Welcome & get ready for the course

Research Beyond the Lab: Open Science and Research Methods for a Global Engineer

Prof. Elizabeth Tilley and Lars Schöbitz

Feb 20, 2025

rbtl-fs25.github.io/website/

This class is being recorded. Access to the recording is restricted to ETH members.

Welcome! 

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Meet the lecturers

Prof. Elizabeth Tilley

- Environmental Engineer 🔨
- Economist 📈
- Turkey Lover 🦃
- Canadian 🇨🇦

Lars Schöbitz

- Environmental Engineer 🔨
- Retired researcher 🛌
- RStudio certified instructor
- Data steward at ETHZ

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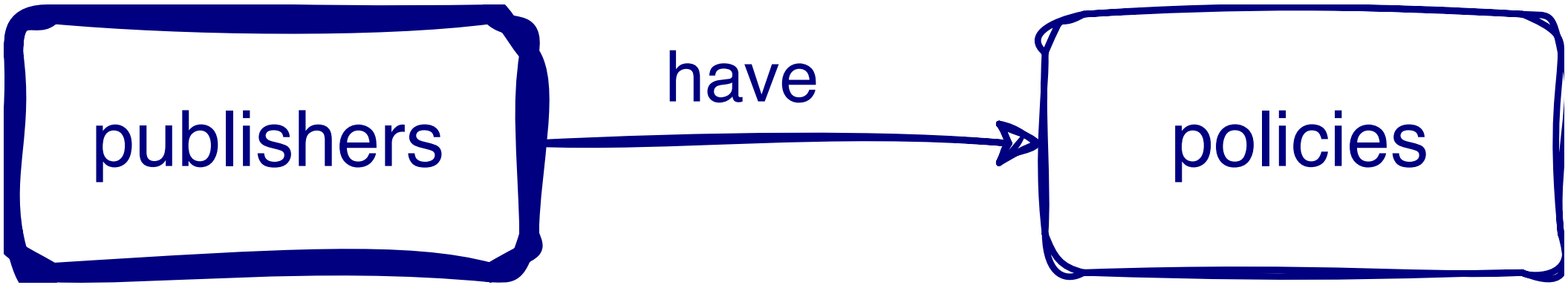
Learning Goals (for the course)

1. Be able to use a common set of data science tools (R, RStudio IDE, Git, GitHub, tidyverse, Quarto) to illustrate and communicate the results of data analysis projects.
2. Learn to use the Quarto file format and the RStudio IDE visual editing mode to produce documents with citations, footnotes, cross-references, figures, and tables.
3. Be able to design a questionnaire to collect information that can be analysed to answer a waste-related research question that is relevant for Zurich.
4. Understand the main challenges associated with managing different types of waste, and how they differ between Europe and Africa.

