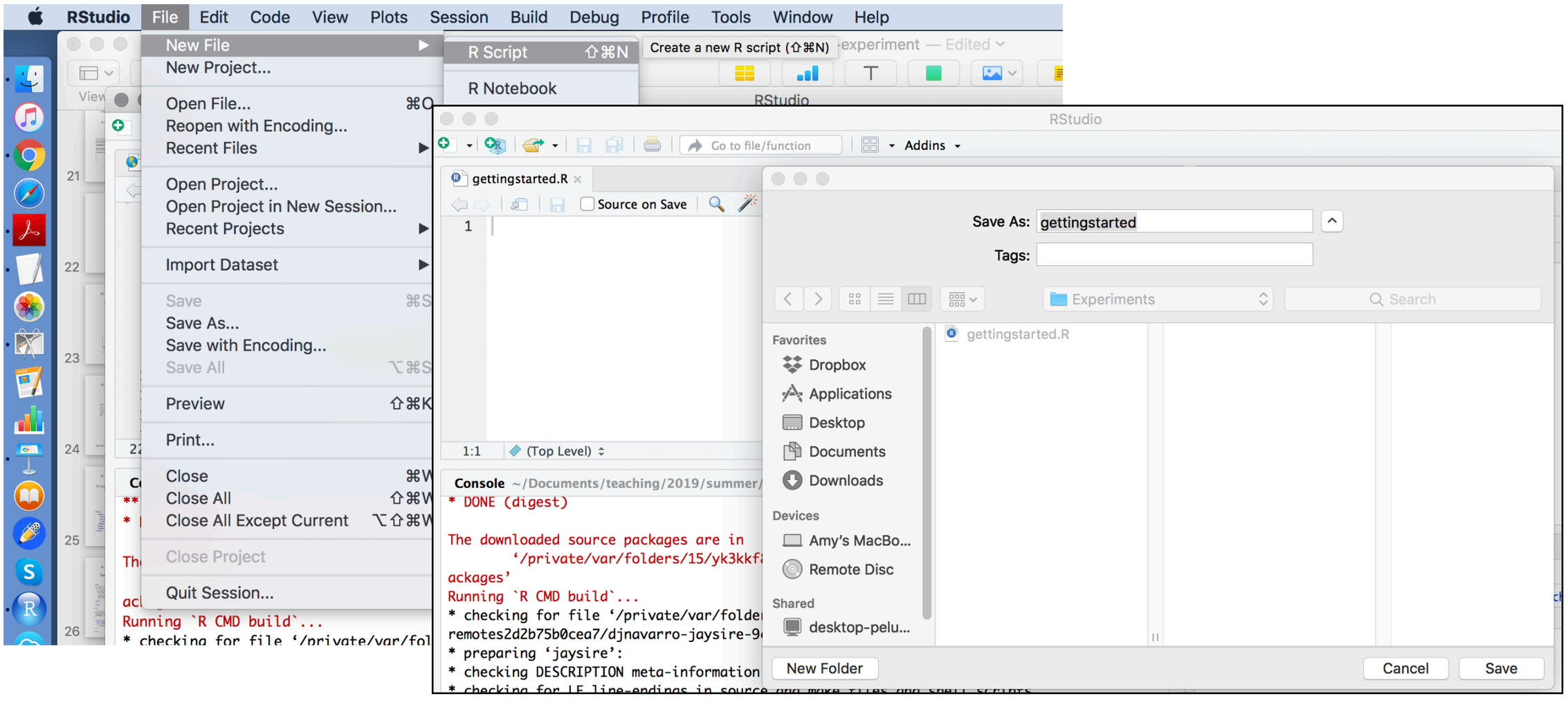

JAYSIRE: GETTING STARTED

Let’s start by creating instructions using the function called `trial_instructions()`

JAYSIRE: GETTING STARTED

Let's start by creating instructions using the function called `trial_instructions()`

```
help(trial_instructions)
```

Takes a bunch of arguments which describe the instructions people will see

R: Specify pages of instructions to display — Find in Topic

Specify pages of instructions to display

Description

The `trial_instructions` function is used to display one or more pages of instructions that a participant can browse.

Usage

```
trial_instructions(pages, key_forward = "rightarrow",
  key_backward = "leftarrow", allow_backward = TRUE,
  allow_keys = TRUE, show_clickable_nav = FALSE,
  button_label_previous = "Previous", button_label_next = "Next",
  post_trial_gap = 0, on_finish = NULL, on_load = NULL,
  data = NULL)
```

Arguments

`pages`	Character vector. Each element should be an HTML-formatted string specifying a page
`key_forward`	This is the key that the subject can press in order to advance to the next page, specified as their numeric key code or as characters
`key_backward`	This is the key that the subject can press in order to return to the previous page.
`allow_backward`	If TRUE, participants can navigate backwards
`allow_keys`	If TRUE, participants can use keyboard keys to navigate
`show_clickable_nav`	If TRUE, buttons will be shown to allow navigation
`button_label_previous`	Text on the "previous" button
`button_label_next`	Text on the "next" button
`post_trial_gap`	The gap in milliseconds between the current trial and the next trial. If NULL,

JAYSIRE: GETTING STARTED

Let's start by creating instructions using the function called `trial_instructions()`

```
instructions <- trial_instructions(
  pages = c(
    "Welcome! Use the arrow buttons to browse these instructions",
    "Press the 'Next' button to begin!"
  ),
  show_clickable_nav = TRUE,
  post_trial_gap = 1000
)
```

JAYSIRE: GETTING STARTED

Let's start by creating instructions using the function called `trial_instructions()`

Putting the instructions into your own variable called instructions

The function name (needs parentheses around arguments)

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instructions <- trial_instructions(
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These are the three arguments to the function:

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instructions <- trial_instructions(
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The two pages are in a vector (the command `c()` does this) separated by commas

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Let participants click back and forth

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How long to wait after clicking before going to the next page

Let participants click back and forth

JAYSIRE: GETTING STARTED

Now let’s build a minimal experiment with just these instructions

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Now let's build a minimal experiment with just these instructions

```
build_experiment(
  timeline = build_timeline(instructions),
  path = file.path("starting_exp"),
  on_finish = fn_save_locally()
)
```

JAYSIRE: GETTING STARTED

Now let's build a minimal experiment with just these instructions

The function name (needs parentheses around arguments)

Builds a timeline consisting only of the instructions we created

```
build_experiment(
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These are the three arguments to the function:

Tells R to put the experiment in a new[*] folder called `starting_exp` in your current directory

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)
```

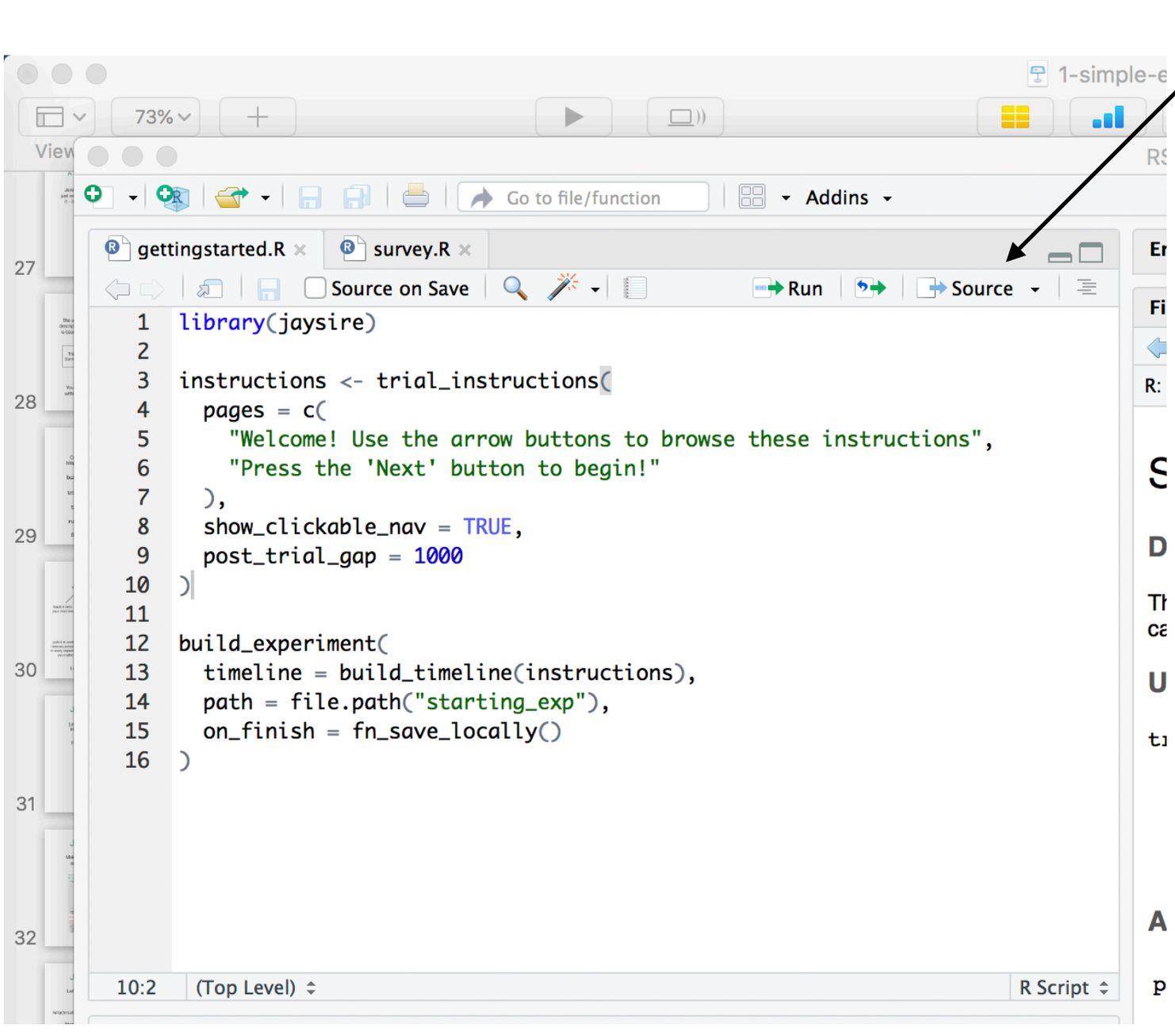
These are the three arguments to the function:

