

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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Tentative plan

1. Experiment logic, motivation, and design
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3. Creating a template experiment with jaysire and putting it online
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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

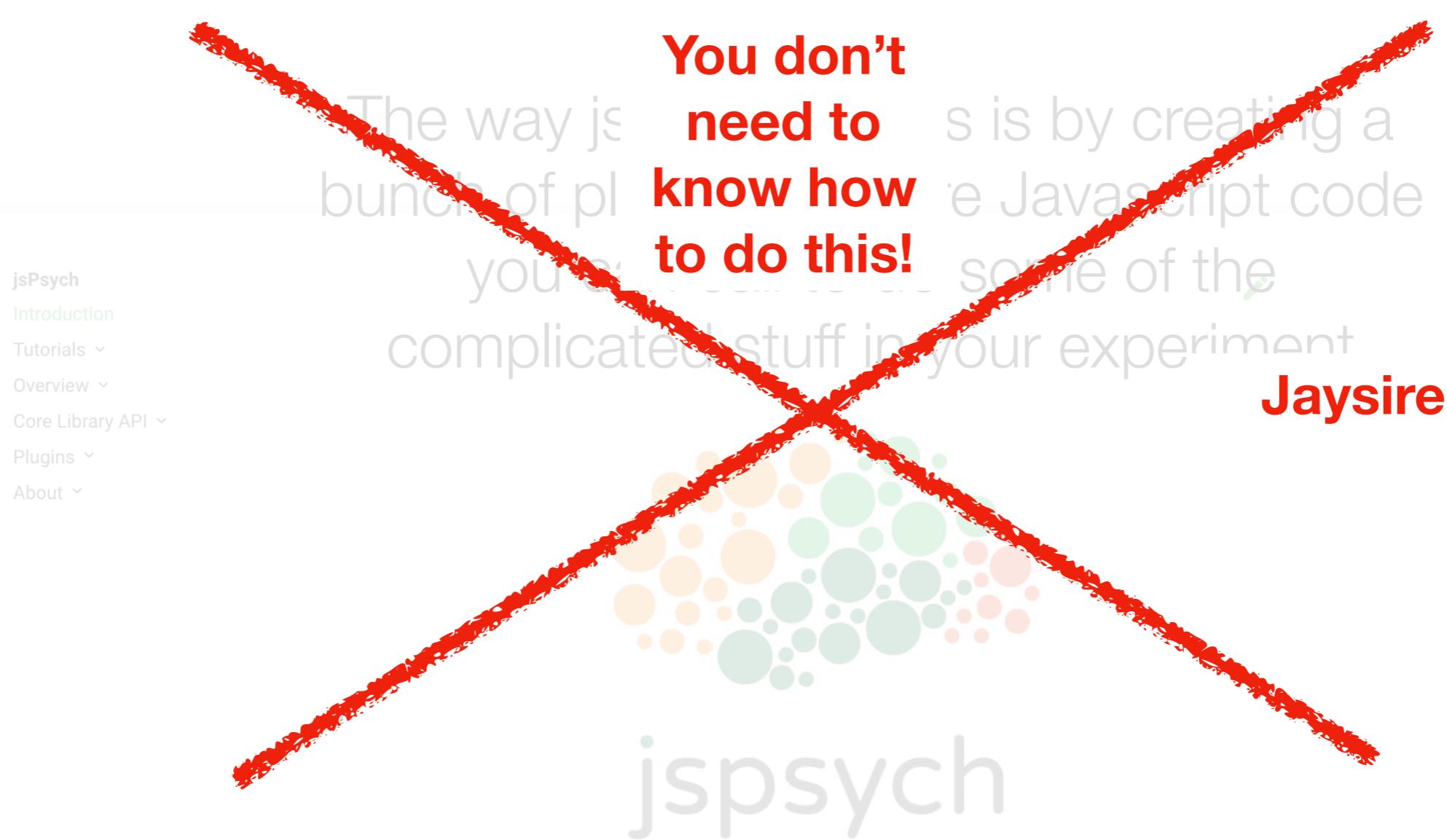
jsPsych
[Introduction](#)
Tutorials ▾
Overview ▾
Core Library API ▾
Plugins ▾
About ▾



jspsych

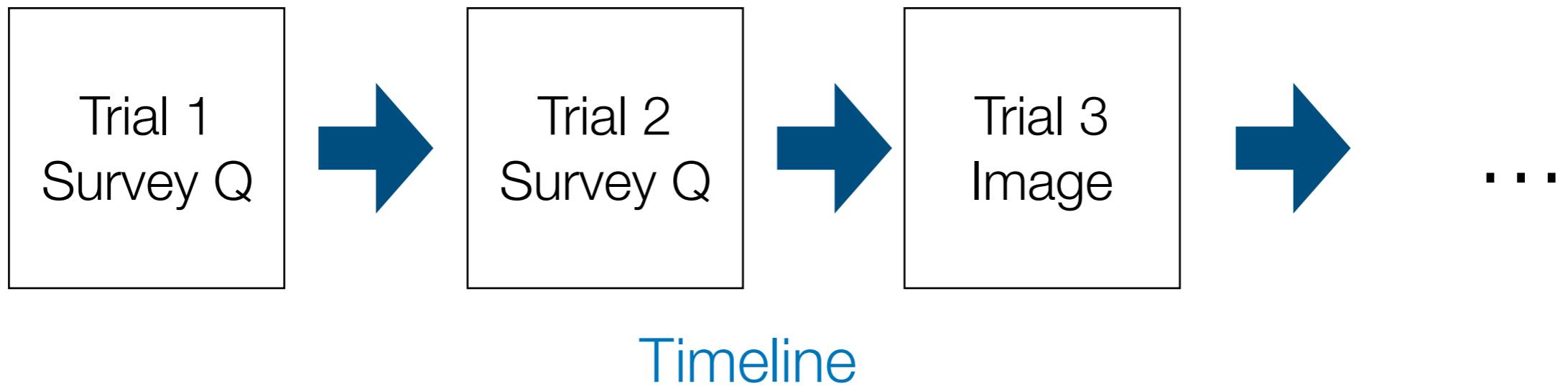
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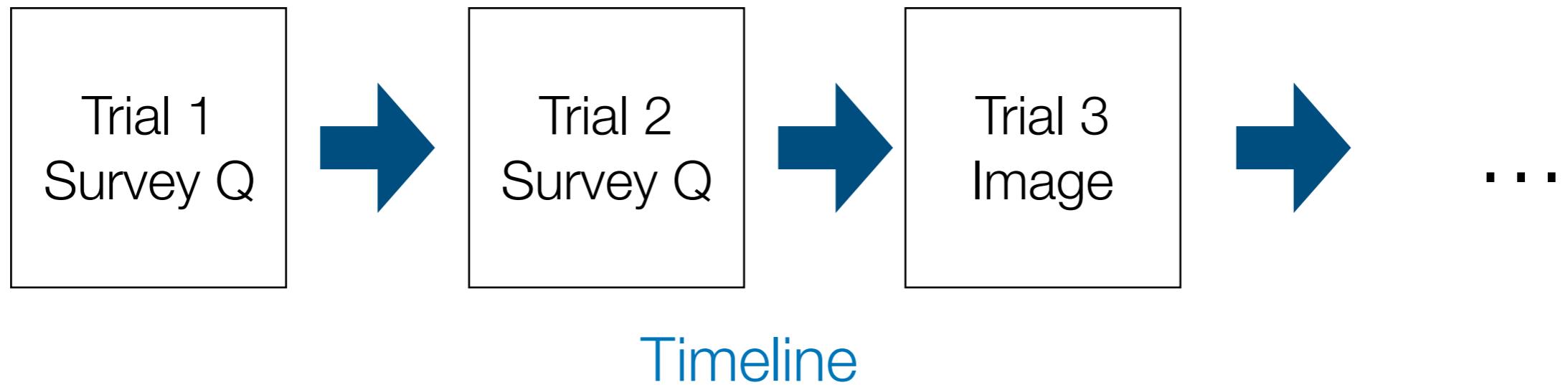
TIMELINES

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).