Why all of this?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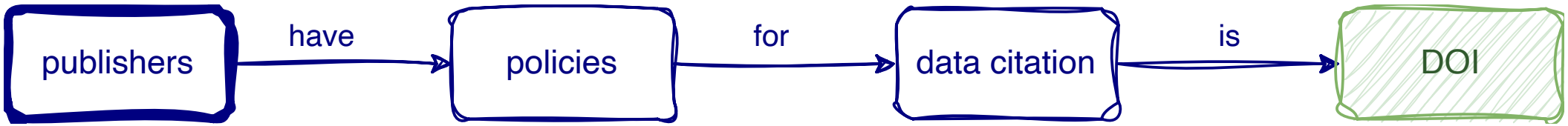
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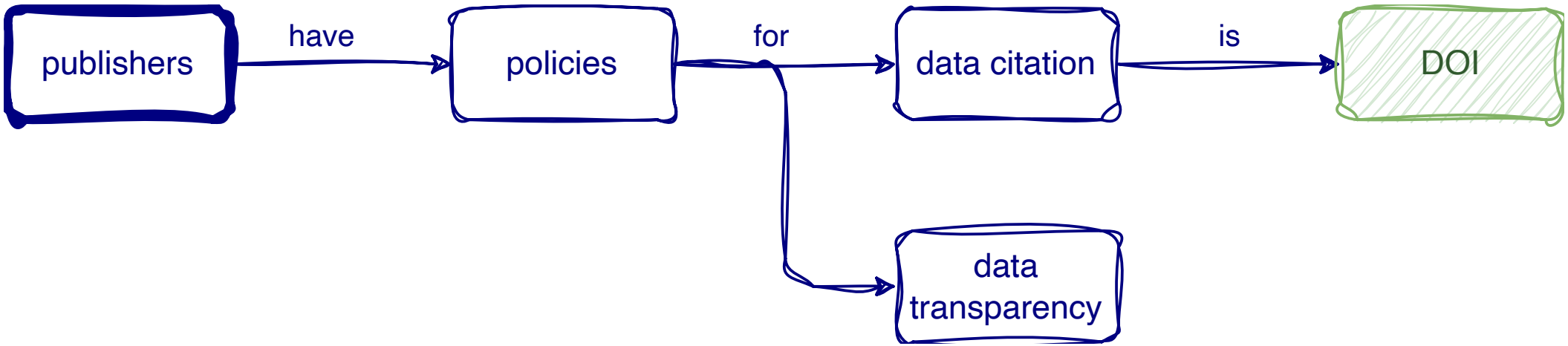
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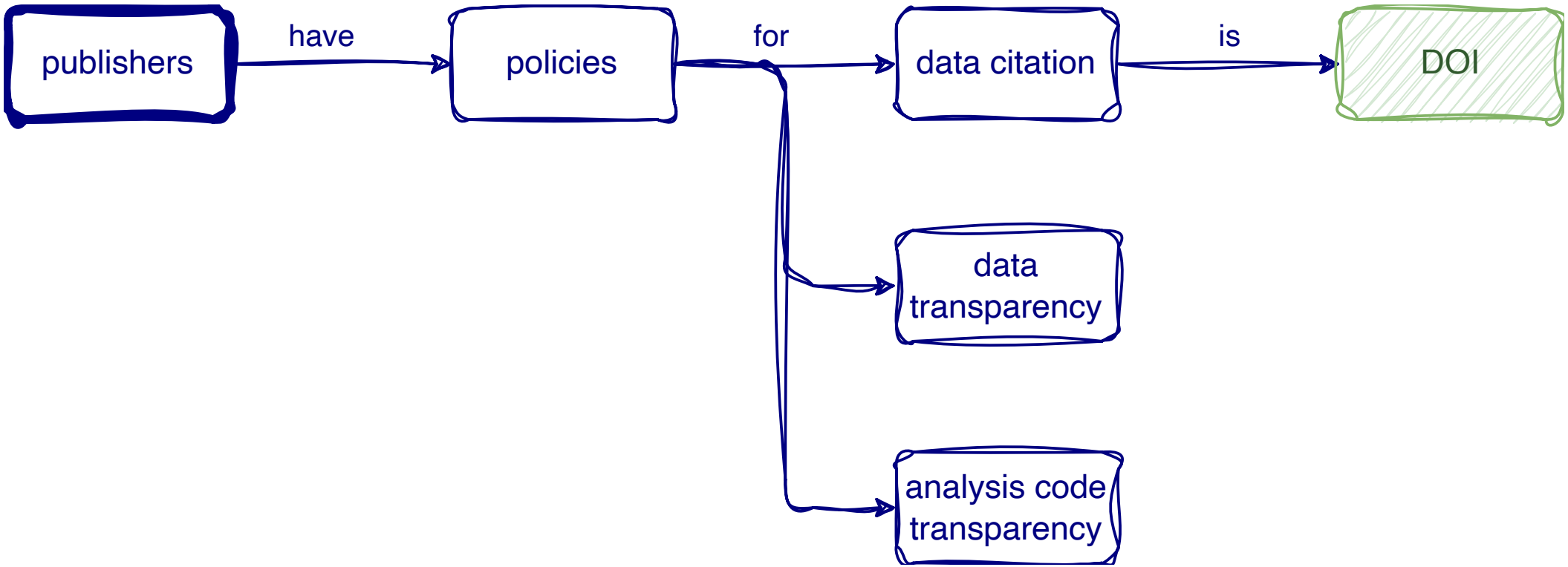
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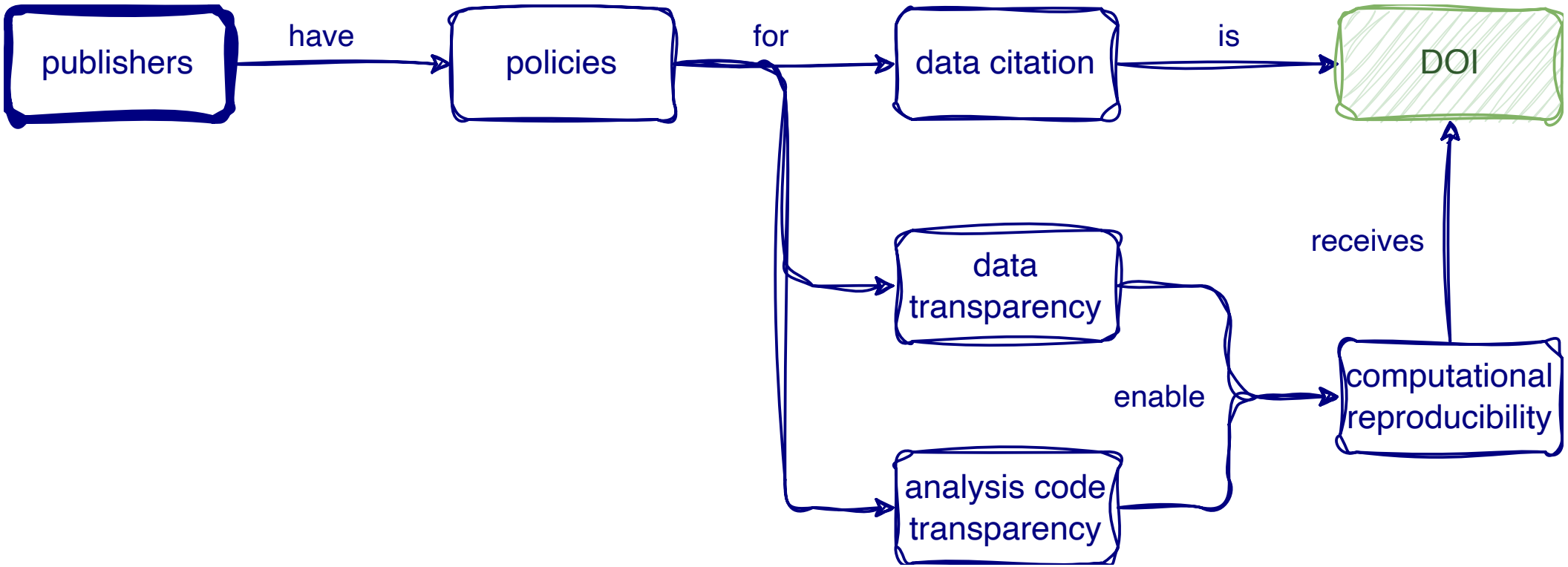