Tells R to save the data locally on your computer

Tells R to put the experiment in a new[*] folder called `starting_exp` in your current directory

JAYSIRE: GETTING STARTED

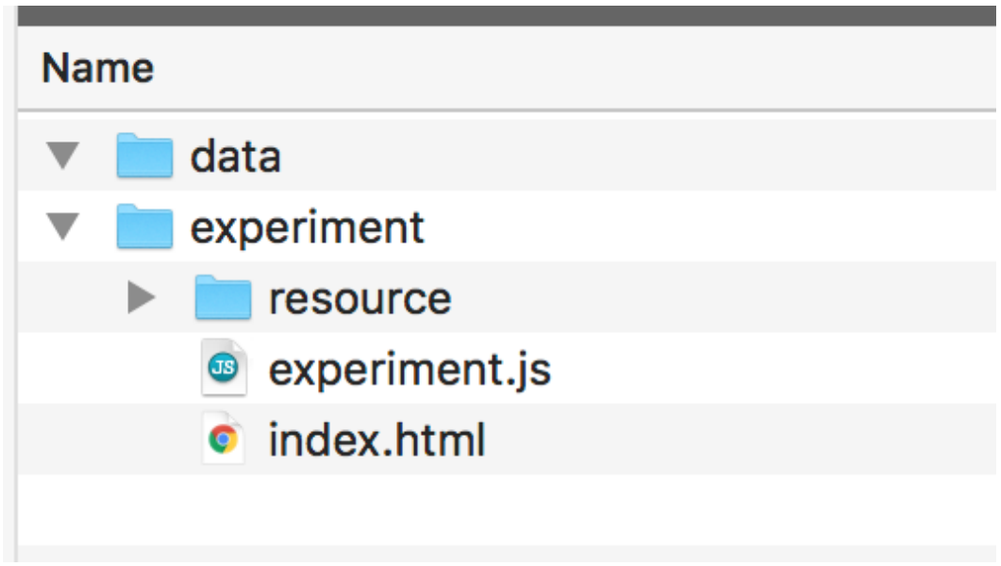
"Source" the experiment in R to get it ready to run



JAYSIRE: GETTING STARTED

"Source" the experiment in R to get it ready to run

You'll see that this builds the experiment - creates two folders inside `starting_exp`



JAYSIRE: GETTING STARTED

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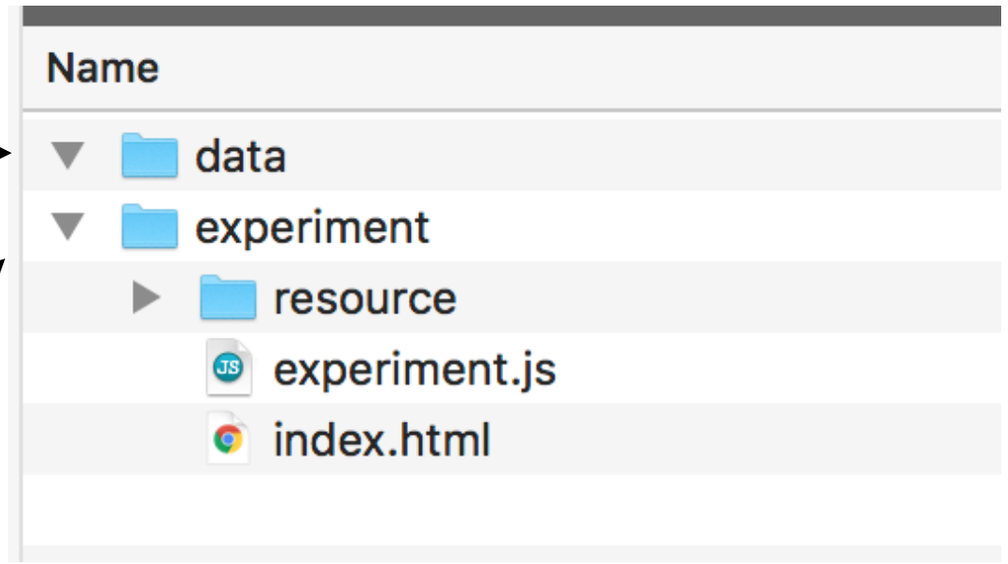
Empty (where data will go)

Javascript and html code for the experiment



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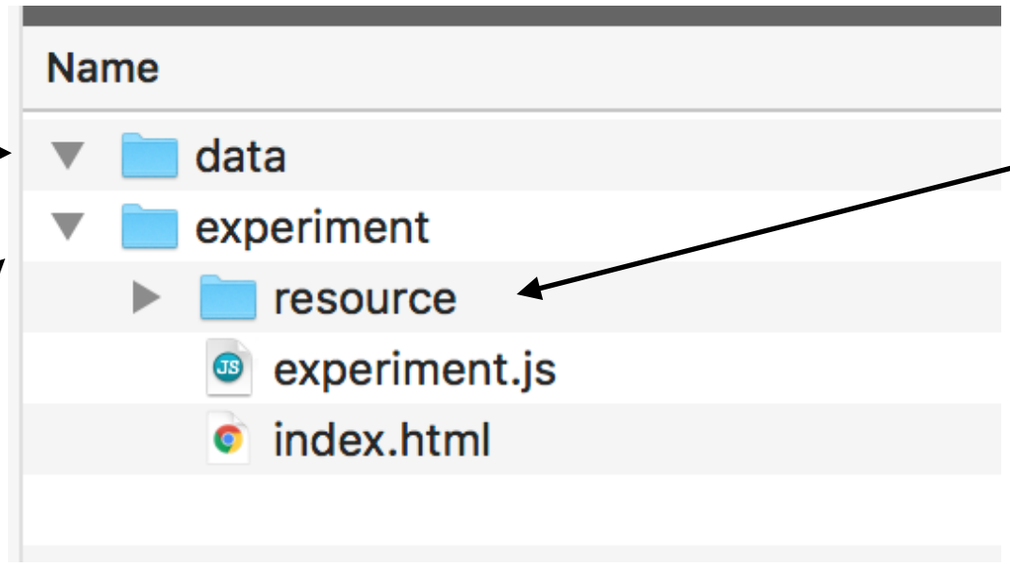

Resource files, if any (we don't have any in this)

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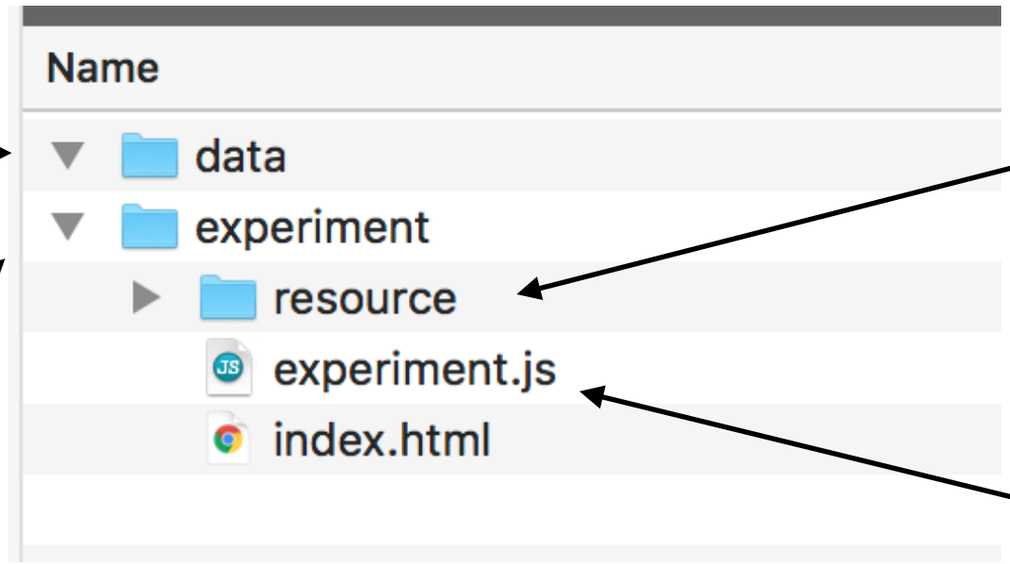