TIMELINES

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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

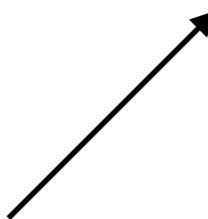
run_ Functions for running the experiment

fn_ Manipulates javascript functions (advanced)

JAYSIRE: INSTALLATION

```
install.packages("remotes")
```

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



loads it onto
your machine

```
library(jaysire)
```

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

```
> remotes::install_github("dnavarro/jaysire")
Downloading GitHub repo dnavarro/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|
```

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

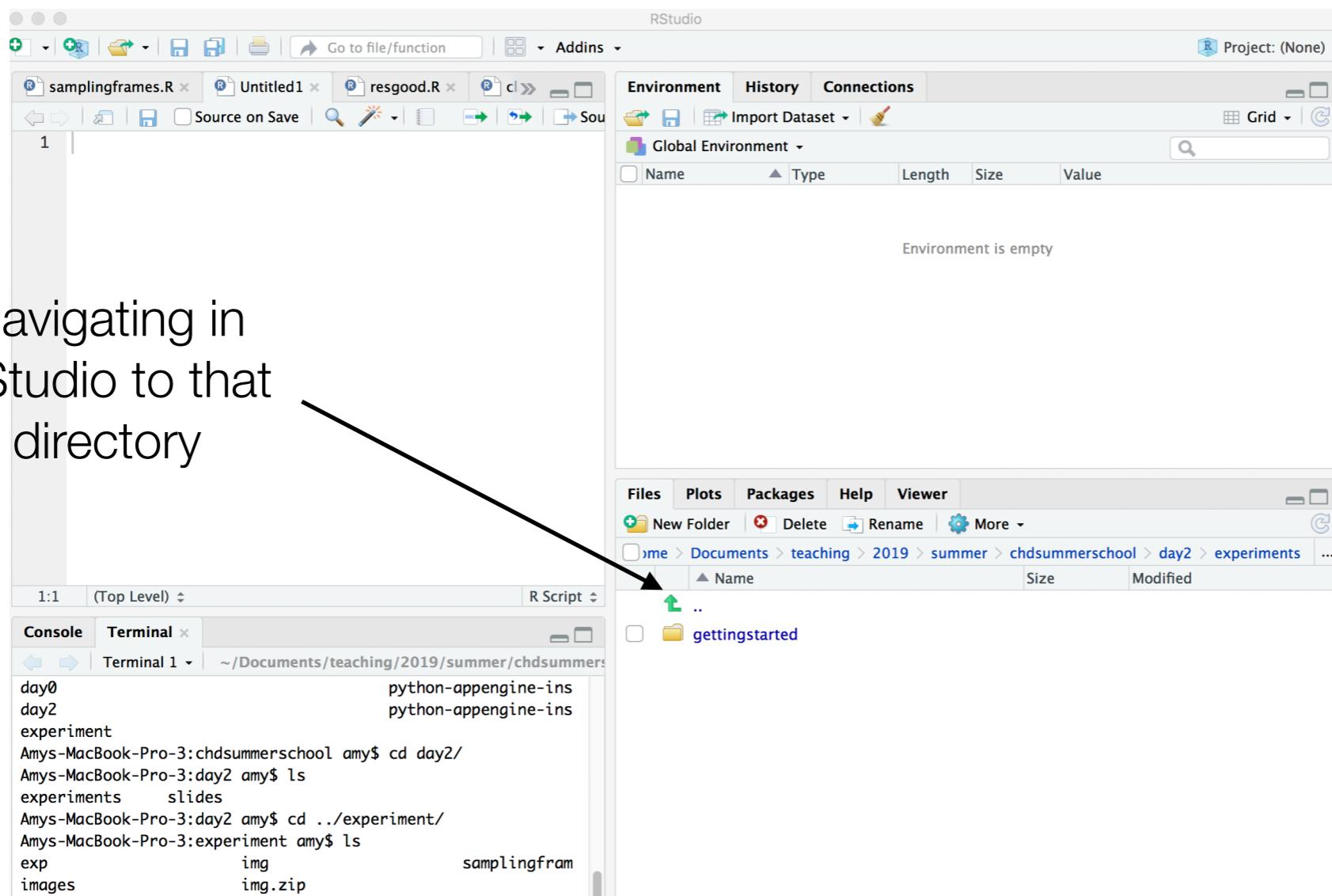
We want you to copy all of day2 into your summerschool folder, so that we don't have 70+ people all trying to change the actual chdss2019_content repository