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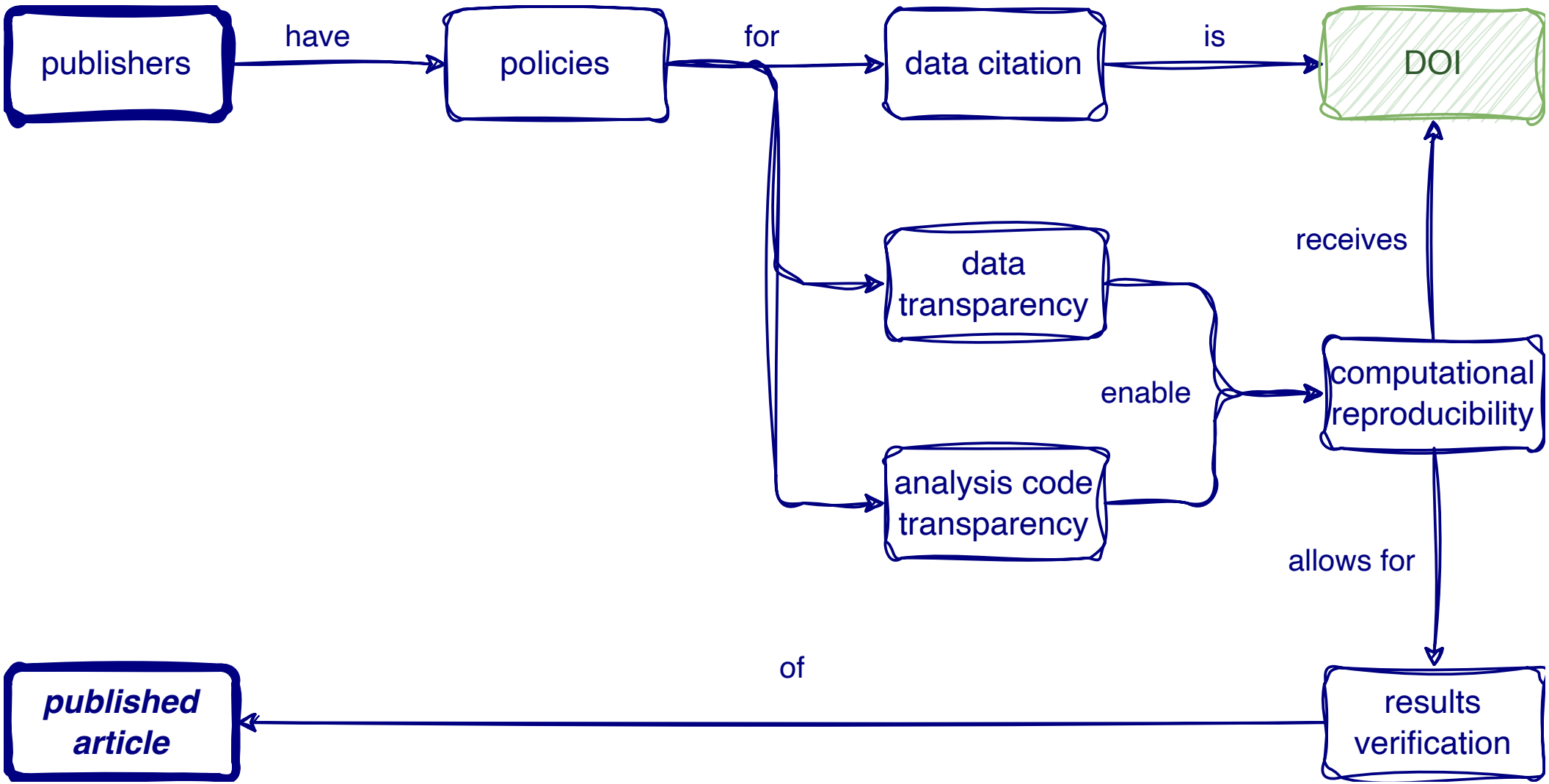
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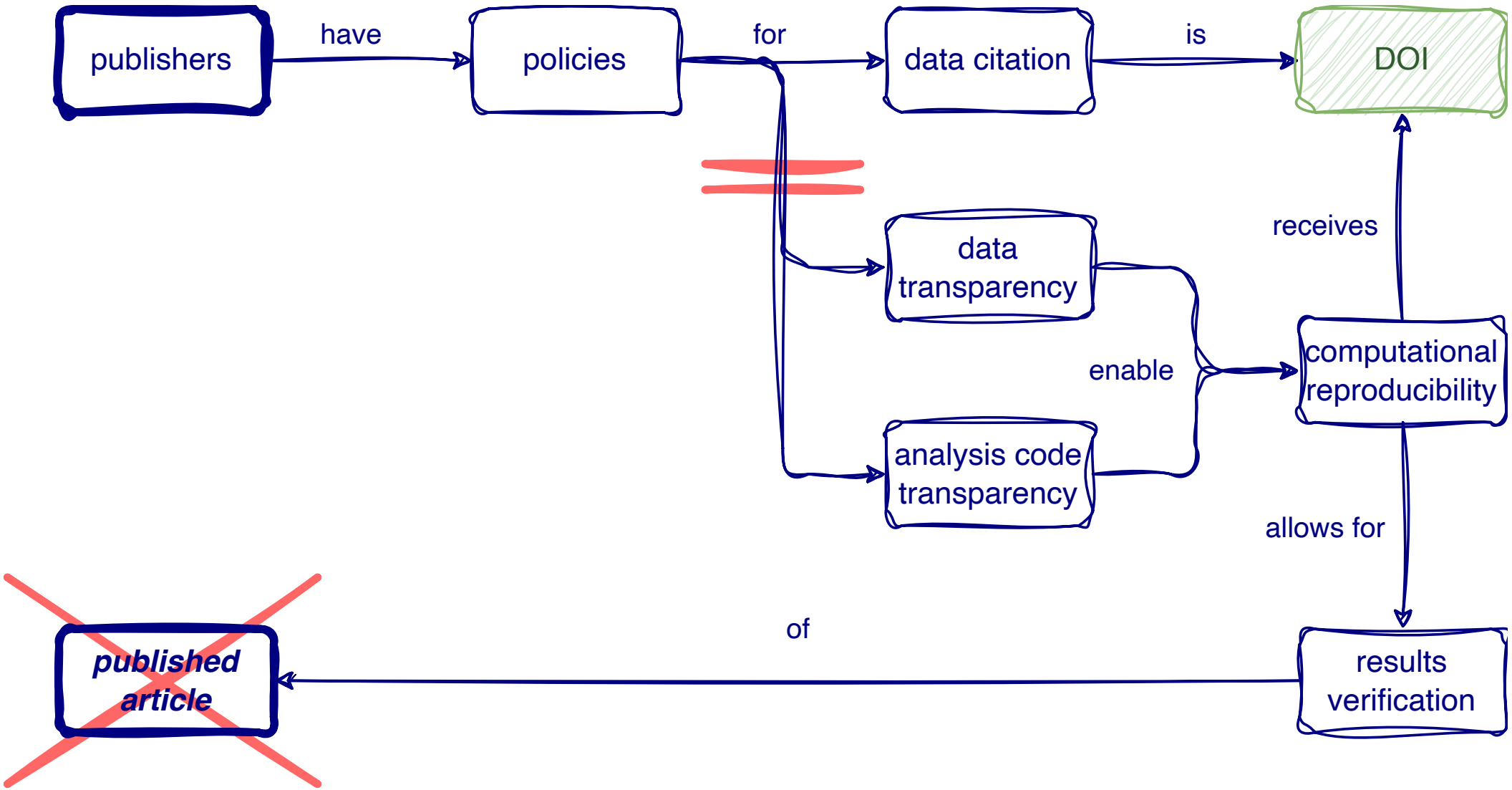
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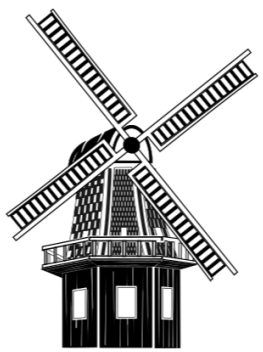
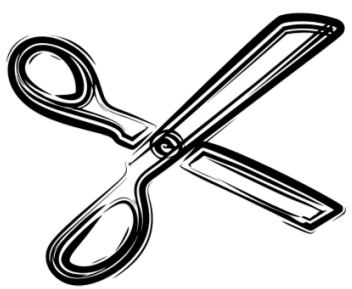
Your turn: About you