Resource files, if any (we don't have any in this)

Javascript version of the R code we just wrote

JAYSIRE: GETTING STARTED

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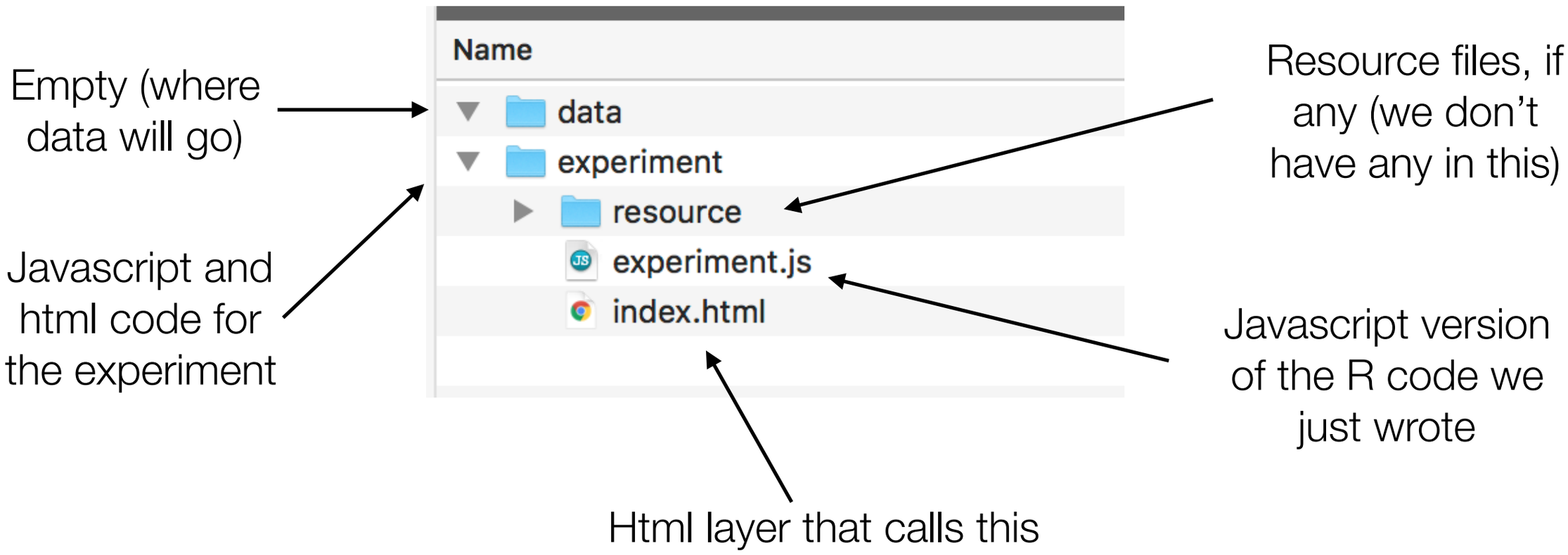


JAYSIRE: GETTING STARTED

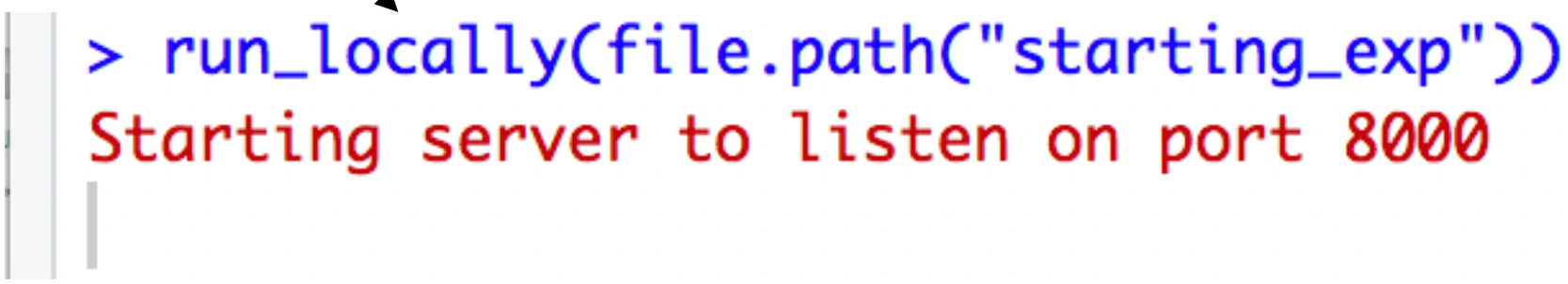
Run it by using the function `run_locally()`.
Type it at the console with your path in as an argument

```
> run_locally(file.path("starting_exp"))
Starting server to listen on port 8000
```

JAYSIRE: GETTING STARTED

Run it by using the function `run_locally()`.
Type it at the console with your path in as an argument

The function name (needs parentheses around arguments)



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Tells R this is a path

```
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Starting server to listen on port 8000
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JAYSIRE: GETTING STARTED

Run it by using the function `run_locally()`.
Type it at the console with your path in as an argument

The function name (needs parentheses around arguments)

Tells R this is a path

Name of the folder with the experiment

```
> run_locally(file.path("starting_exp"))
Starting server to listen on port 8000
```

EXERCISE

Try sourcing it again: what happens? Why?

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It assumes that `starting_exp` folder doesn't contain any subfolders. Since it does (you've already built it) it throws an error. Can avoid this by deleting the `data` and `experiment` folders each time you source again (tedious) or add in this bit to your code:

```
# set directory (deletes any existing old experiment builds in it)
my_directory <- file.path("starting_exp")
# create the empty folder if necessary
if(dir.exists(my_directory)) {
  unlink(my_directory, recursive = TRUE)
}
```

EXERCISE

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```

And then replace the argument in build_experiment:

```
path = my_directory,
```

EXERCISE

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```
# set directory (deletes any existing old experiment builds in it)
my_directory <- file.path("classsurvey_exp")
# create the empty folder if necessary
if(dir.exists(my_directory)) {
  unlink(my_directory, recursive = TRUE)
}
```

And then replace the argument in build_experiment:

```
path = my_directory,
```

How do you run it this time?

EXERCISE

Change your instructions so they look like this:

Page 1

Welcome! Use the arrow buttons to browse these instructions

< Backward Forward >

Page 2

In this experiment you will solve some equations.

It is *very important* that you do your best.

< Backward Forward >

Page 3

Press the 'Forward' button to begin!

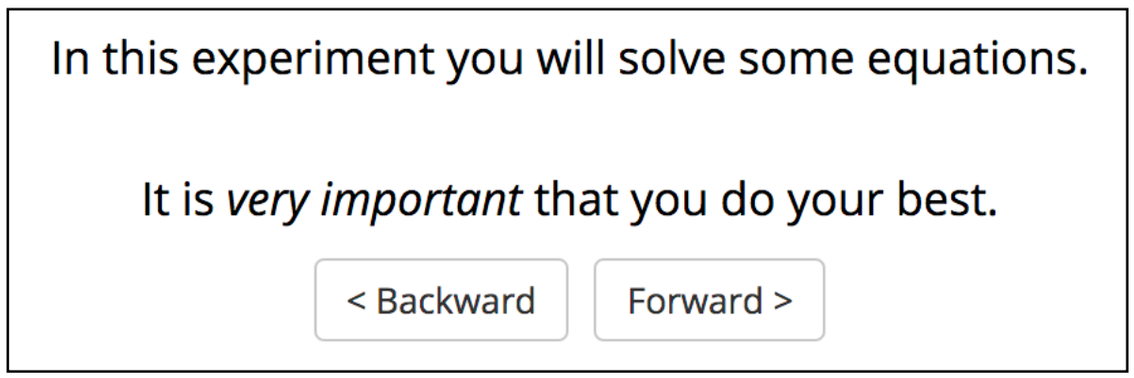
< Backward Forward >

EXERCISE

Change your instructions so they look like this:

Page 1

Page 2



Page 3

Hints: remember to use `help(trial_instructions)` to figure out how to change the button labels. And the text in the instruction pages can be formatted using html tags.