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

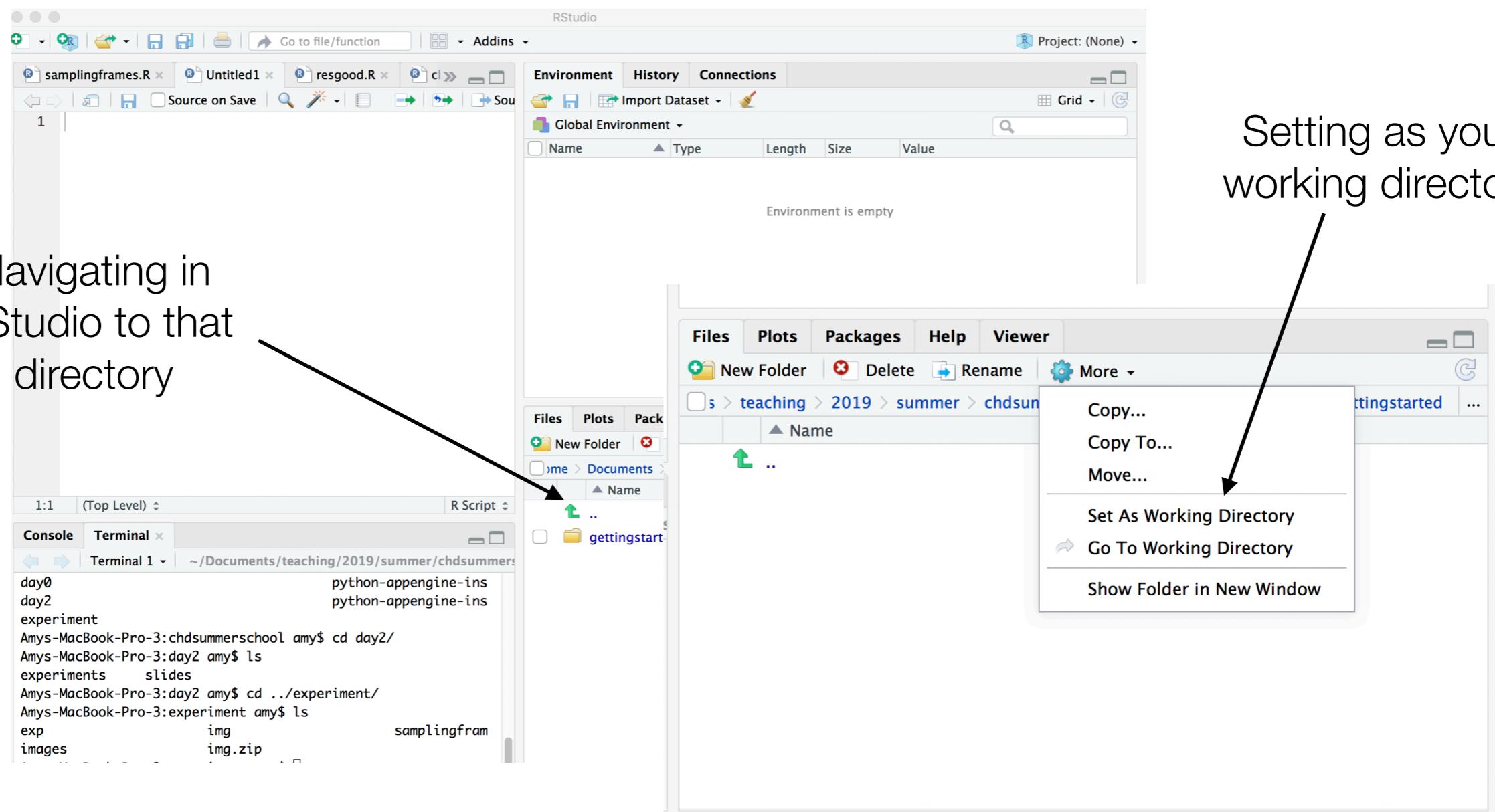
JAYSIRE: GETTING STARTED

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



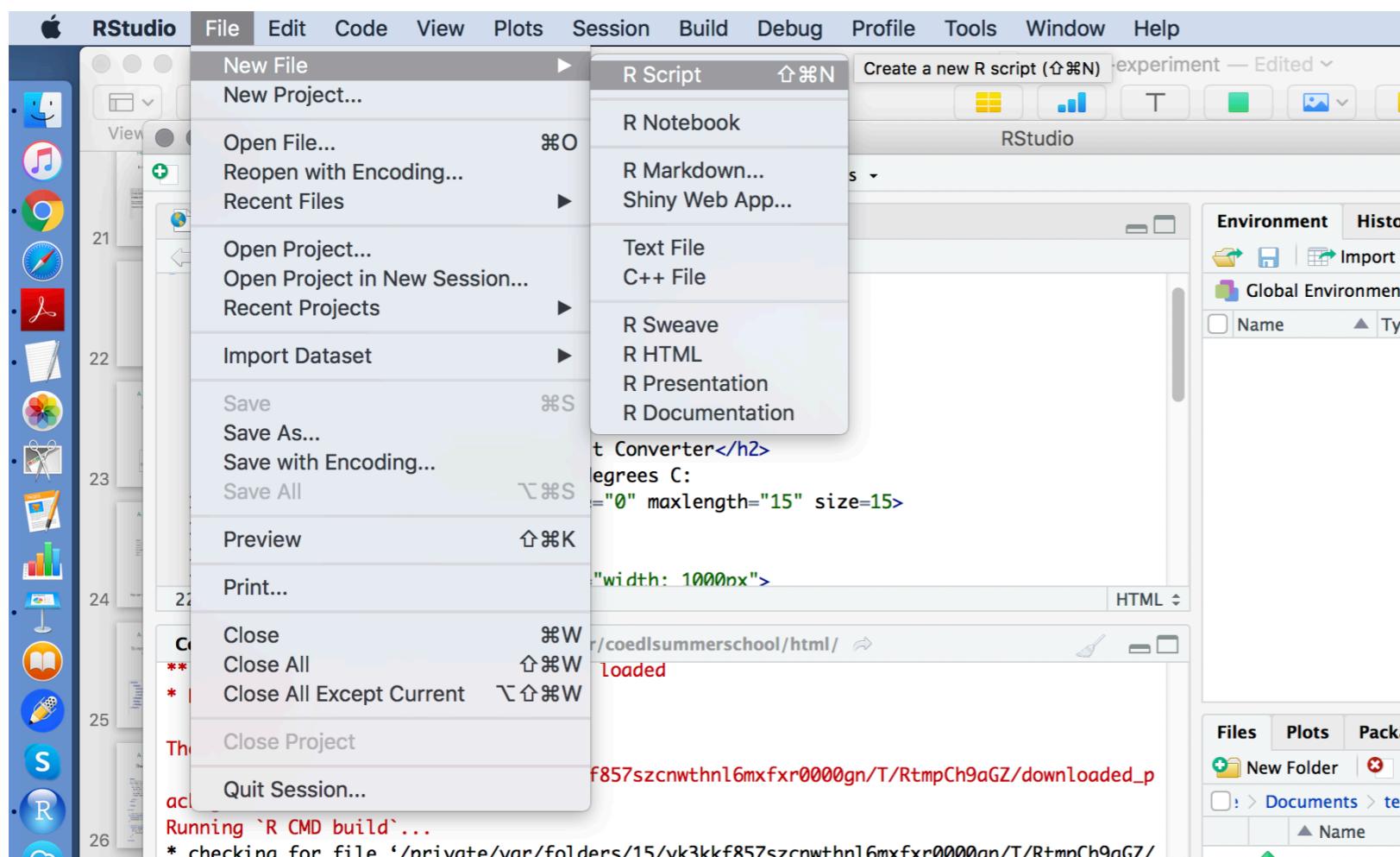
JAYSIRE: GETTING STARTED

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



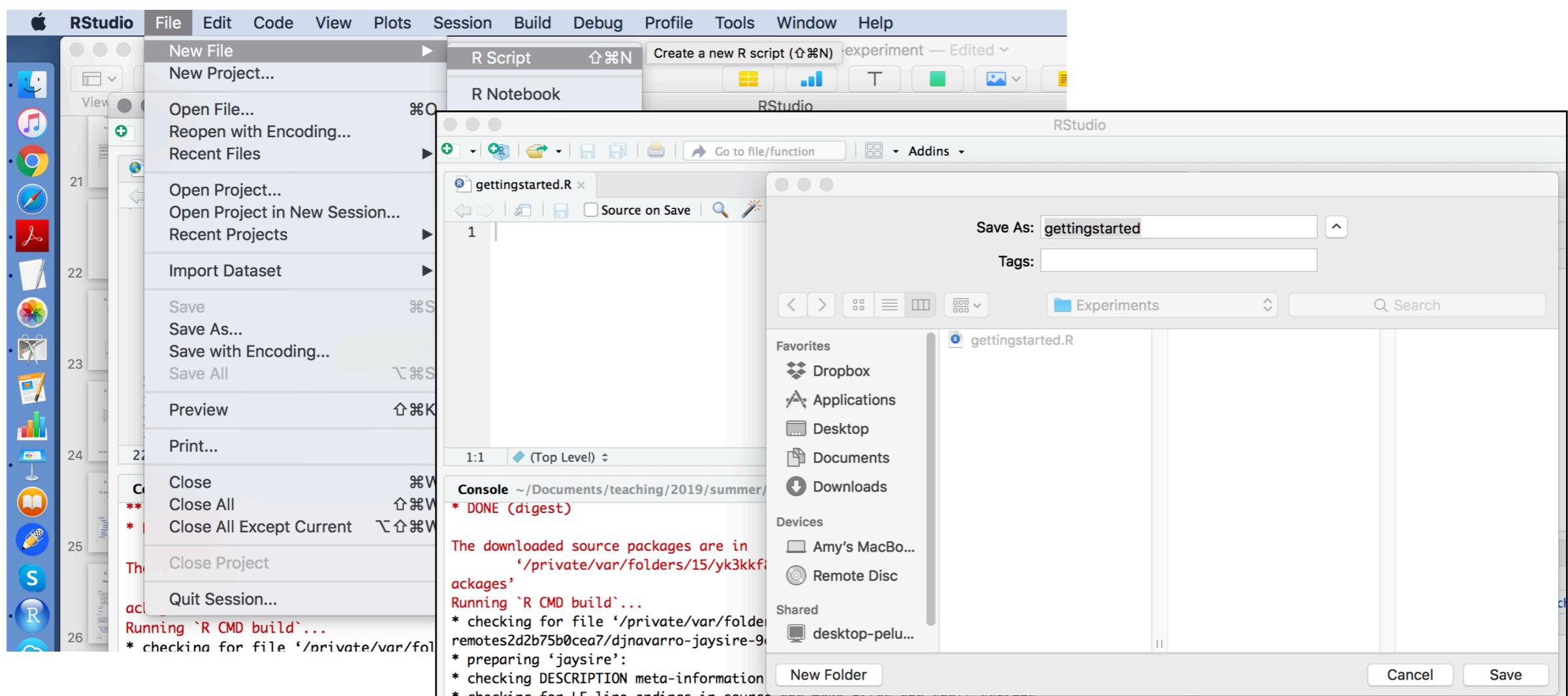
JAYSIRE: GETTING STARTED

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

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`help(trial_instructions)`

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

The screenshot shows the R help documentation for the `trial_instructions` function. The title is "Specify pages of instructions to display". The "Description" section states: "The `trial_instructions` function is used to display one or more pages of instructions that a participant can browse." The "Usage" section shows the function signature: `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)`. The "Arguments" section lists the parameters:

<code>pages</code>	Character vector. Each element should be an HTML-formatted string specifying a page
<code>key_forward</code>	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
<code>key_backward</code>	This is the key that the subject can press in order to return to the previous page.
<code>allow_backward</code>	If TRUE, participants can navigate backwards
<code>allow_keys</code>	If TRUE, participants can use keyboard keys to navigate
<code>show_clickable_nav</code>	If TRUE, buttons will be shown to allow navigation
<code>button_label_previous</code>	Text on the "previous" button
<code>button_label_next</code>	Text on the "next" button
<code>post_trial_gap</code>	The gap in milliseconds between the current trial and the next trial. If NULL, there will be no gap

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,  
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)
```

JAYSIRE: GETTING STARTED

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

Putting the instructions into your own variable called instructions

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The function name (needs parentheses around arguments)

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)

These are the three arguments to the function:

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instructions <- trial_instructions(  
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```
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```

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```

```
)
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These are the three arguments to the function:

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

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```

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show_clickable_nav = TRUE,  
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```

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

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JAYSIRE: GETTING STARTED

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Builds a timeline consisting only of the instructions we created

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```

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

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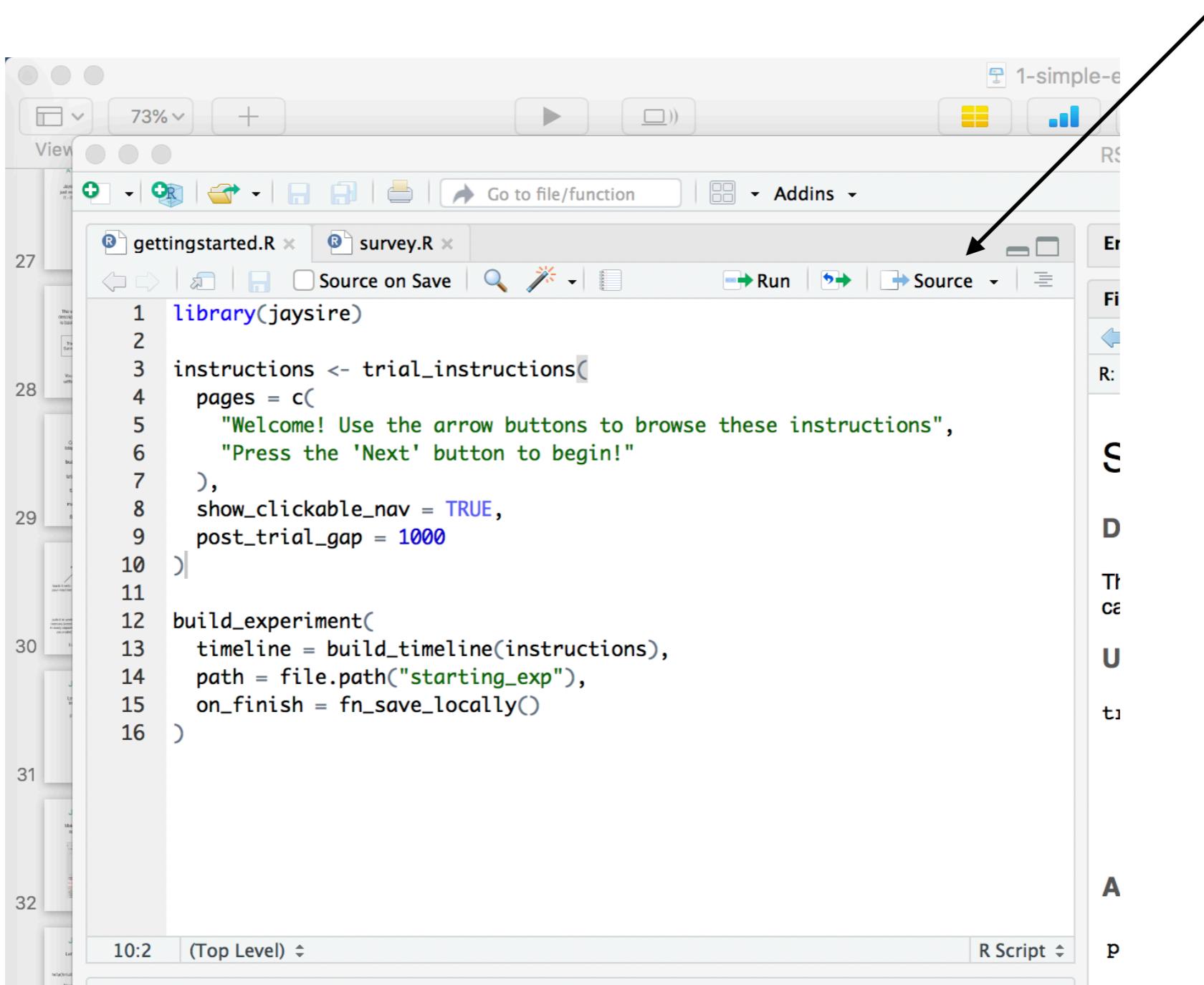
```
build_experiment(  
  timeline = build_timeline(instructions),  
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  on_finish = fn_save_locally()  
)
```