> Pick an item and take notes for 1 minute:
>
> What does the item you have picked have to do with the reason for you being here?





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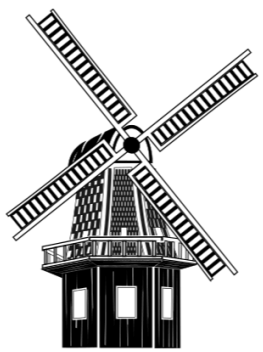
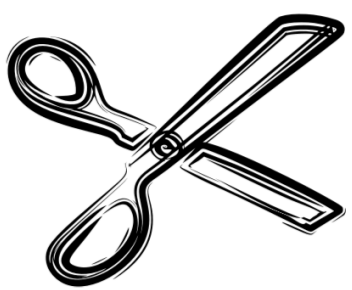
01:00

In pairs

> **Take 2 minutes each to share with your partner:**
>
> What does the item you have picked have to do with the reason for you being here?





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05:00

Course Calendar

module	date	topic
1	20 February 2025	Welcome & get ready for the course
2	27 February 2025	Data science lifecycle & Exploratory data analysis using visualization
3	06 March 2025	Data transformation with dplyr
4	13 March 2025	Data import & Data organization in spreadsheets
5	20 March 2025	Conditions & Dates & Tables
6	27 March 2025	Data types & Vectors & Pivoting
7	03 April 2025	Joining tables & Creating and publishing scholarly articles with Quarto and GitHub pages
8	10 April 2025	Waste Research
9	17 April 2025	Research Design
	24 April 2025	Easter Break
	01 May 2025	Labour Day Break
10	08 May 2025	Questionnaires
11	15 May 2025	Pre-test and logistics
12	22 May 2025	Data collection
	29 May 2025	Data analysis & report writing
	05 June 2025	Project submission due date
	11 June 2025	Exam (13:00 to 15:00)

Course structure

- My turn: Lecture segments + live coding
- Our turn: Live coding + follow along
- Your turn: Exercises in pairs

My turn: Lecture segments + live coding

- Instructor writes and narrates code out loud
- Instructor explains concepts and principles that are relevant
- Code is displayed on screen

Our turn: Live coding + follow along

- Instructor writes and narrates code out loud
- Instructor explains concepts and principles that are relevant
- Code is displayed on screen
- Learners join by writing and executing the same code

Your turn: Exercises in pairs

- Two learners work together in pairs
- One person does the typing (the driver)
- One person offers comments and suggestions (the navigator)

Getting help

- (from next week), please use a pink sticky note to indicate that you have a problem. I will try to address your issue if time permits.
- (from next week), during your turn exercises, please use a yellow sticky note to indicate when you have completed an exercise.