ADDING A TRIAL

Let’s make a trial that presents the stimulus as html and collects a response using buttons:

```
trial1 <- trial_html_button_response(
  stimulus = "13 + 23 = 36",
  choices = c("true", "false"),
  post_trial_gap = 500
)
```

ADDING A TRIAL

Let's make a trial that presents the stimulus as html and collects a response using buttons:

Putting this trial into your own variable called trial1

The function name (needs parentheses around arguments)

```
trial1 <- trial_html_button_response(
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The stimulus shown to the participant

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The stimulus shown to the participant

The button choices and labels

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```

The stimulus shown to the participant

The button choices and labels

How long to wait after clicking before going to the next page

ADDING A TRIAL

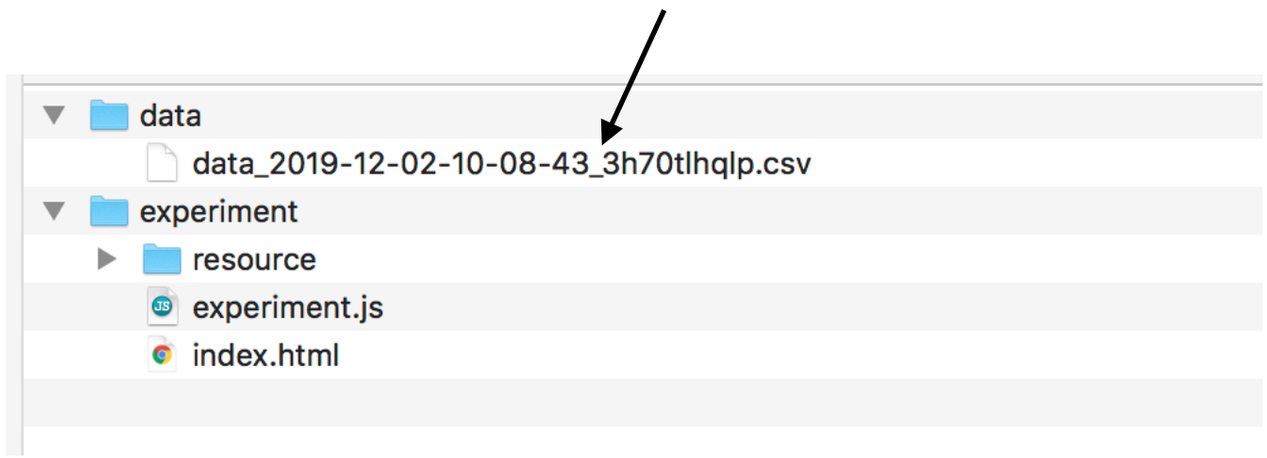
Let’s make a trial that presents the stimulus as html and collects a response using buttons:

Need to also remember to add it to the timeline!

```
build_experiment(
  timeline = build_timeline(instructions,trial1),
  path = my_directory,
  on_finish = fn_save_locally()
)
```

ADDING A TRIAL

This time when we run it there is data to save, which goes in the `data` folder



It’s saved as a csv (with some things saved in a format called JSON format, which tomorrow we’ll learn how to turn into manageable form). Still even now you can see what is there

EXERCISE

Add another trial which shows the equation `2+2=5` for only 500ms before it disappears.

The participant should have three response options: `true`, `false`, and `I don't know`

NOW LET’S PUT IT ONLINE!

FIRST LET'S MODIFY OUR R CODE

Now we need to make it save on the app engine instead of locally