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

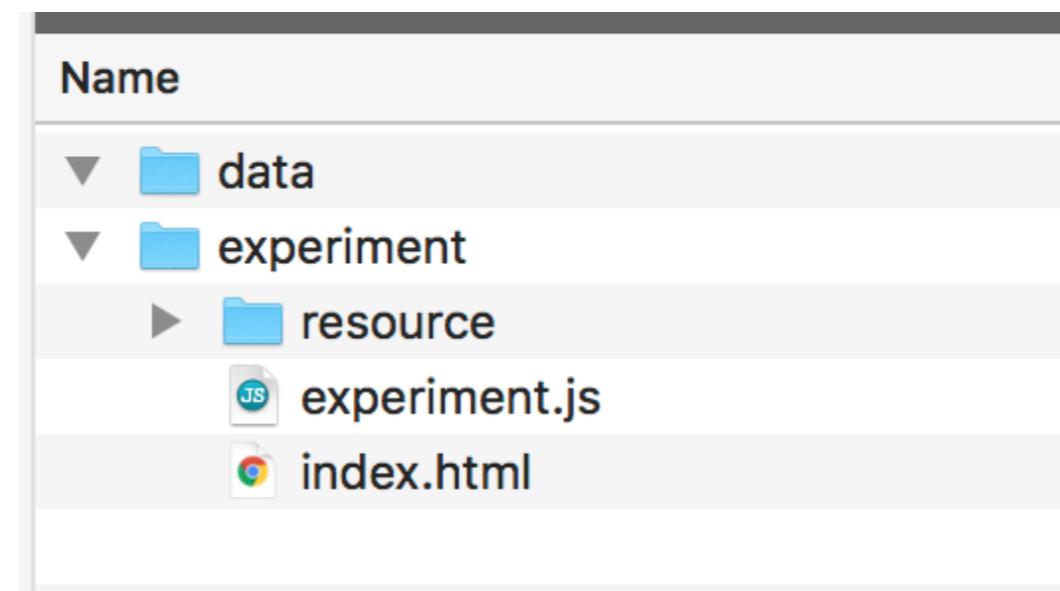


```
library(jaysire)
instructions <- trial_instructions(
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  ),
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)
build_experiment(
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```

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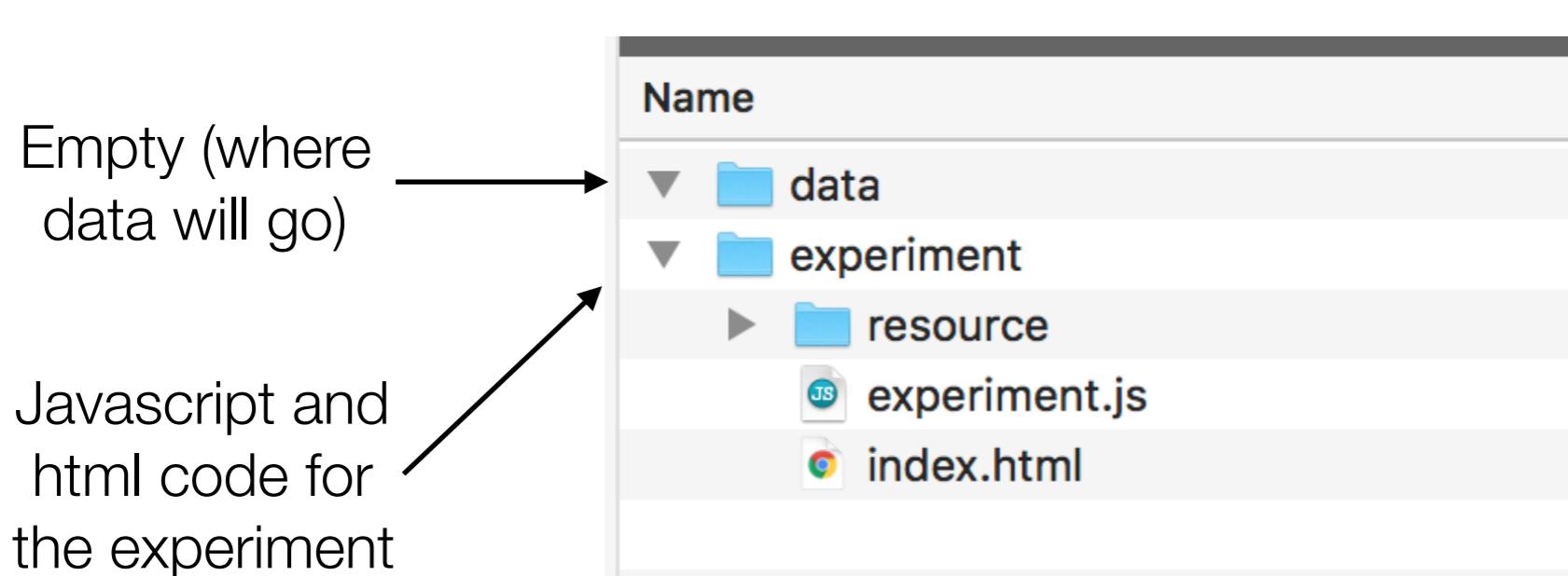
You’ll see that this builds the experiment - creates two folders inside `starting_exp`



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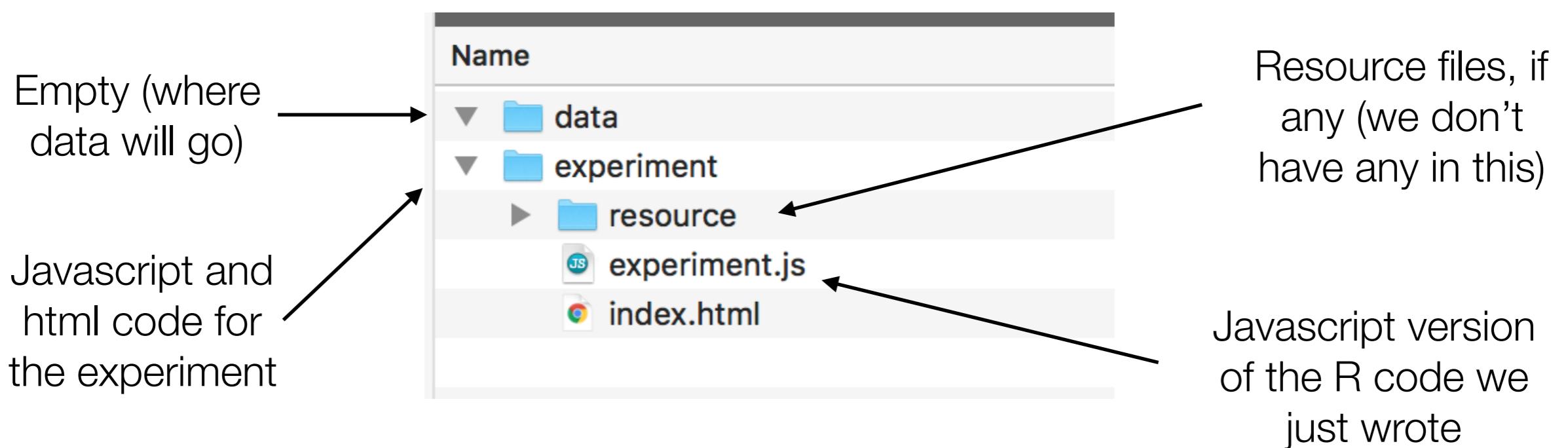
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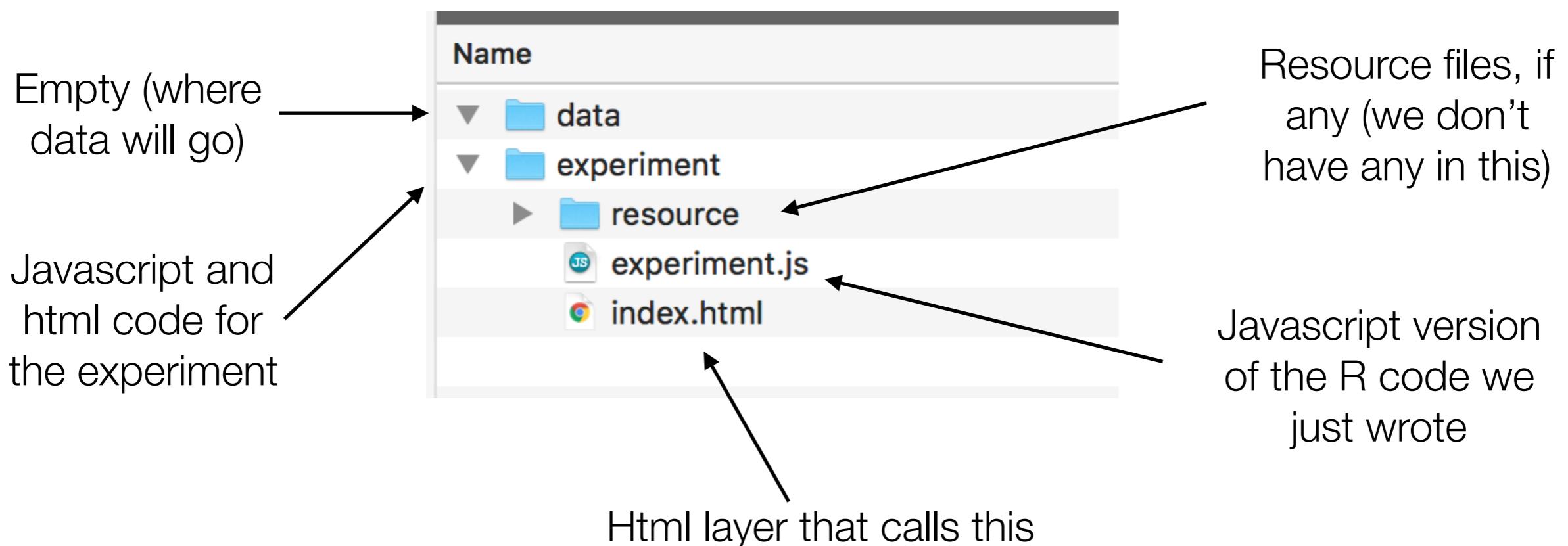
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“Source” the experiment in R to get it ready to run

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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
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Type it at the console with your path in as an argument

The function name (needs
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Tells R this is a
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Name of the folder with
the experiment