Platforms and Tools

- Course website
- R
- tidyverse R Packages
- Posit Cloud
- RStudio IDE
- Quarto publishing system
- Zotero reference management
- Google Workspace (Sheets & Forms)

Course website

rbtl-fs25.github.io/website/

Our turn: Open and bookmark the course webiste

1. Open a web browser on your laptop.
2. Navigate to the course website: rbtl-fs25.github.io/website/
3. Create a bookmarks folder named rbtl-fs25 in your bookmarks toolbar
4. Add a bookmark of the course website to the folder rbtl-fs25

Learning Objectives (for this week)

1. Learners can access the Posit Cloud workspace for the course.
2. Learners can open an issue on GitHub and tag the course instructor.
3. Learners can clone a repository from GitHub and use the GitHub PAT to push a commit from their local repository to GitHub.
4. Learners can navigate the course website and understand the learning objectives of the course.

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Version Control

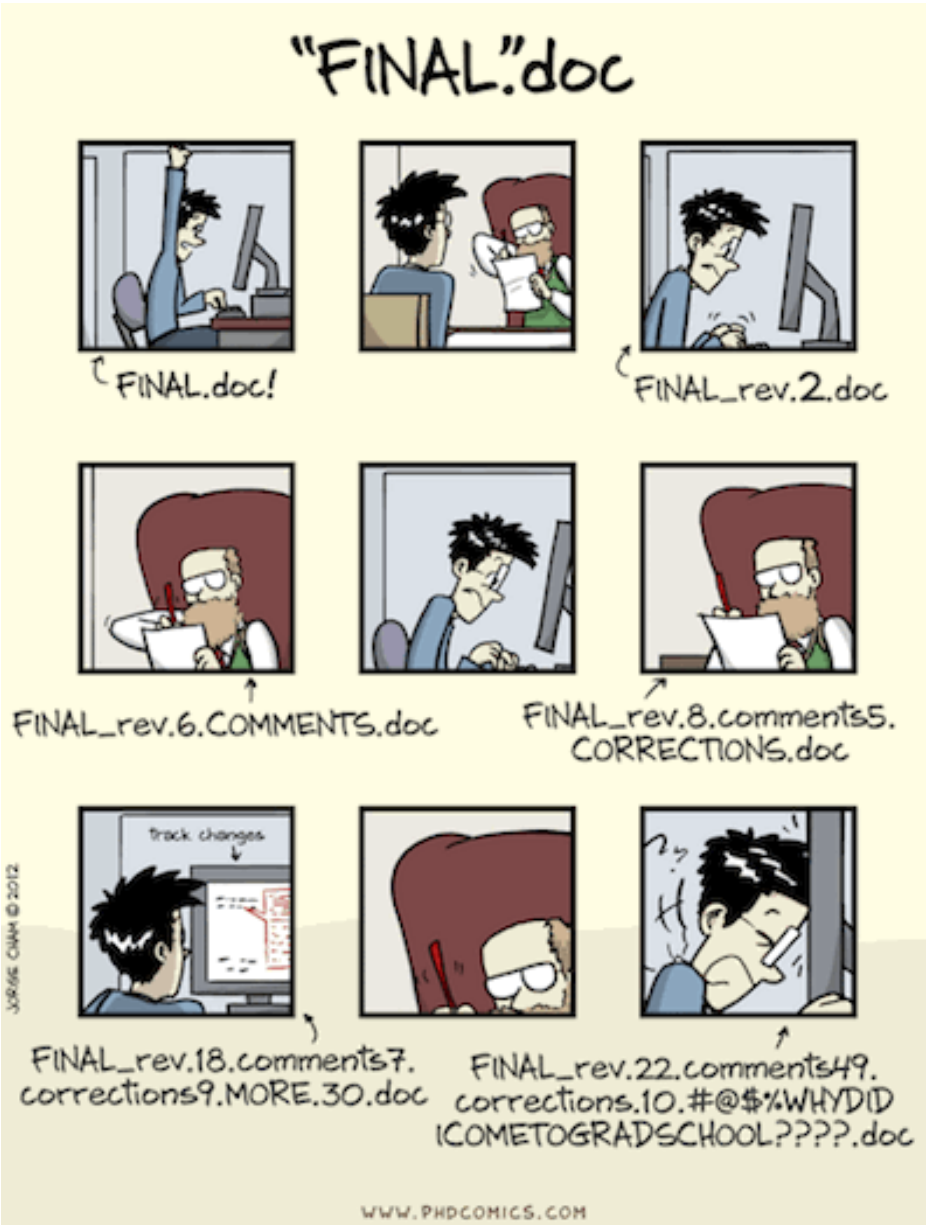
Version Control with Git and GitHub

A way to share files with others, so they can:

- download
- re-use
- contribute

You can view the history of files, and jump back in time to any point.

Why is it useful?



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Git and GitHub

- Git is a software for version control
- Created in 2005
- Popular among programmers collaboratively developing code
- Tracks changes in a set of files (directory/folder/repository)

- GitHub is a hosting platform for version control using Git
- Launched in 2008, aquired by Microsoft in in 2018, Microsoft for US$ 7.5 billion
- > 100 million Users (20.5 in 2022 alone) (October, 2023)
- Social media for software developers

My turn: A tour of GitHub

Sit back and enjoy!

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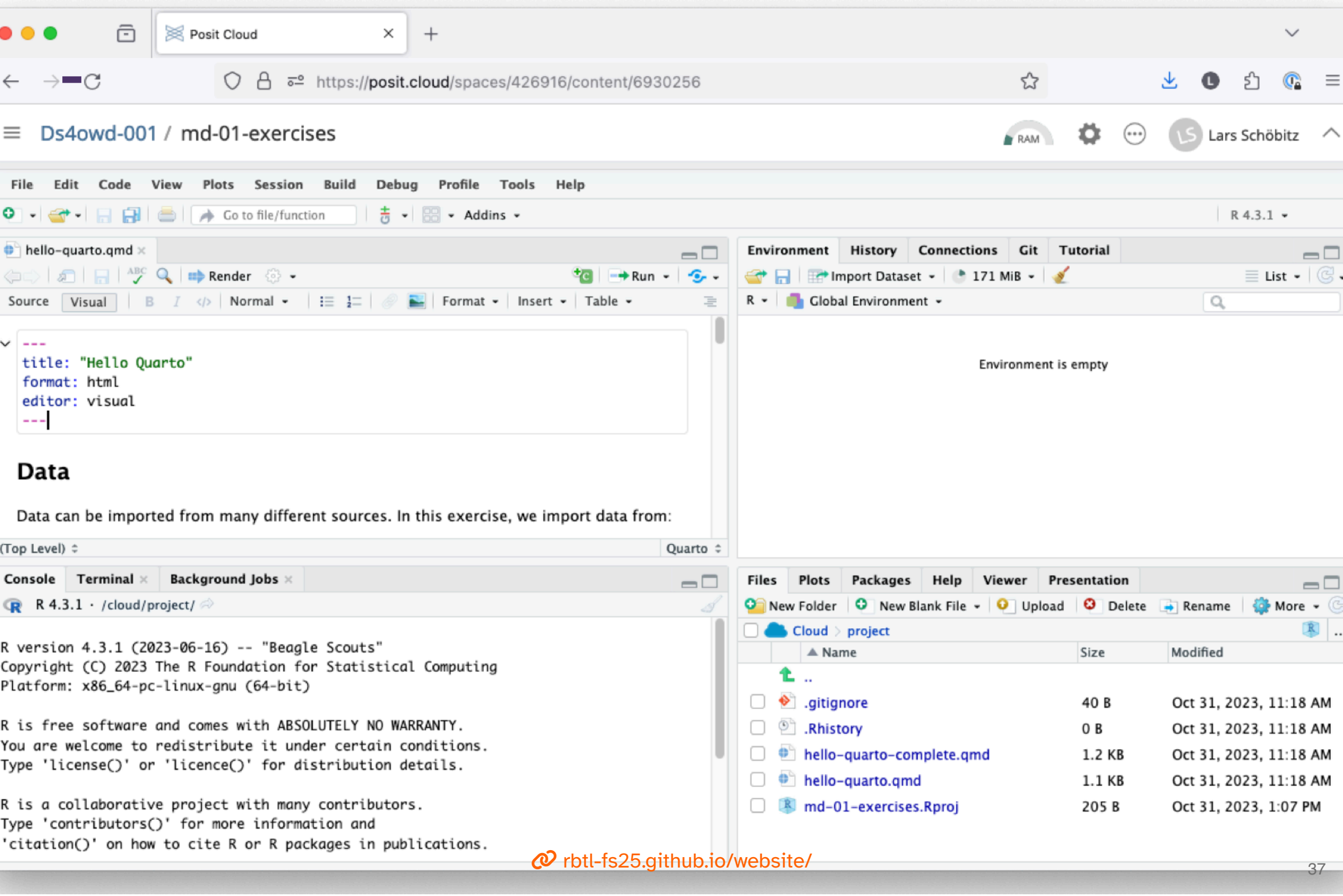
Your turn: Get a GitHub account