```
build_experiment(
  timeline = build_timeline(instructions,trial1),
  path = file.path(my_directory),
  on_finish = fn_save_datastore()
)
```

This bit is new

FIRST LET'S MODIFY OUR R CODE

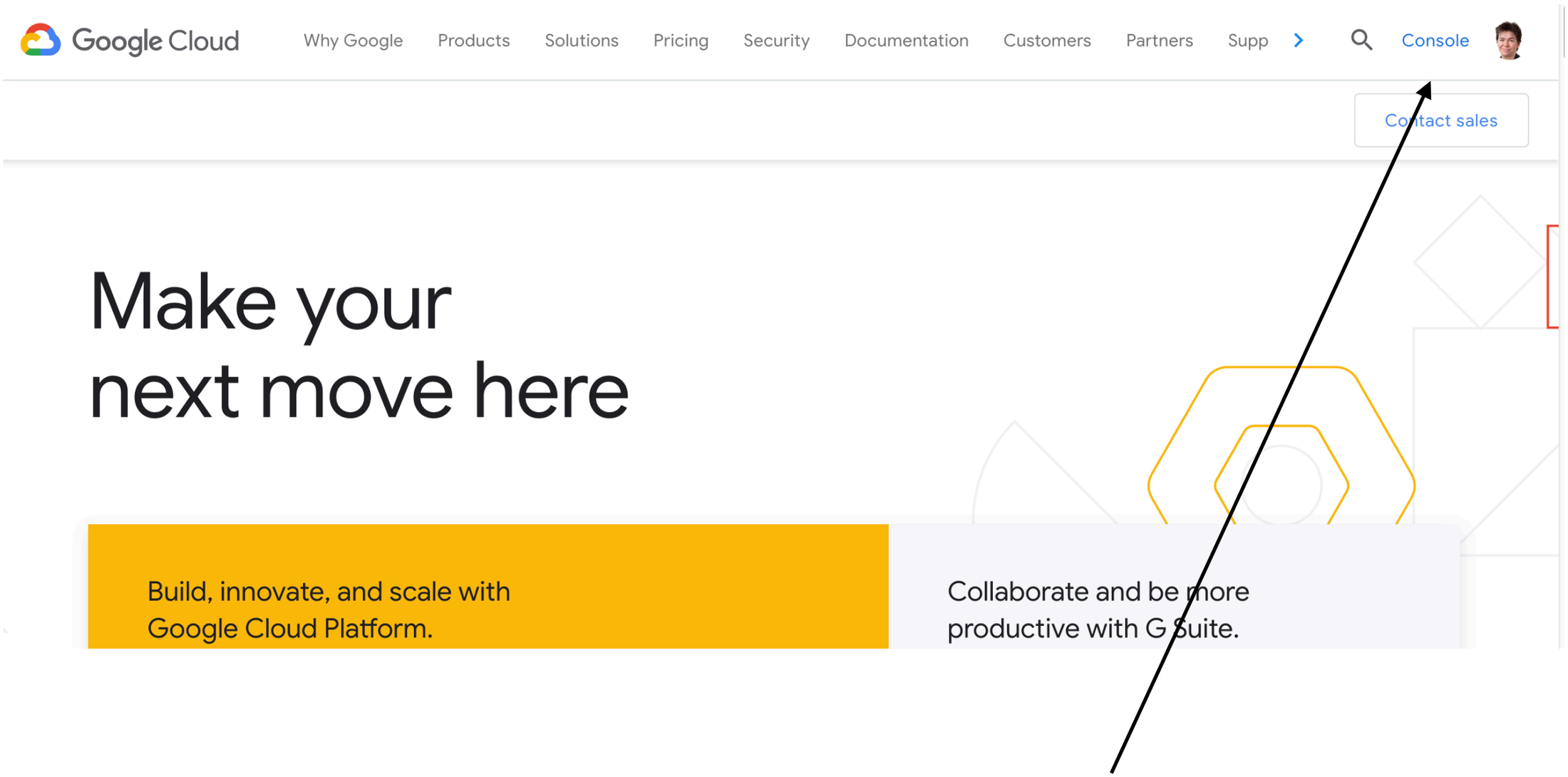
When you source it now, two different files appear in your experiment folder. You don't need to do anything with them; they are for interfacing with the backend of the Google App Engine (GAE)

OUTLINE OF STEPS

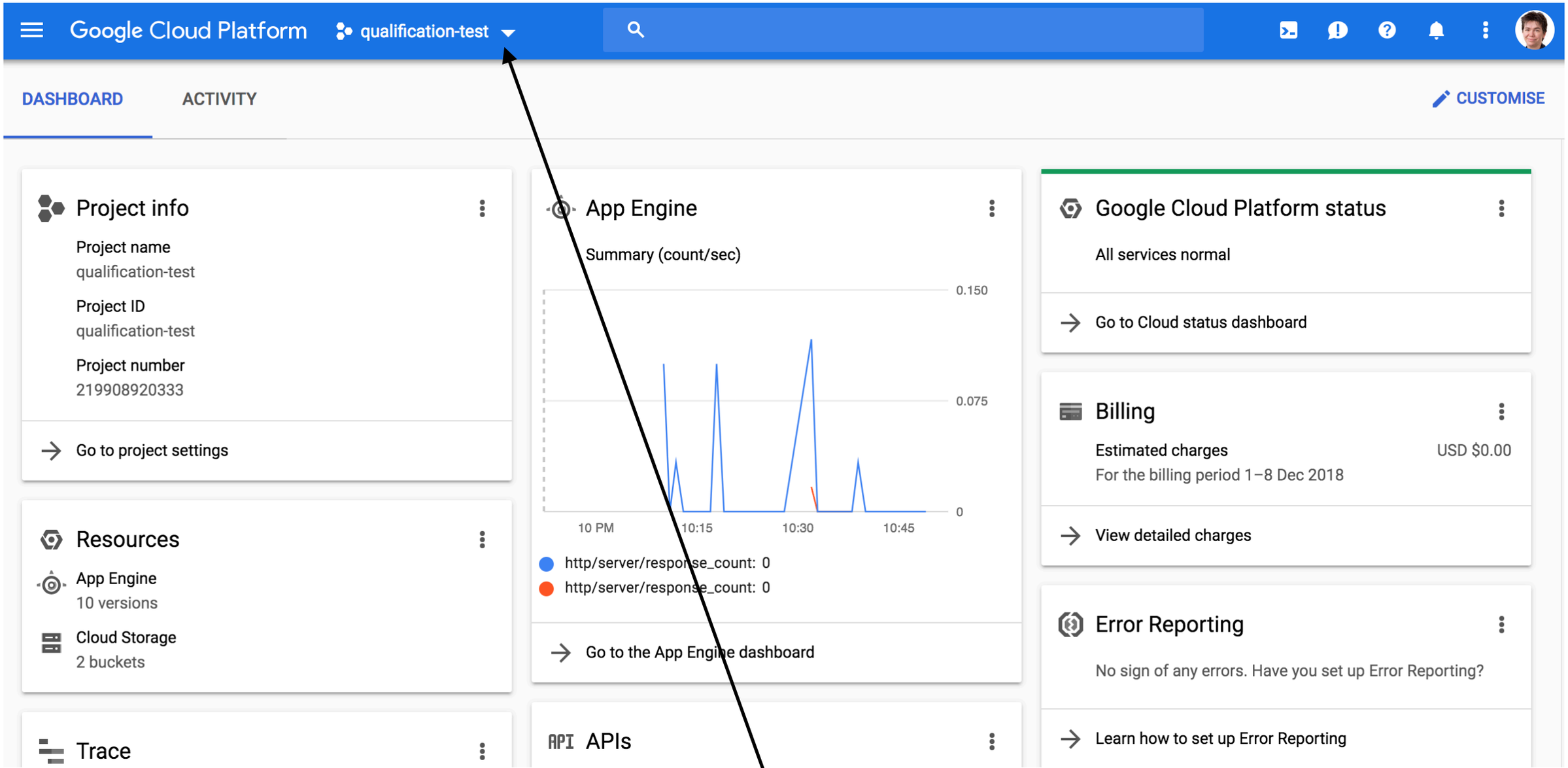
1. Go to google cloud
2. Make a new project (or go into an existing one if you're just modifying an old one)
3. Open a terminal and go to the command line in the directory with the experiment
4. Initialise google cloud in that directory
5. Deploy the experiment so it shows up online.
6. Go to your project url.

1. GO TO GOOGLE CLOUD

cloud.google.com