```
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```

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)
}
```

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And then replace the argument in `build_experiment`:

```
path = my_directory,
```

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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 >

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Press the 'Forward' button to begin!

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Forward >

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  
)
```

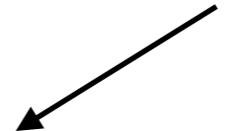
ADDING A TRIAL

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
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The stimulus
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The stimulus
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The button
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labels

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

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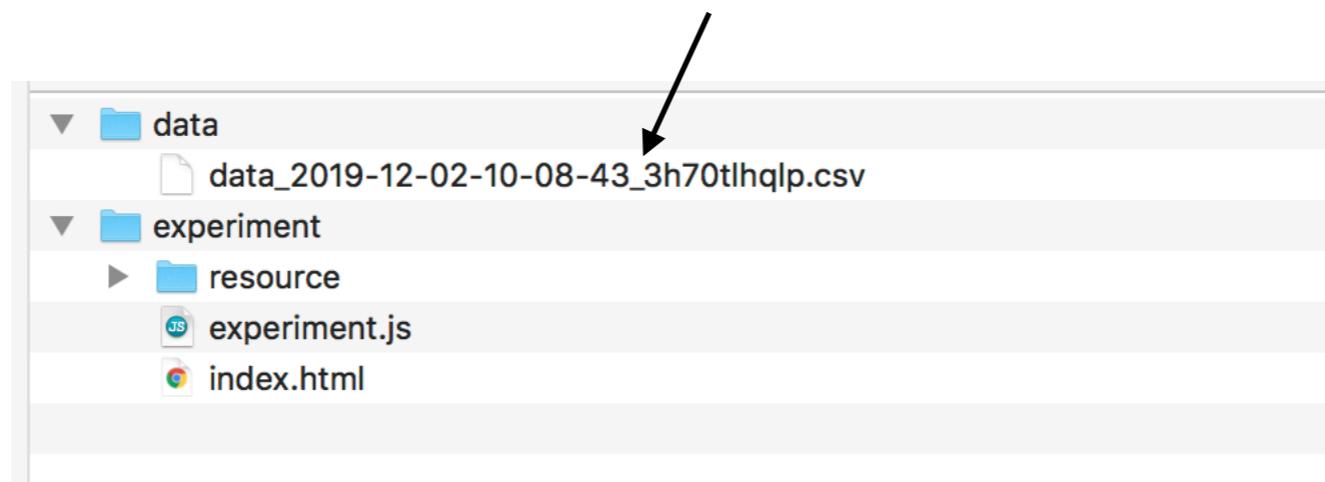
Need to also remember to add it to the timeline!

```
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.

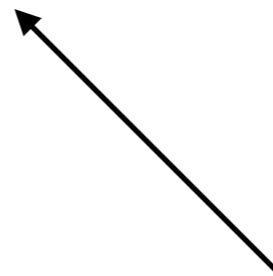
The participant should have three response options: true, false, and I don't know

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)

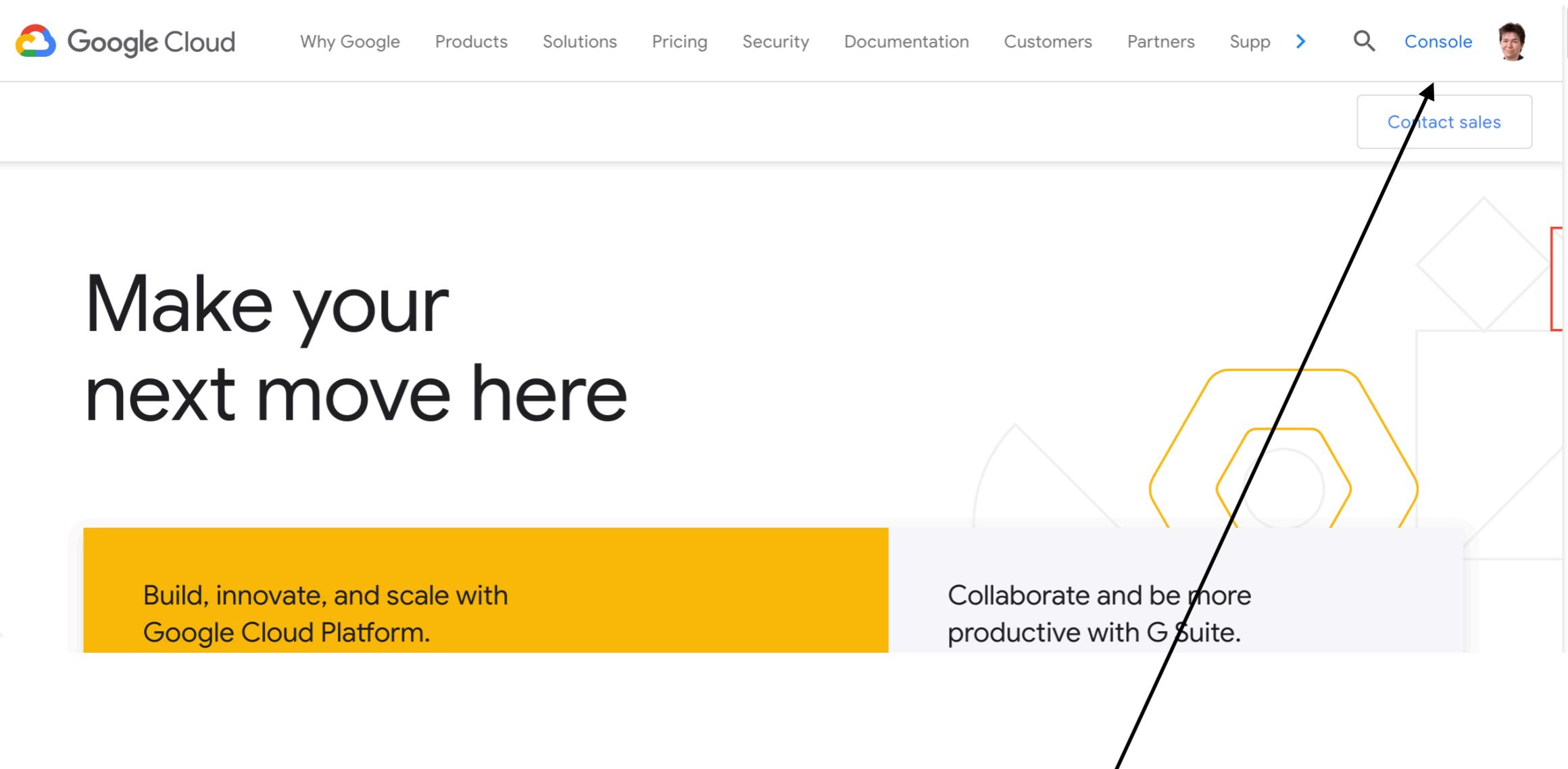


OUTLINE OF STEPS

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



Go to console

2. CREATE PROJECT IN GOOGLE CLOUD