1. Open a web browser on your laptop.
2. Navigate to the course website: rbtl-fs25.github.io/website/
3. If you haven't yet, bookmark the course website
4. In the left-hand menu, clock on Module 1, then select am-01: GitHub
5. Follow the instructions
6. Place a yellow sticky note on your laptop when you have completed the assignment

Posit Cloud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R 4.3.1 · /cloud/project/
R version 4.3.1 (2023-06-16) -- "Beagle Scouts"
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Platform: x86_64-pc-linux-gnu (64-bit)
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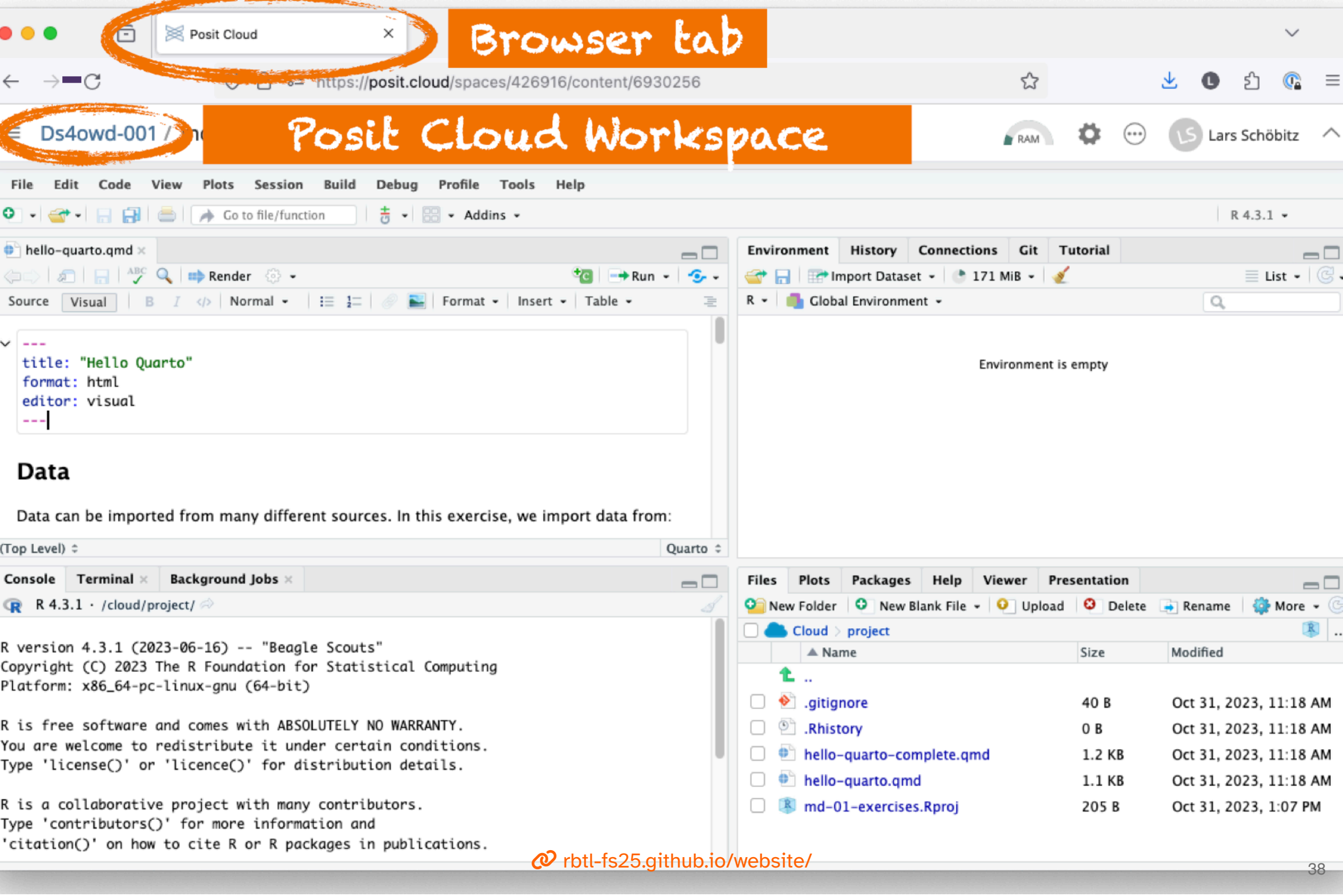