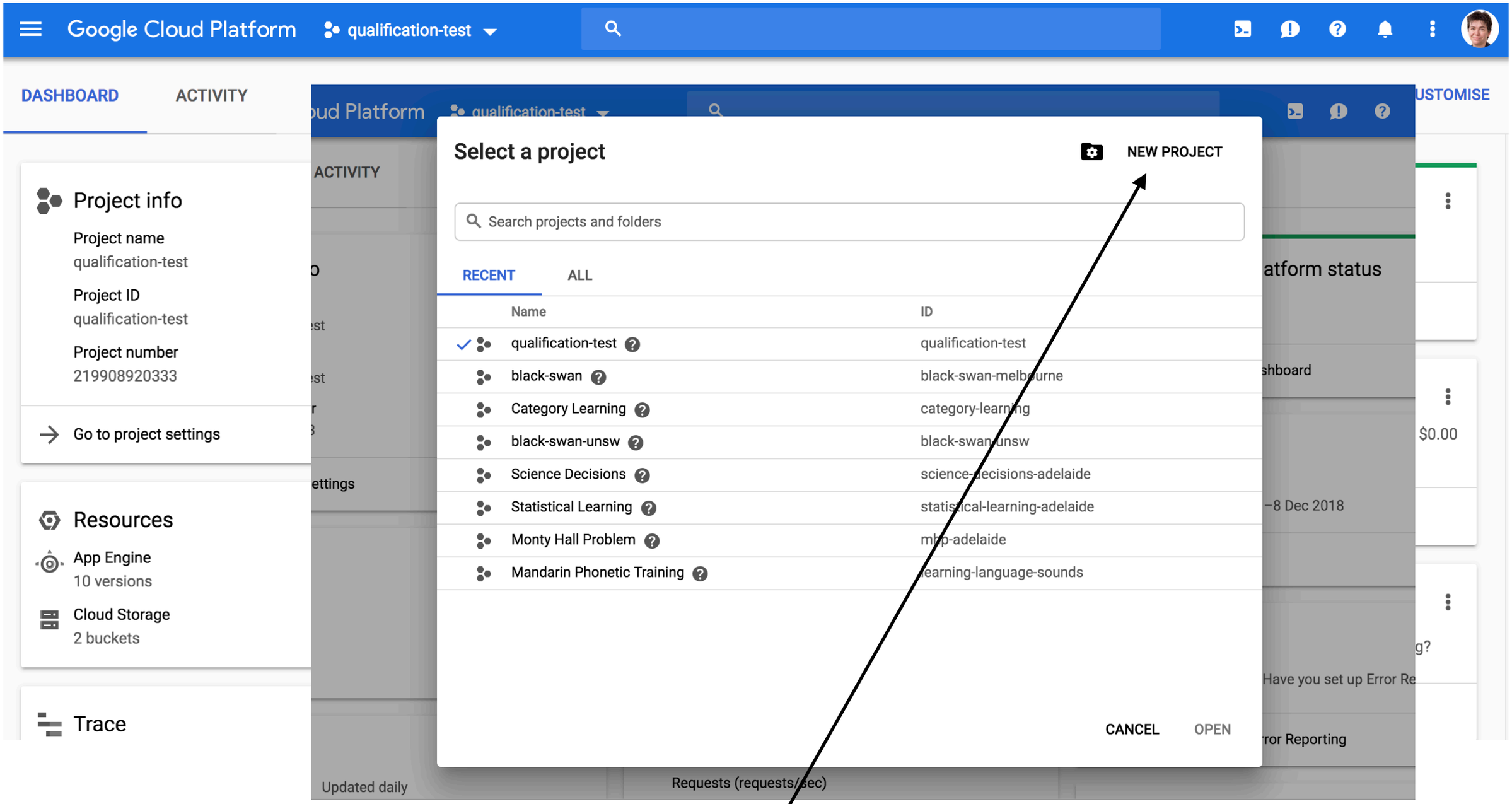


2. CREATE PROJECT IN GOOGLE CLOUD



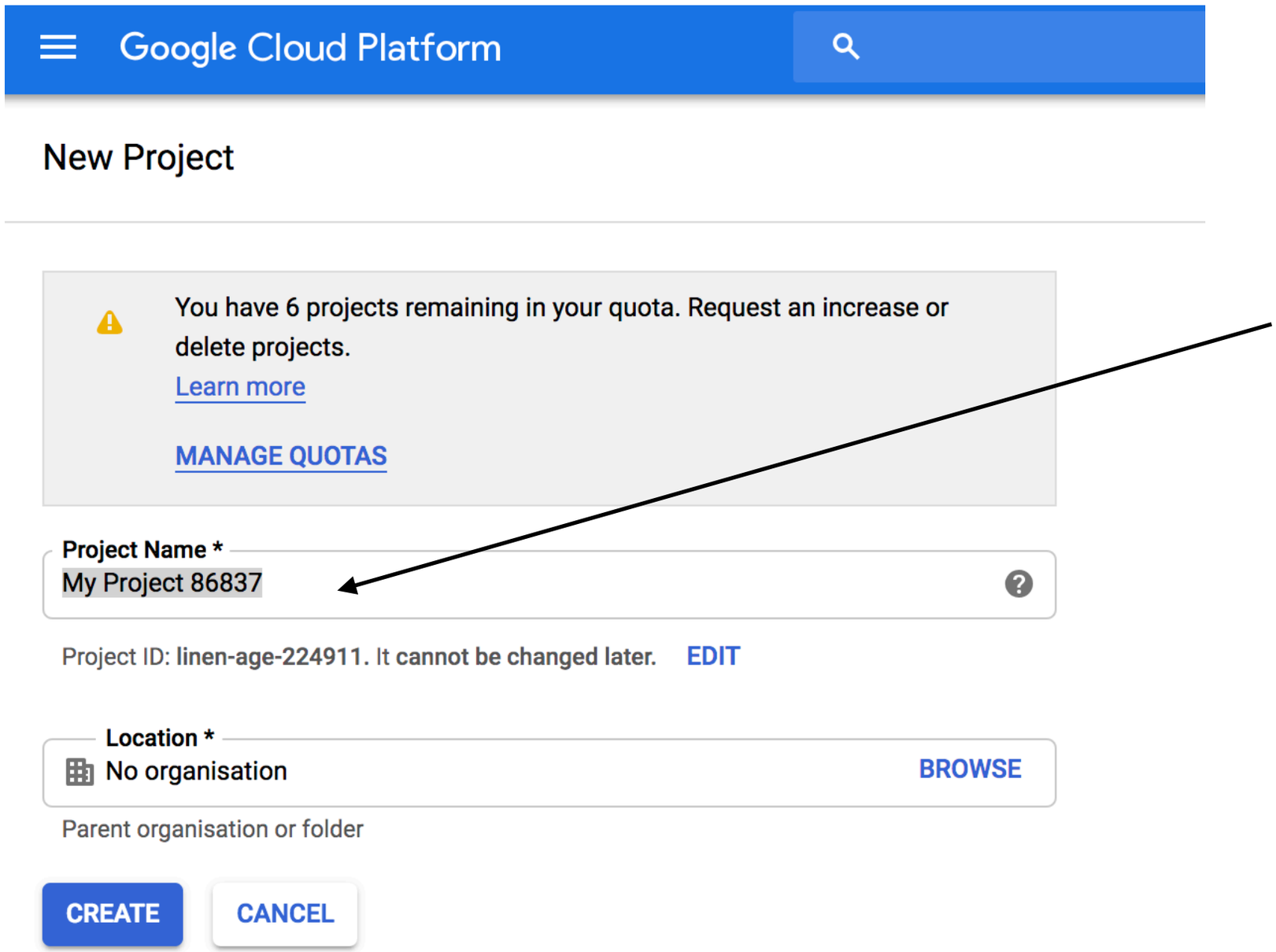
This will list your projects

2. CREATE PROJECT IN GOOGLE CLOUD



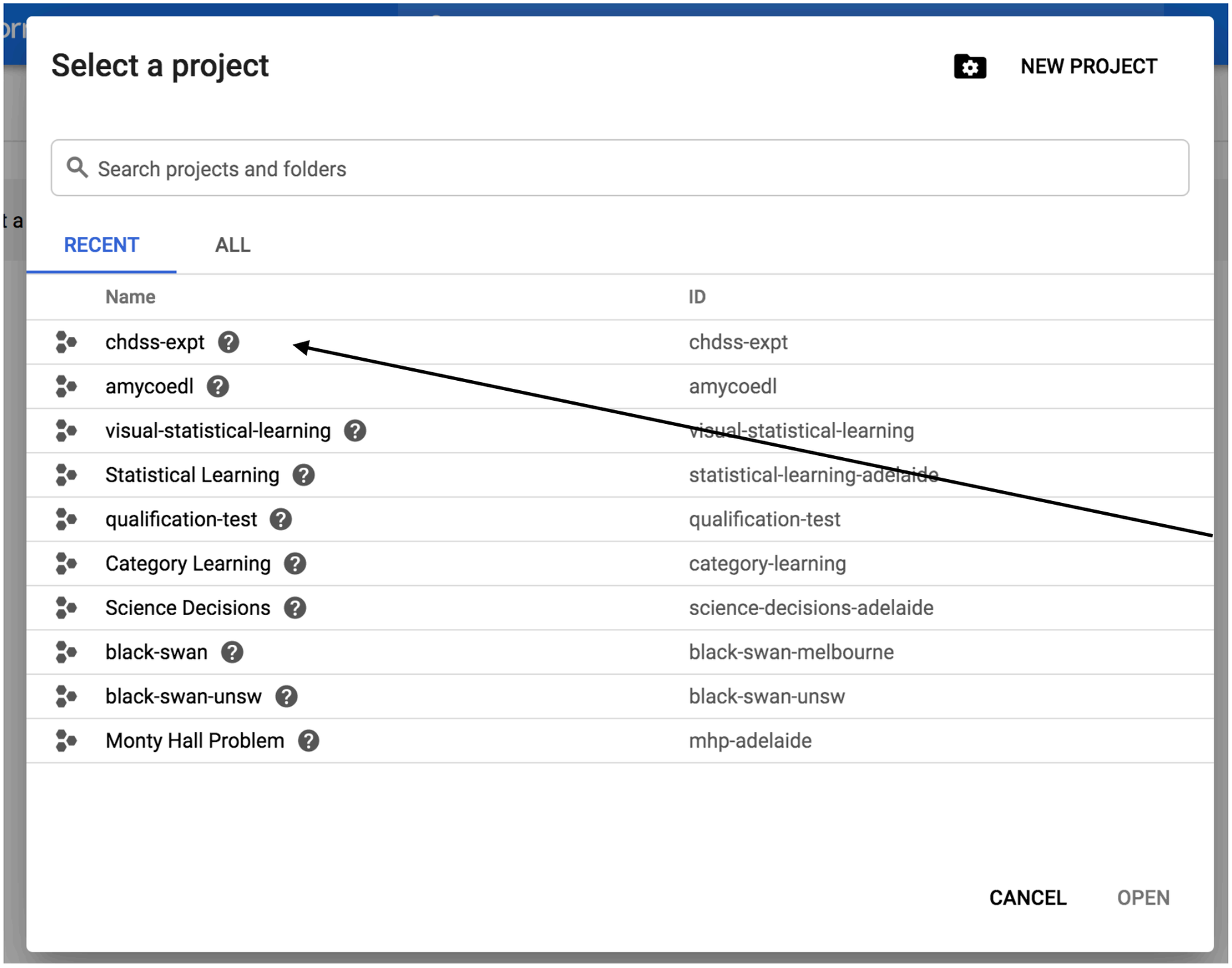
You can select “new project”

2. CREATE PROJECT IN GOOGLE CLOUD



This is what is going to show up in your url so try to name it something descriptive (for you) but that doesn't give away details you don't want to give away to the participants

2. CREATE PROJECT IN GOOGLE CLOUD



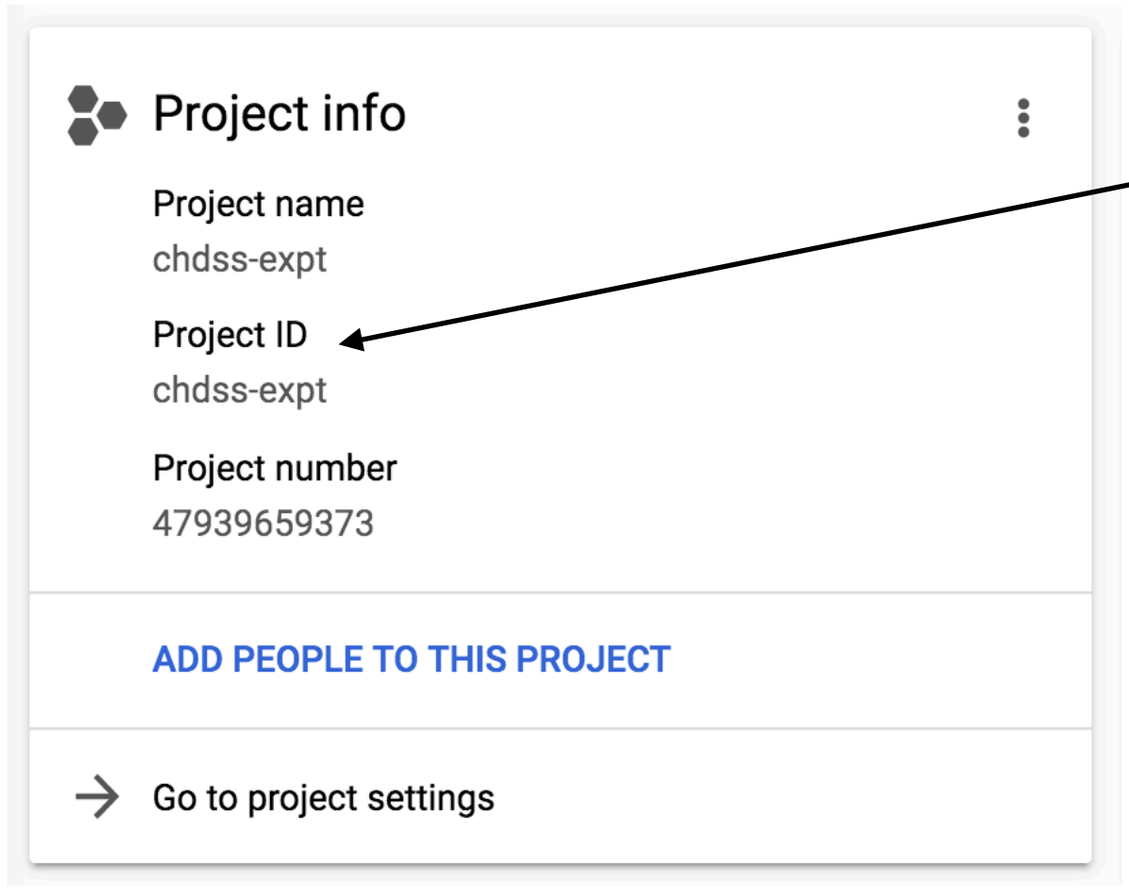
Now select it from your list

3. DEPLOY THE EXPERIMENT

At the R console type: `run_appengine(path,project_id)`

Your path is my_directory and your project id is your project name:

`run_appengine(my_directory,"chdss-expt")`



3. DEPLOY THE EXPERIMENT

It will probably give you a message like the following:

```
To deploy, enter the following command at the console:
gcloud app deploy starting_exp/experiment/app.yaml --project=chdss-expt
```

So go to your terminal and type that

```
gcloud app deploy starting_exp/experiment/app.yaml --project=chdss-expt
```

3. DEPLOY THE EXPERIMENT

```
You are creating an app for project [chdss-expt].
WARNING: Creating an App Engine application for a project is irreversible and the region
cannot be changed. More information about regions is at
<https://cloud.google.com/appengine/docs/locations>.

Please choose the region where you want your App Engine application
located:

 [1] asia-east2    (supports standard and flexible)
 [2] us-west2      (supports standard and flexible)
 [3] asia-northeast2 (supports standard and flexible)
 [4] europe-west6  (supports standard and flexible)
 [5] us-central    (supports standard and flexible)
 [6] europe-west3  (supports standard and flexible)
 [7] europe-west2  (supports standard and flexible)
 [8] europe-west   (supports standard and flexible)
 [9] us-east1      (supports standard and flexible)
 [10] us-east4      (supports standard and flexible)
 [11] asia-northeast1 (supports standard and flexible)
 [12] asia-south1   (supports standard and flexible)
 [13] australia-southeast1 (supports standard and flexible)
 [14] southamerica-east1 (supports standard and flexible)
 [15] northamerica-northeast1 (supports standard and flexible)
 [16] cancel
Please enter your numeric choice: 13
```

3. DEPLOY THE EXPERIMENT

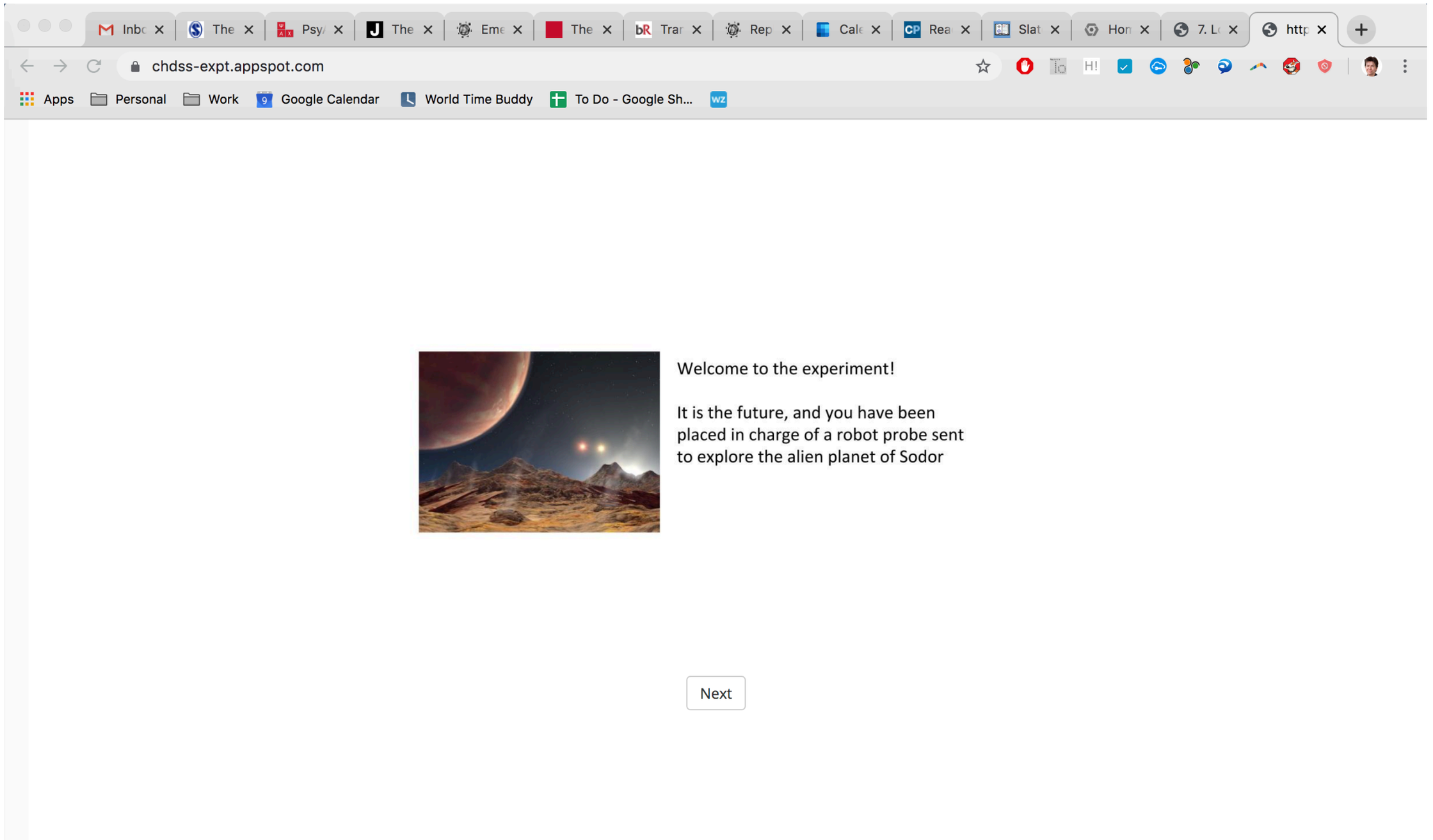
```
Creating App Engine application in project [chdss-expt] and region [australia-southeast1]....done.
Services to deploy:

descriptor:      [/Users/amy/Documents/teaching/2019/summer/chdsummerschool/samplingframes/exp/
experiment/app.yaml]
source:          [/Users/amy/Documents/teaching/2019/summer/chdsummerschool/samplingframes/exp/
experiment]
target project:  [chdss-expt]
target service:  [default]
target version:  [20191216t142805]
target url:      [https://chdss-expt.appspot.com]

Do you want to continue (Y/n)? Y
```

4. GO TO YOUR EXPERIMENT!

```
Beginning deployment of service [default]...
Some files were skipped. Pass `--verbosity=info` to see which ones.
You may also view the gcloud log file, found at
[/Users/amy/.config/gcloud/logs/2019.12.16/14.26.09.118147.log].

╔═══════════════════════════════════════════════════════════════╗
╠═ Uploading 10 files to Google Cloud Storage                   ═╣
╚═══════════════════════════════════════════════════════════════╝

File upload done.
Updating service [default]...done.
Setting traffic split for service [default]...done.
Deployed service [default] to [https://chdss-expt.appspot.com]

You can stream logs from the command line by running:
  $ gcloud app logs tail -s default

To view your application in the web browser run:
  $ gcloud app browse --project=chdss-expt


Updates are available for some Cloud SDK components.  To install them,
please run:
  $ gcloud components update