The screenshot shows the Google Cloud Platform dashboard for the project "qualification-test". A large black arrow points from the text "This will list your projects" at the bottom to the project name "qualification-test" in the top navigation bar.

Project info
Project name: qualification-test
Project ID: qualification-test
Project number: 219908920333
→ Go to project settings

Resources
App Engine: 10 versions
Cloud Storage: 2 buckets

App Engine
Summary (count/sec)
0.150
0.075
0
10 PM 10:15 10:30 10:45
● http/server/response_count: 0
● http/server/response_count: 0
→ Go to the App Engine dashboard

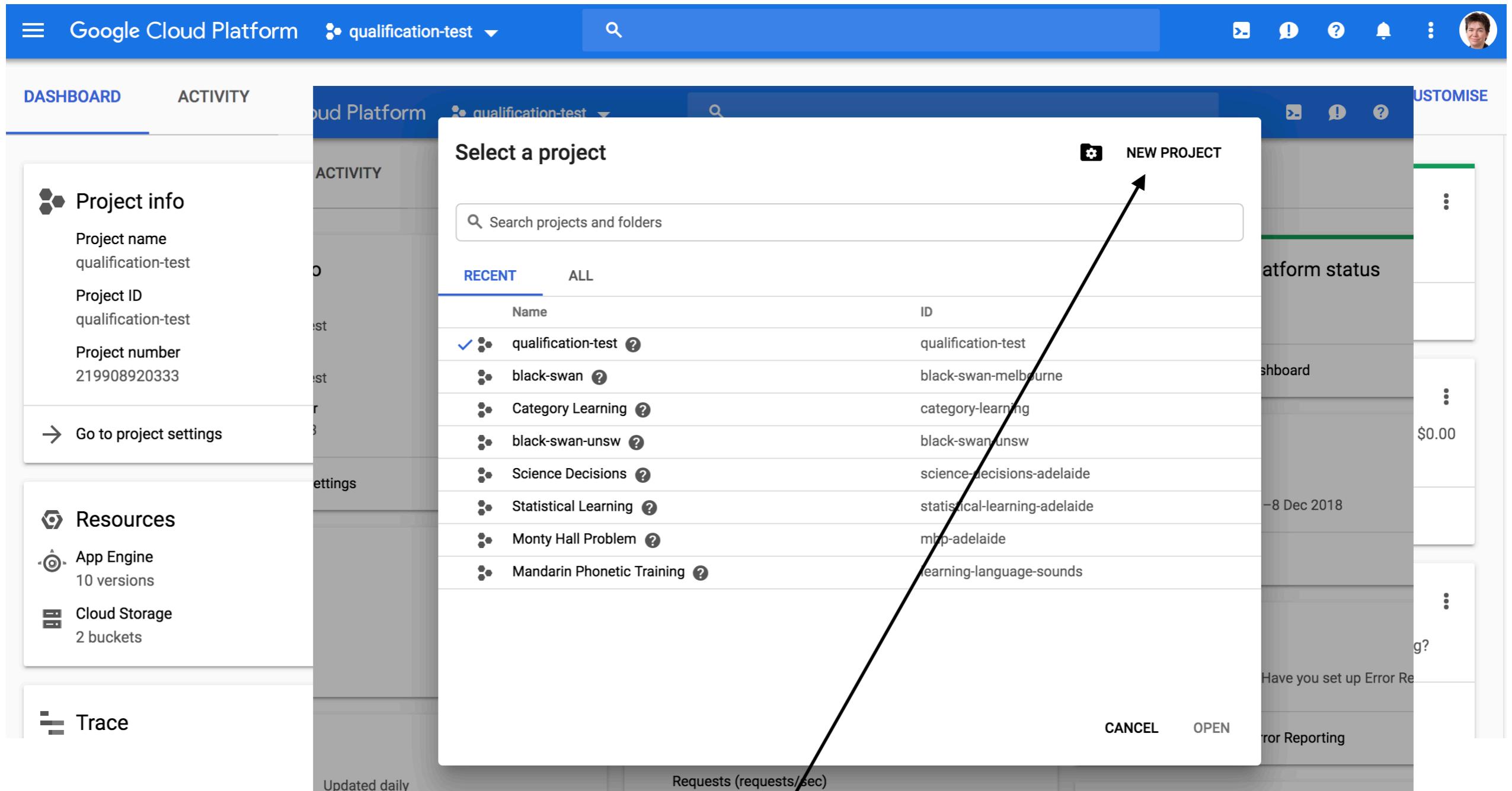
Google Cloud Platform status
All services normal
→ Go to Cloud status dashboard

Billing
Estimated charges: USD \$0.00
For the billing period 1–8 Dec 2018
→ View detailed charges

Error Reporting
No sign of any errors. Have you set up Error Reporting?
→ Learn how to set up Error Reporting

This will list your projects

2. CREATE PROJECT IN GOOGLE CLOUD



You can select “new project”

2. CREATE PROJECT IN GOOGLE CLOUD

Google Cloud Platform

New Project

You have 6 projects remaining in your quota. Request an increase or delete projects.

[Learn more](#)

[MANAGE QUOTAS](#)

Project Name *
My Project 86837

Project ID: linen-age-224911. It cannot be changed later. [EDIT](#)

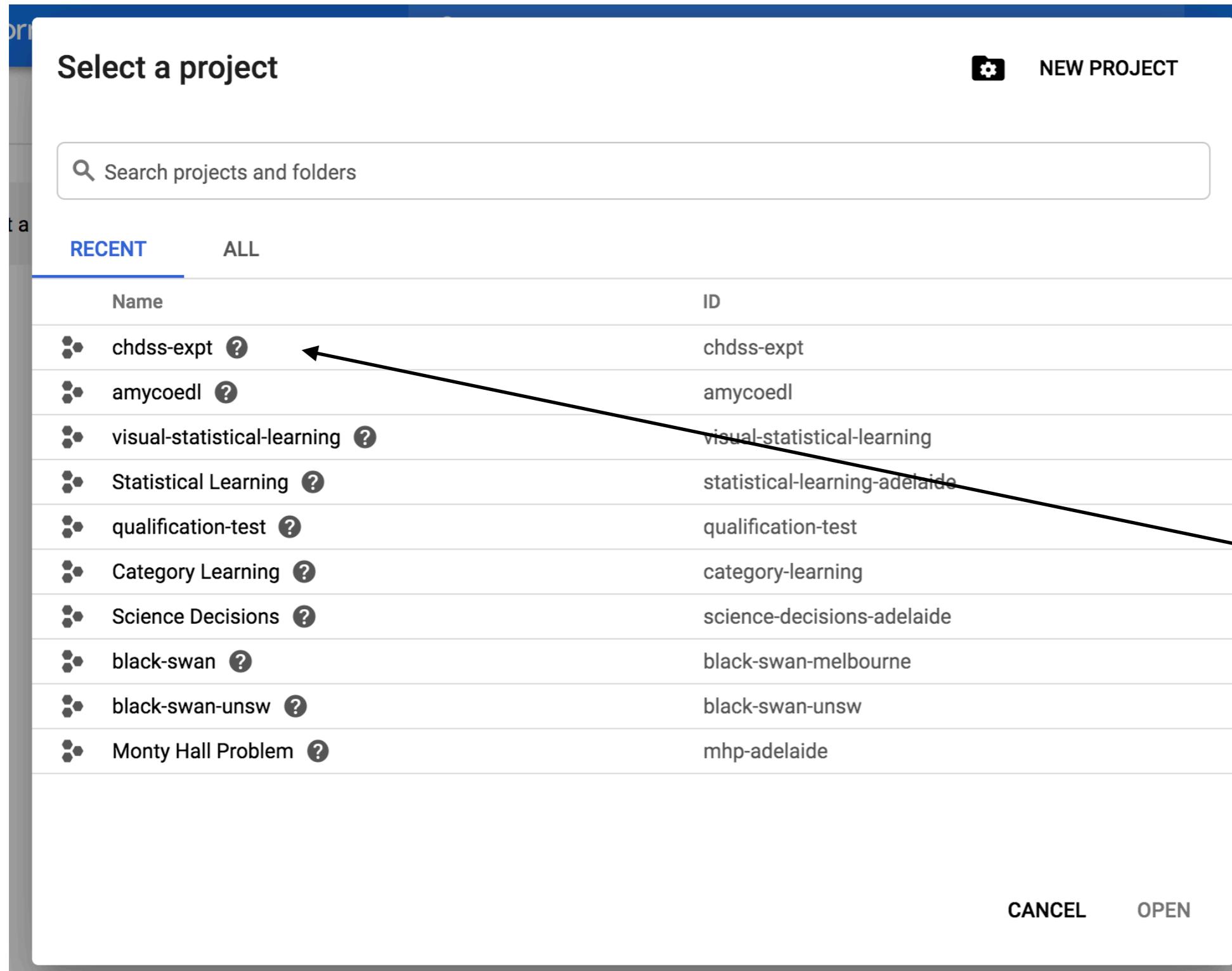
Location *
No organisation [BROWSE](#)

Parent organisation or folder

CREATE **CANCEL**

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

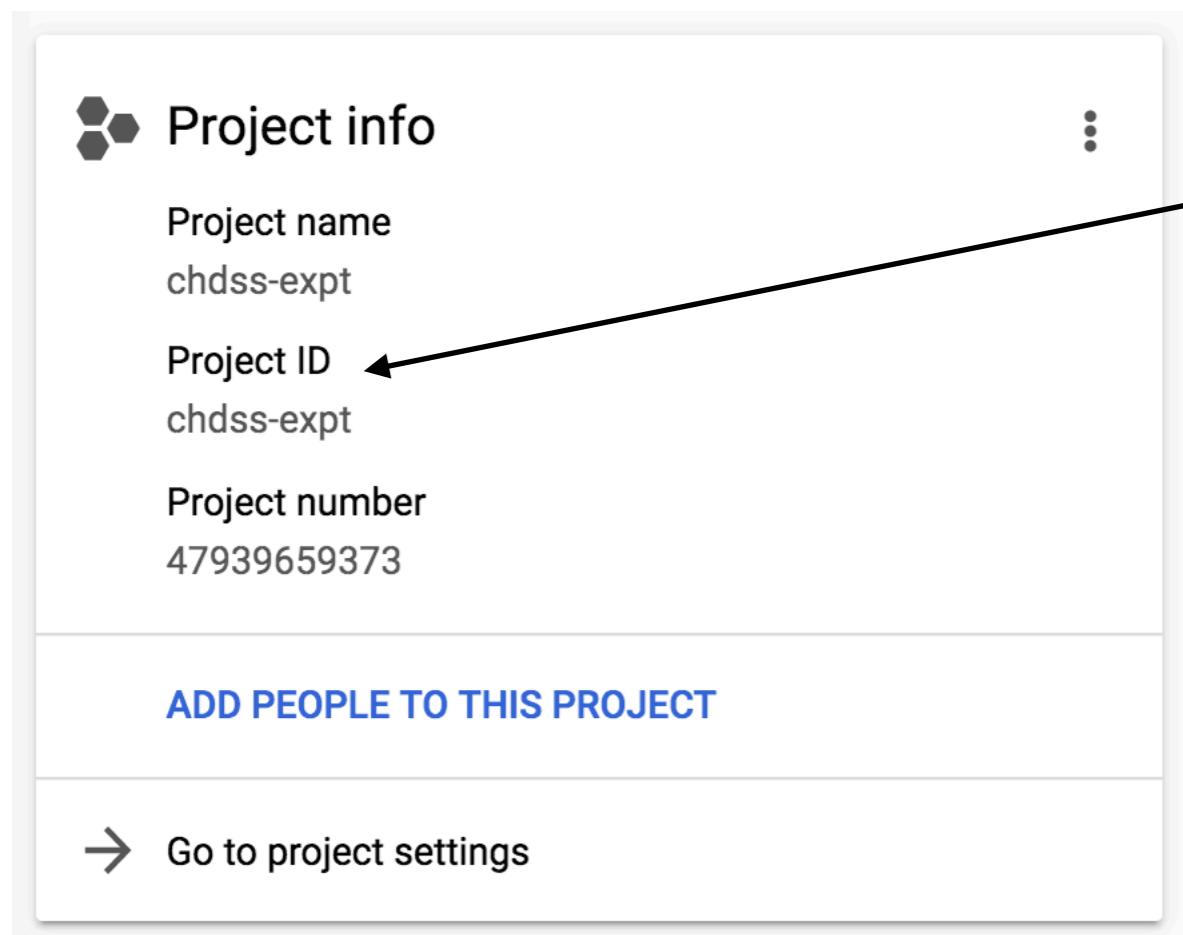


Now select it
from your list

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
```