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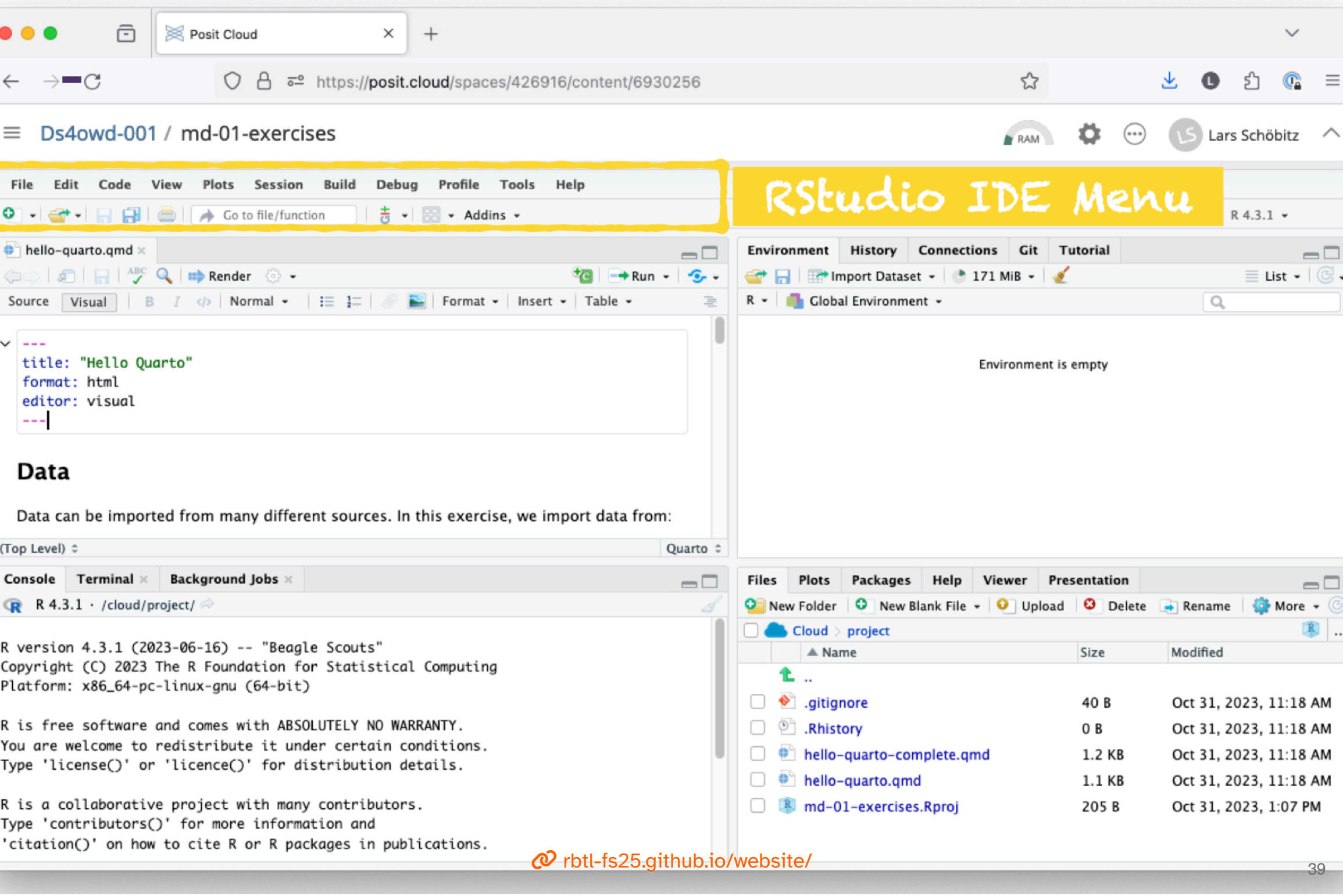
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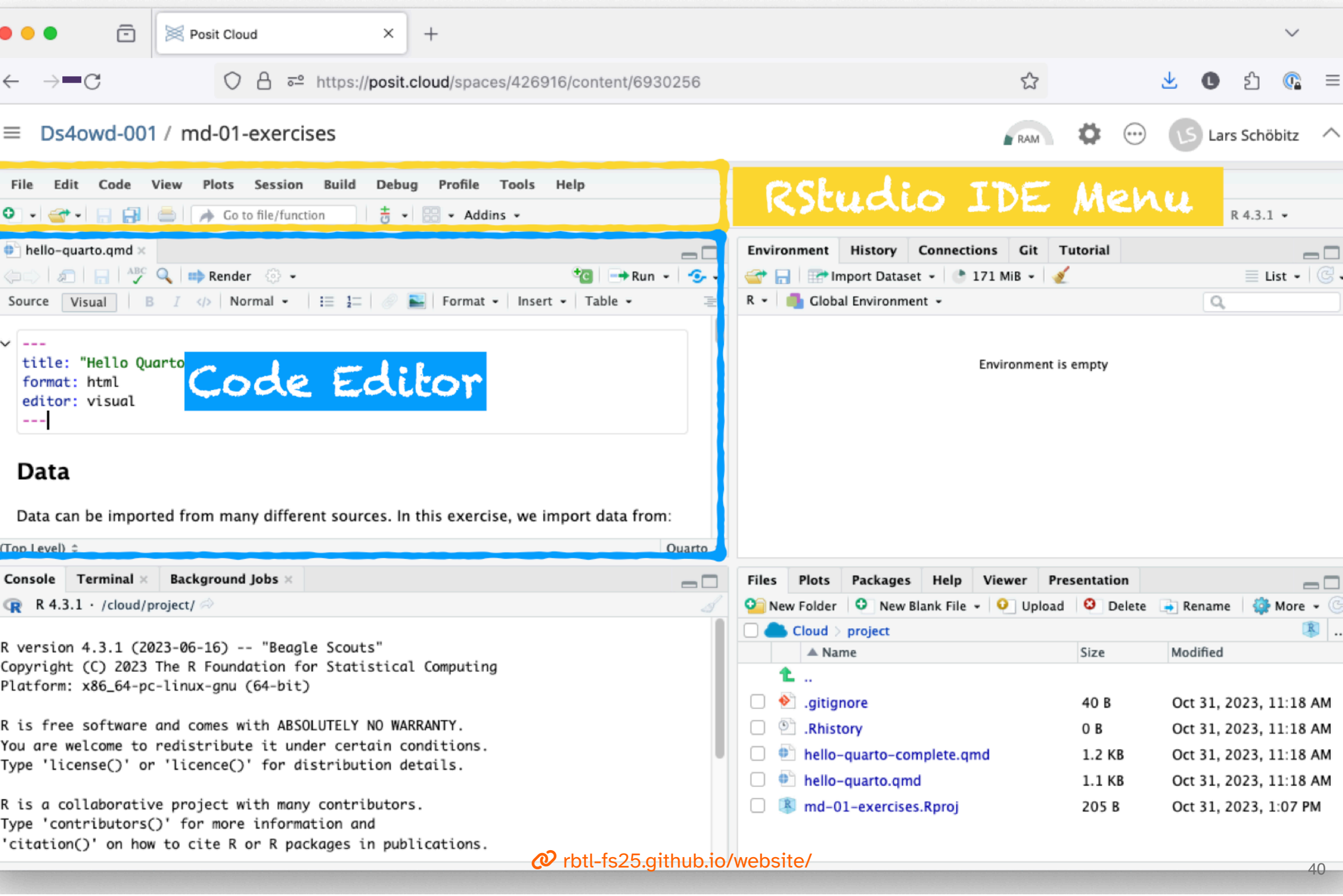
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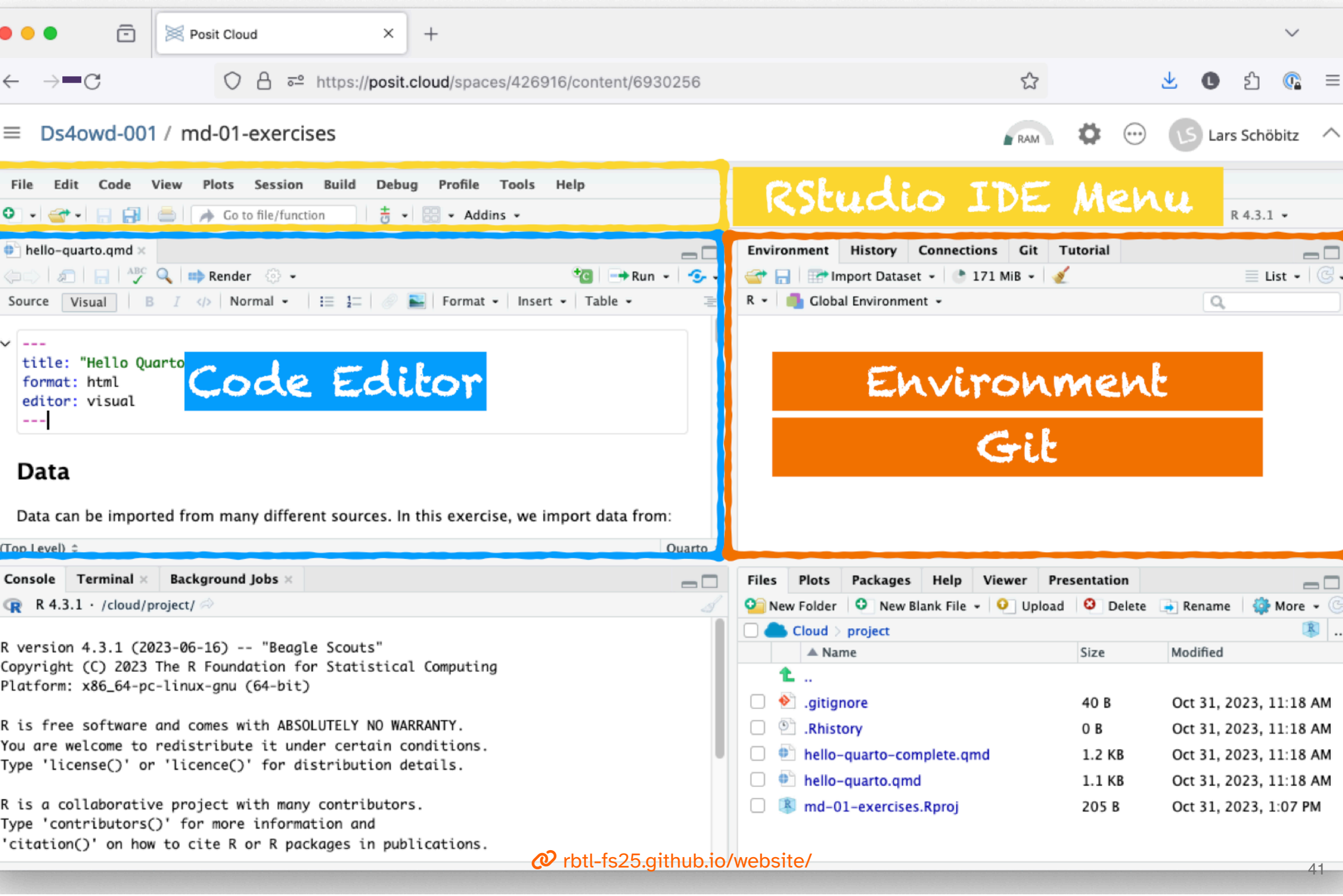
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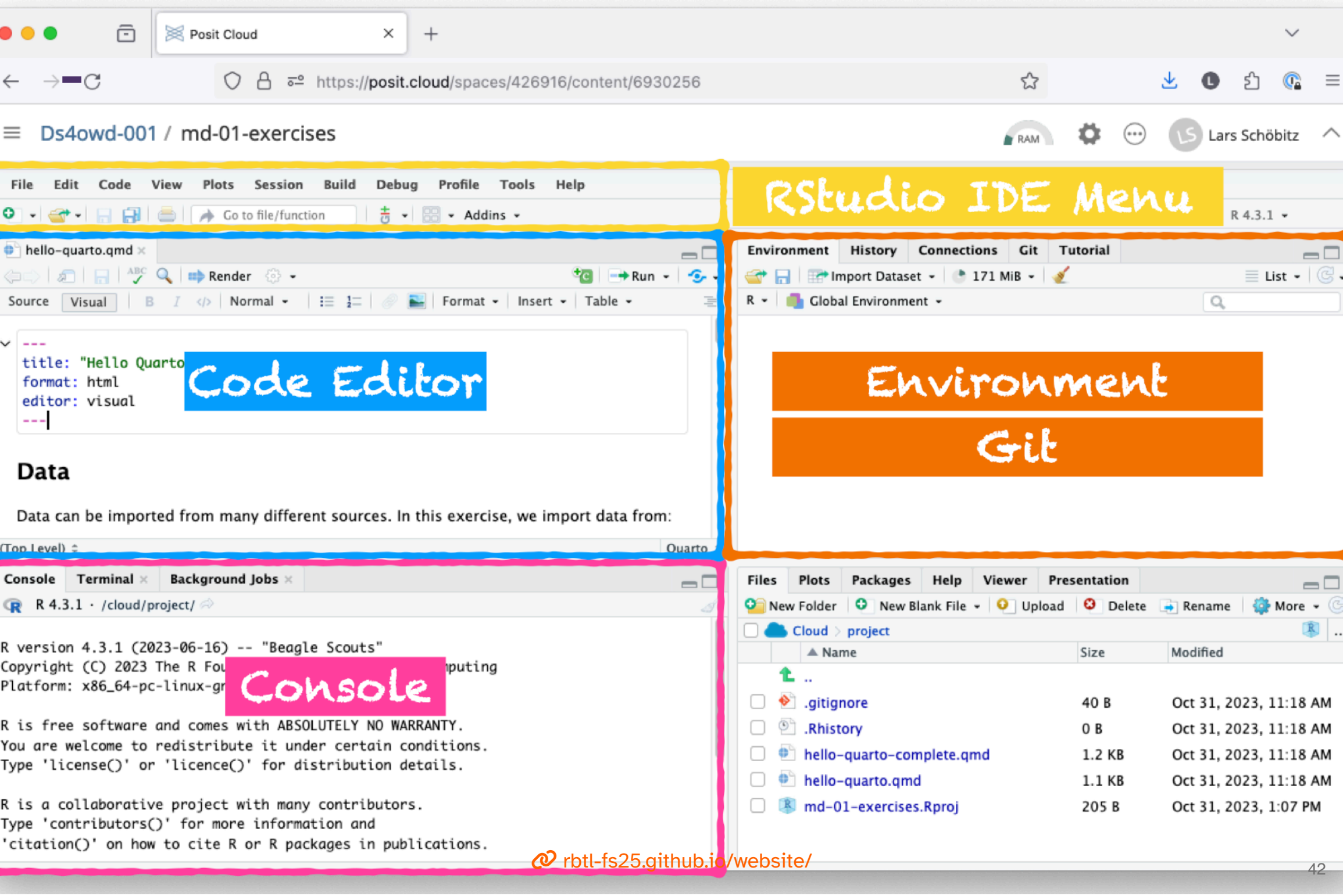
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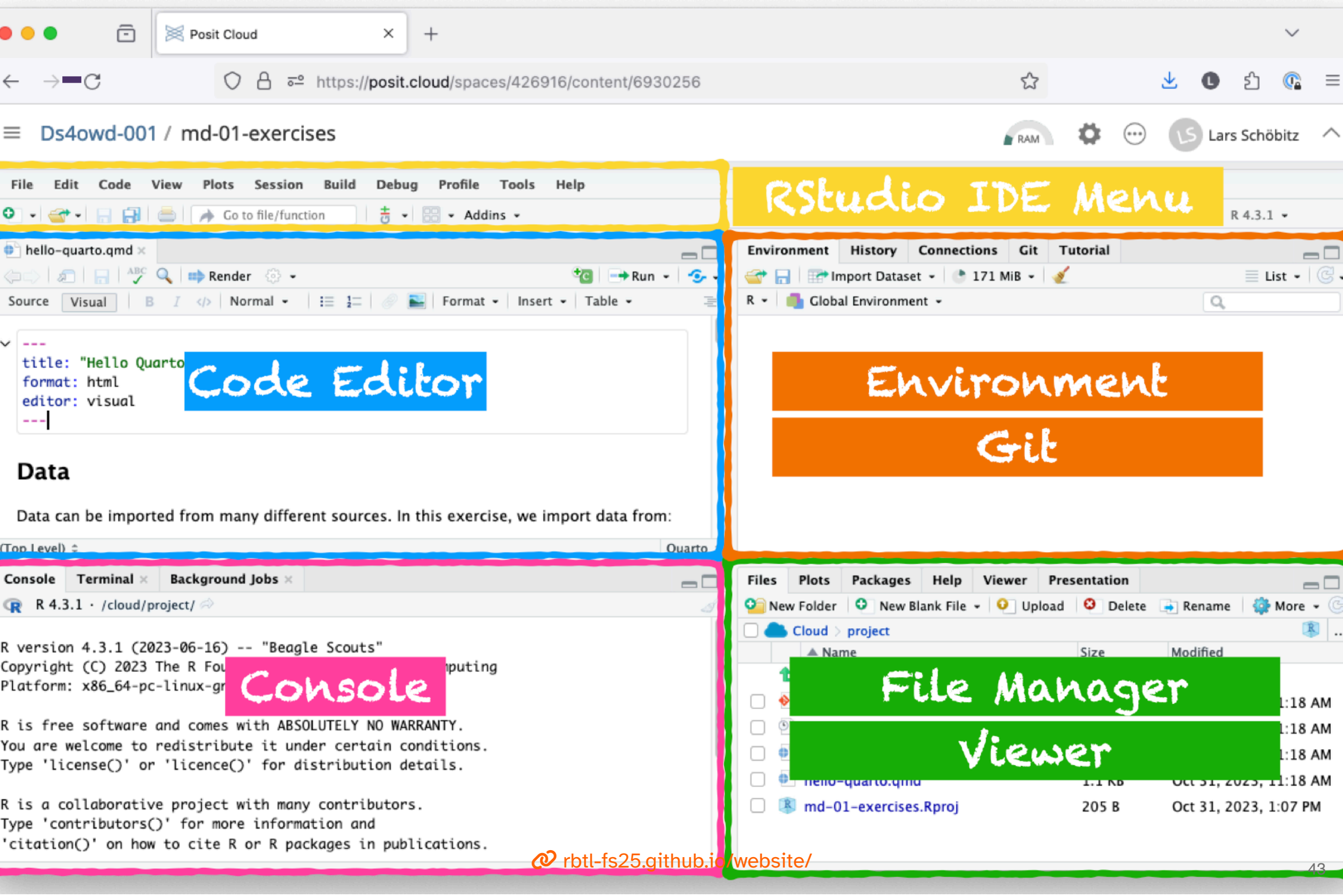
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Your turn: Log into Posit Cloud with GitHub account