Amys-MacBook-Pro-3:samplingframes amy$
```

There is your url!

4. GO TO YOUR EXPERIMENT!



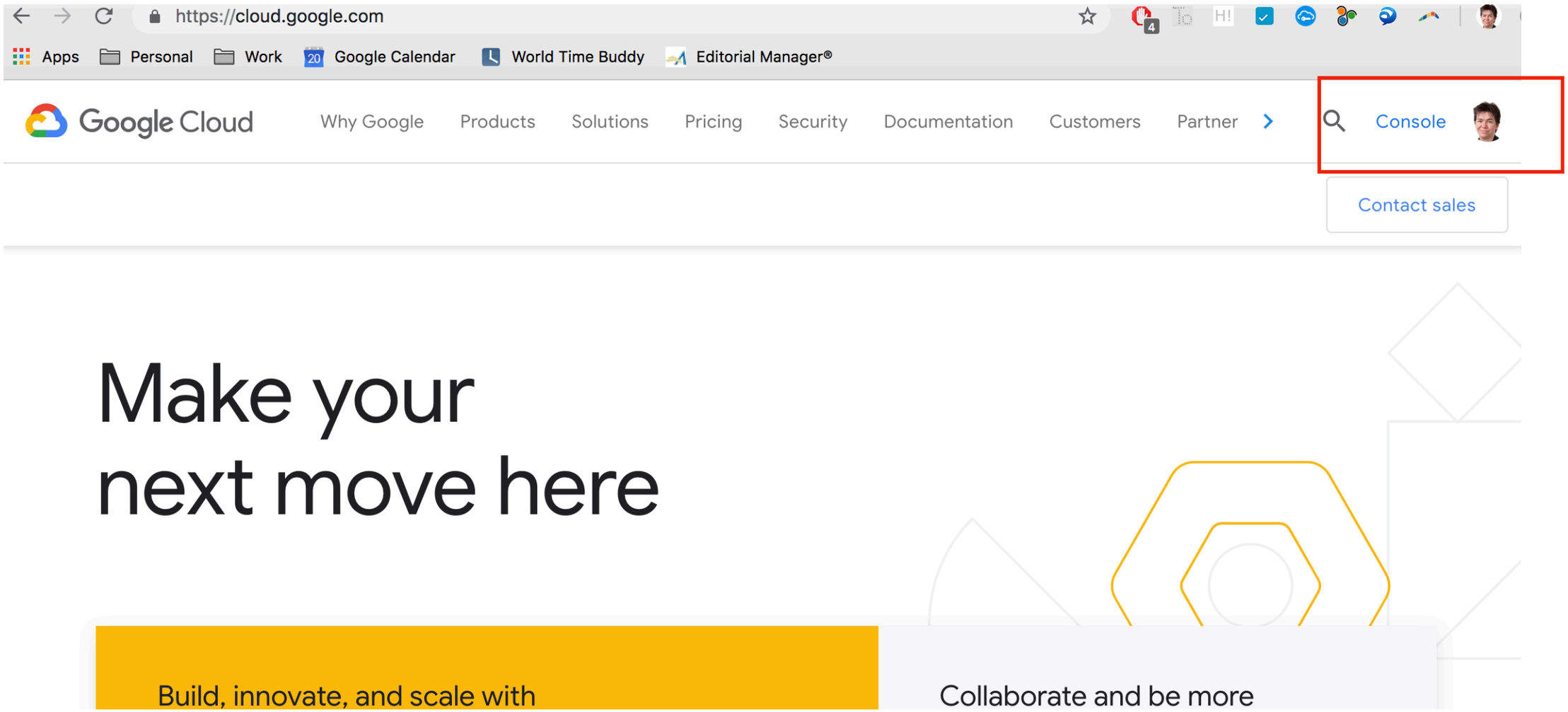
WHAT IF YOU MAKE CHANGES?

Save and source

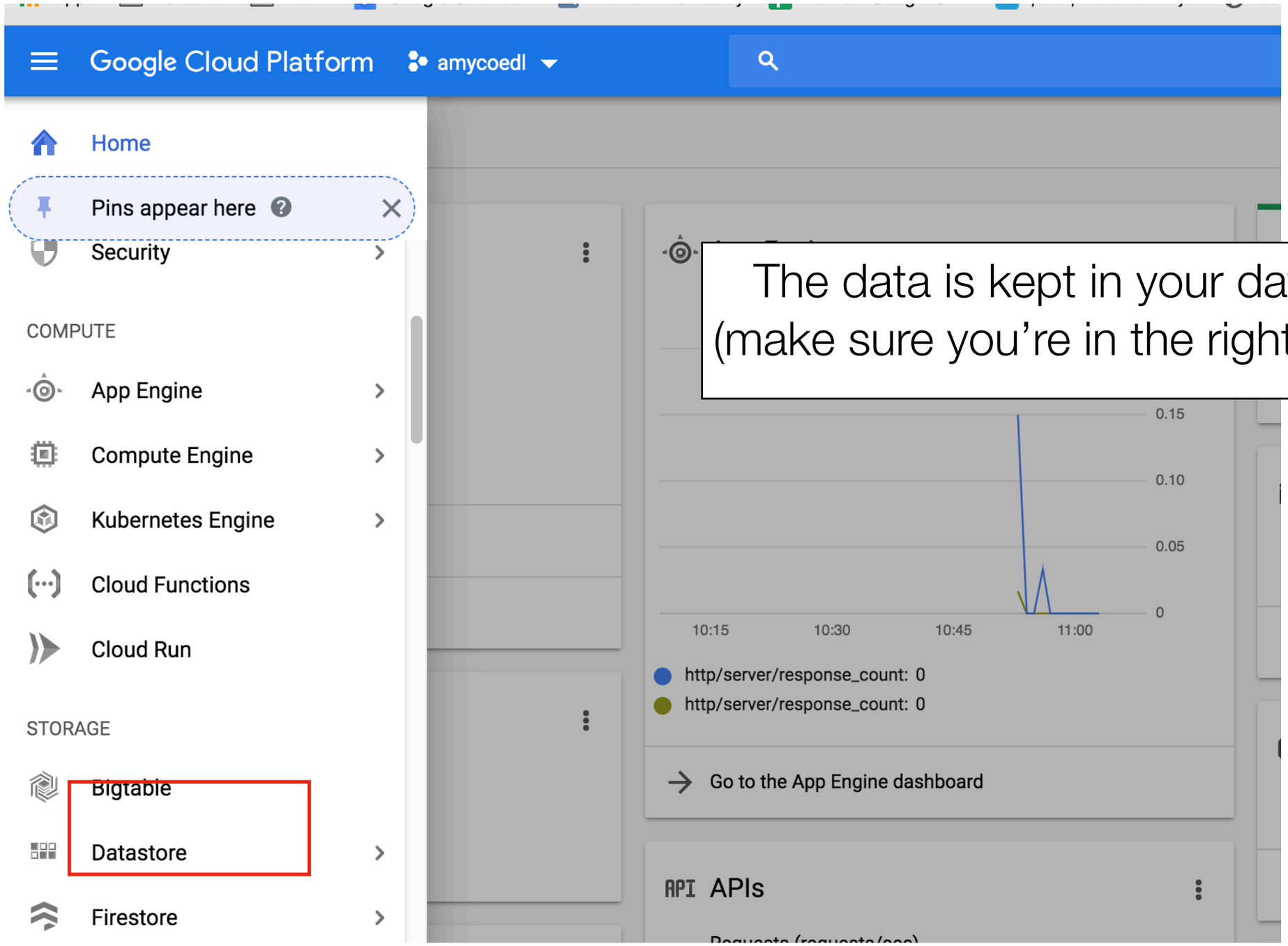
Use the `run_appengine()` function to redeploy

VIEW YOUR DATA

You can see your data coming in by looking in the google cloud console online

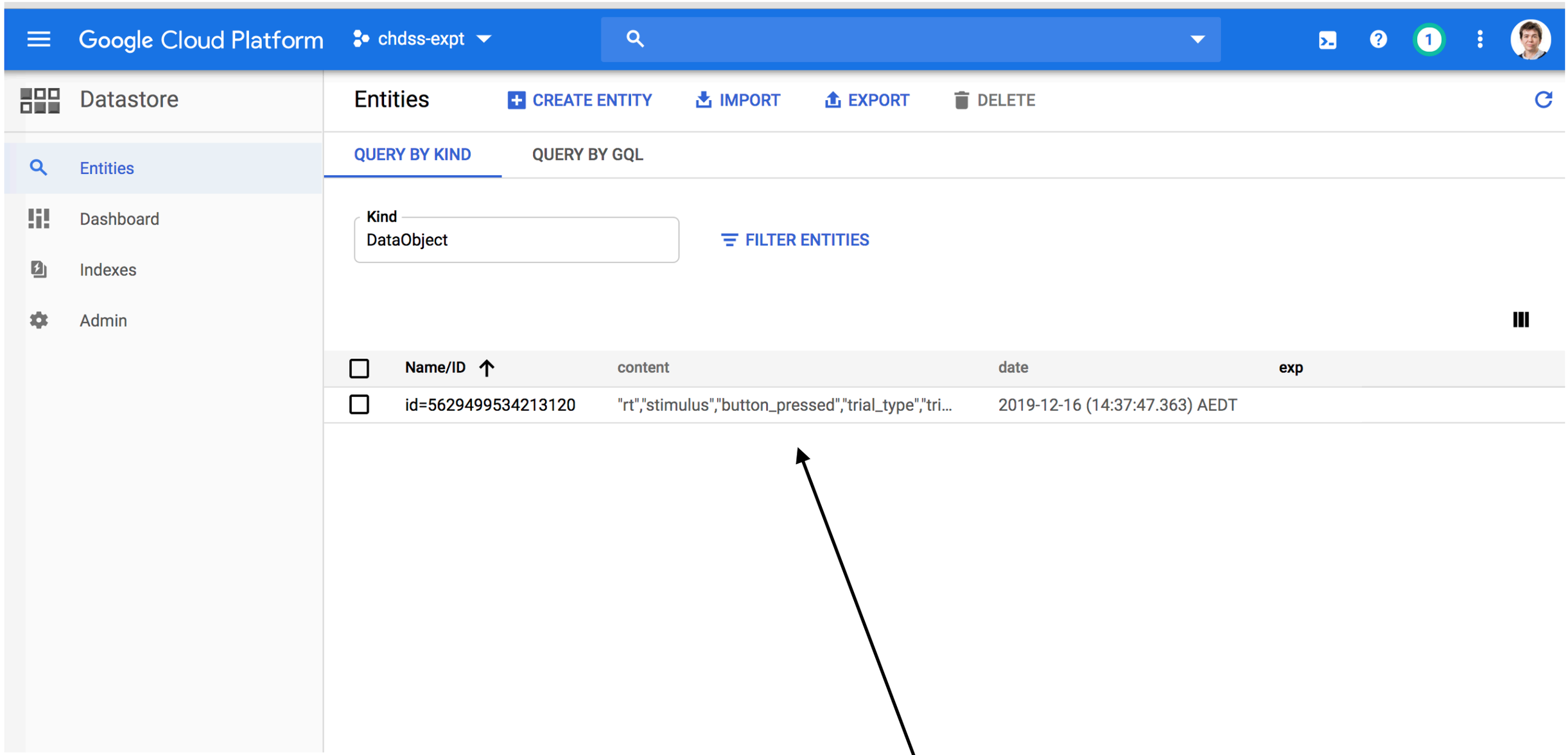


VIEW YOUR DATA



The data is kept in your datastore (make sure you're in the right project!)

VIEW YOUR DATA



There it is!

DOWNLOADING DATA IS EASY

Go to your url and add on **`/info`**— it will automatically download a csv file called **`results`**

* Note that this will probably change in future versions of jaysire, because it creates a security issue (anybody can do this). It's still in development and we ran out of time and figured it would be best to just get something working for now. The documentation for jaysire will reflect any changes that are made