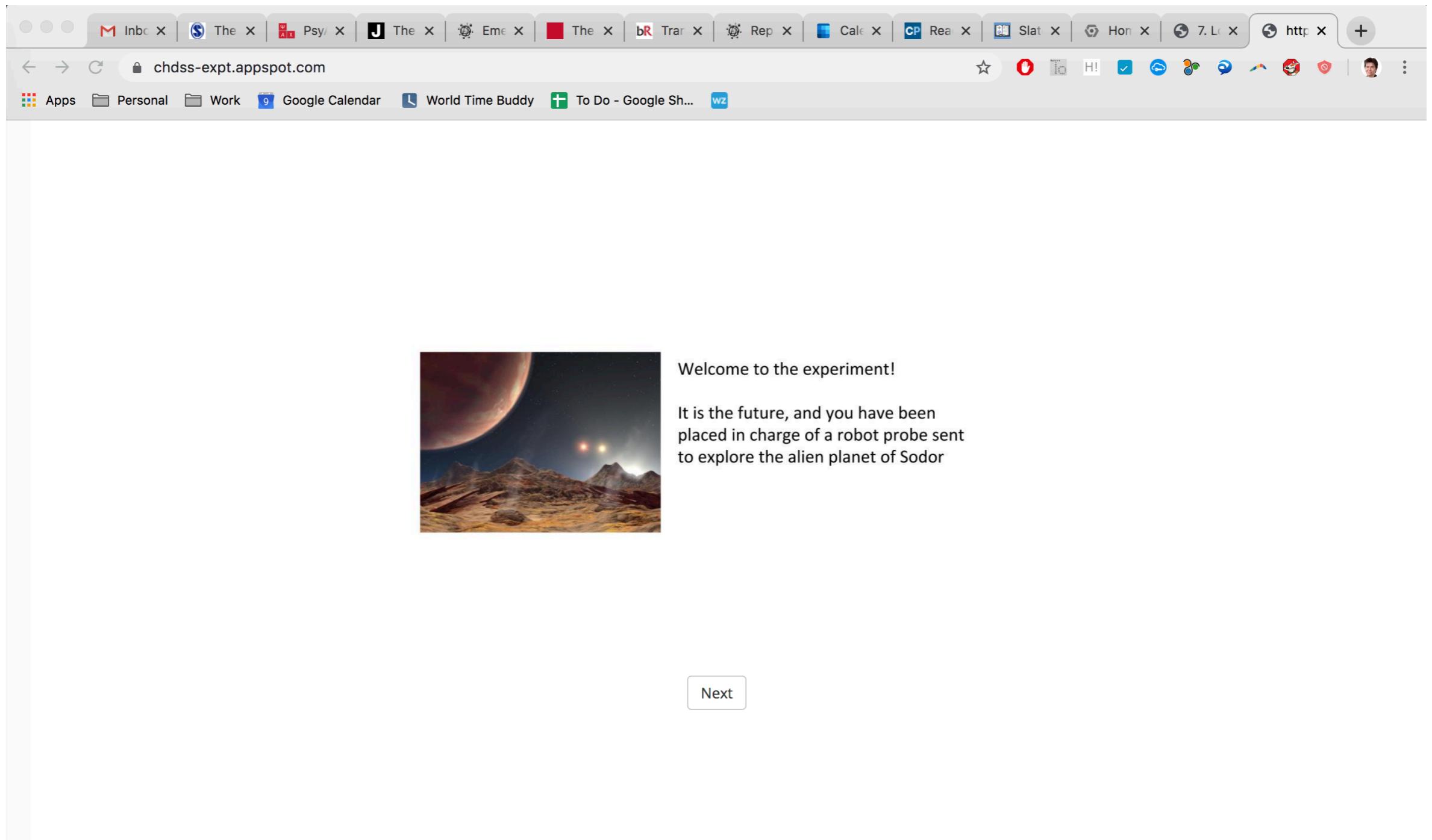
Updates are available for some Cloud SDK components. To install them, please run:

```
$ gcloud components update
```

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

There is your url!

4. GO TO YOUR EXPERIMENT!



The screenshot shows a web browser window with a tabs bar at the top containing various open tabs. The active tab is titled "chdss-expt.appspot.com". Below the tabs is the browser's toolbar with icons for back, forward, search, and other functions. The main content area displays a landing page for an experiment. On the left is a large image of a reddish-orange alien planet with a prominent ring system, set against a dark background with distant stars and small celestial bodies. To the right of the image, the text reads:

Welcome to the experiment!
It is the future, and you have been placed in charge of a robot probe sent to explore the alien planet of Sodor

At the bottom right of the content area is a small "Next" button.

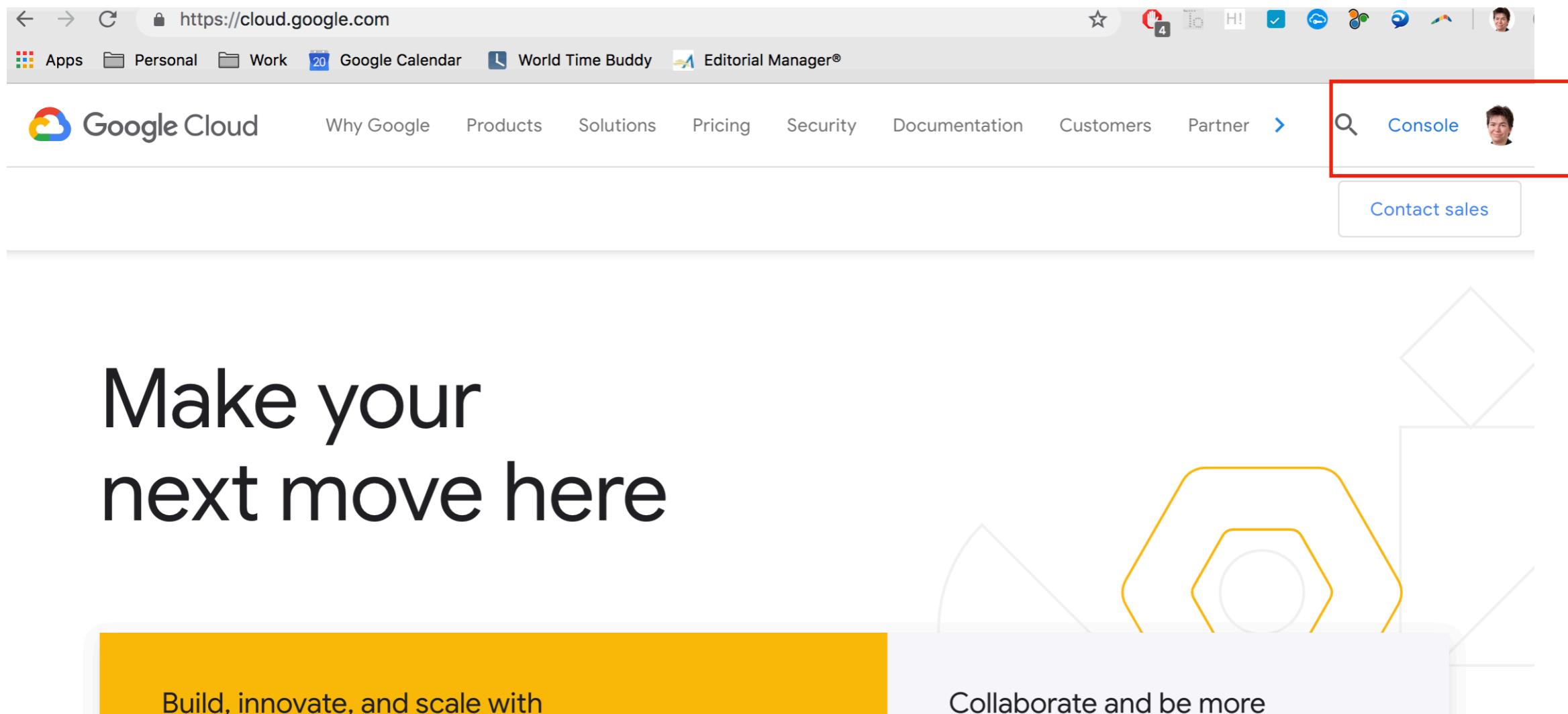
WHAT IF YOU MAKE CHANGES?

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



The screenshot shows the Google Cloud homepage at https://cloud.google.com. The top navigation bar includes links for Apps, Personal, Work, Google Calendar, World Time Buddy, Editorial Manager®, Why Google, Products, Solutions, Pricing, Security, Documentation, Customers, Partner, and a search bar labeled "Console". A red box highlights the "Console" link in the search bar. Below the search bar is a "Contact sales" button. The main content area features the text "Make your next move here" and two buttons: "Build, innovate, and scale with" (yellow background) and "Collaborate and be more" (light gray background). The background of the page features abstract geometric shapes.

VIEW YOUR DATA

The screenshot shows the Google Cloud Platform dashboard for the project "amycoedl". The left sidebar lists various services under "COMPUTE" and "STORAGE". Under "STORAGE", the "Datastore" service is highlighted with a red box. A callout bubble above the sidebar says "Pins appear here". On the right, there is a chart titled "The data is kept in your datastore (make sure you're in the right project!)". The chart shows a single data series named "http/server/response_count" with two points: one at 0.15 and another at 0.05. Below the chart is a link to "Go to the App Engine dashboard".

Pins appear here

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

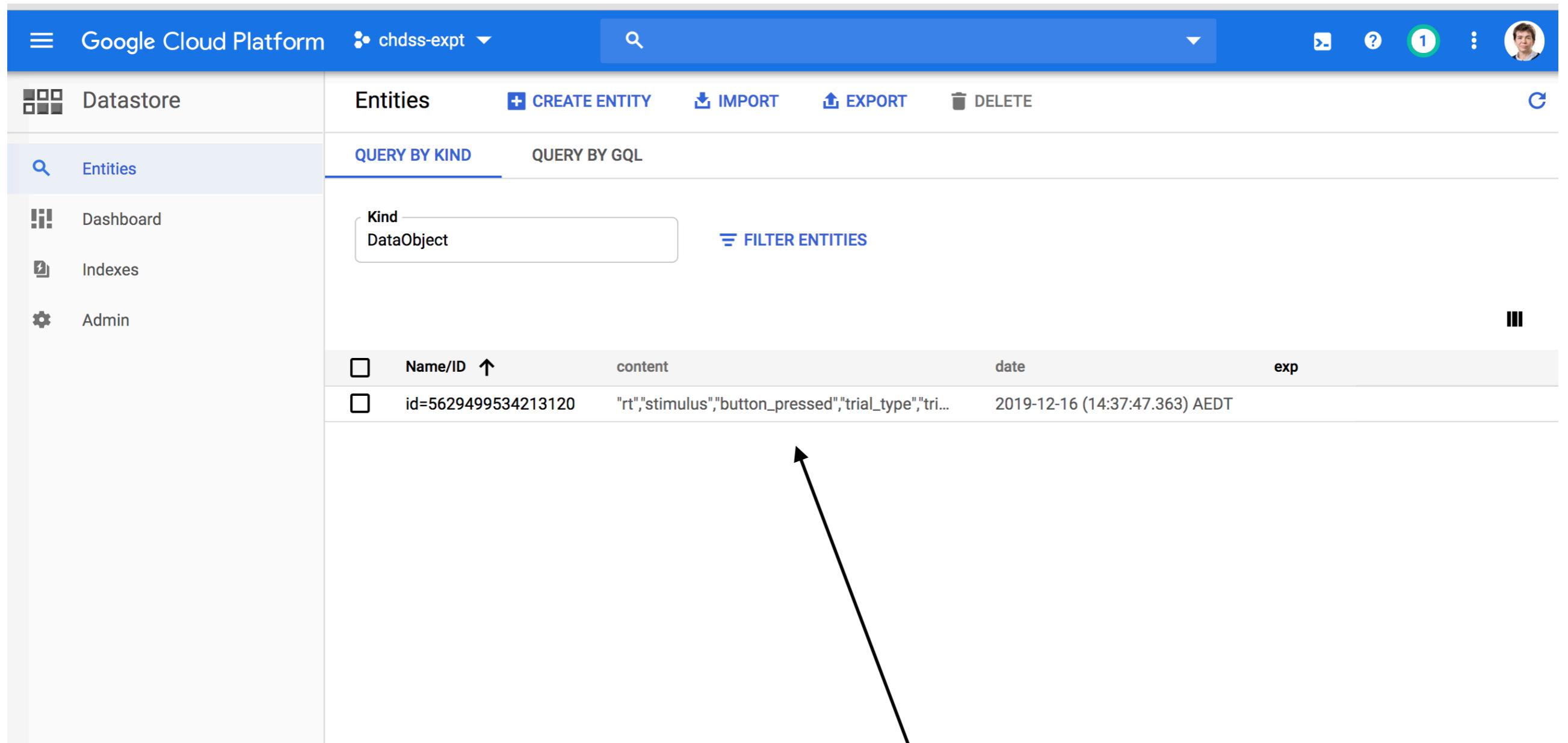
http/server/response_count: 0

http/server/response_count: 0

→ Go to the App Engine dashboard

API APIs

VIEW YOUR DATA



The screenshot shows the Google Cloud Platform Datastore interface. The left sidebar has options for Datastore, Entities, Dashboard, Indexes, and Admin. The main area is titled 'Entities' with buttons for CREATE ENTITY, IMPORT, EXPORT, and DELETE. It shows two tabs: 'QUERY BY KIND' (selected) and 'QUERY BY GQL'. A 'Kind' dropdown is set to 'DataObject'. Below it is a table with columns: Name/ID, content, date, and exp. One row is visible: id=5629499534213120, content: "rt","stimulus","button_pressed","trial_type","tri...", date: 2019-12-16 (14:37:47.363) AEDT.

<input type="checkbox"/> Name/ID ↑	content	date	exp
<input type="checkbox"/> id=5629499534213120	"rt","stimulus","button_pressed","trial_type","tri...	2019-12-16 (14:37:47.363) AEDT	

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