1. Open a web browser on your laptop.
2. Navigate to the course website: rbtl-fs25.github.io/website/
3. If you haven't yet, bookmark the course website
4. In the left-hand menu, clock on Module 1, then select `am-02: Posit Cloud`
5. Follow the instructions
6. Place a yellow sticky note on your laptop when you have completed the assignment

⚠ **GitHub Authorisation**

rbtl-fs25.github.io/website/

- If this is your first time logging in to Posit Cloud with your GitHub account, you will be prompted to authorize Posit Cloud to access your GitHub account information.
- Once you have authorized access, you will be redirected back to the Posit Cloud website and logged in to your account.

Hello Quarto

Meeting you where you are

I'll **assume** you

- do not have R or git experience
- have not worked in an IDE before (e.g. RStudio IDE)
- want to learn about R
- want to learn about Quarto and publishing
- want to learn about project management with GitHub

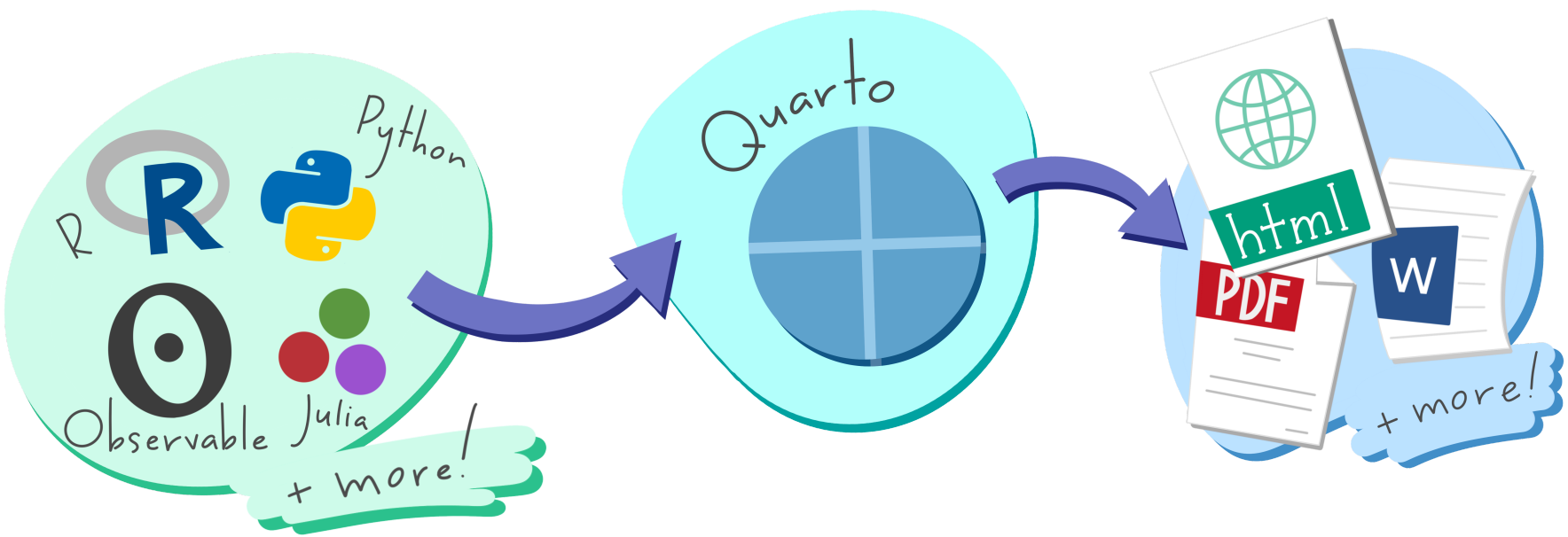
I'll **teach** you

- R
- Quarto syntax and formats
- Markdown
- Git via RStudio GUI
- GitHub issues, project management, and publishing

What is Quarto?

Quarto ...

- is a new, open-source, scientific, and technical publishing system
- aims to make the process of creating and collaborating dramatically better



My turn: A tour of Quarto

Sit back and enjoy!

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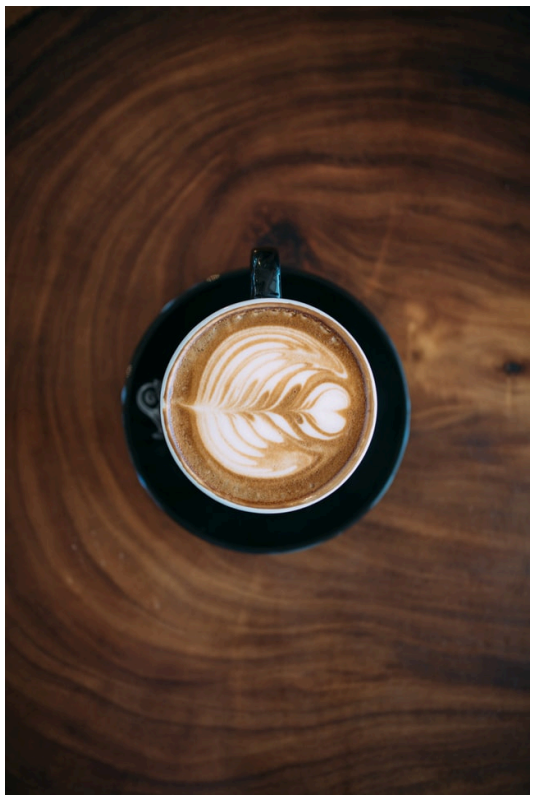
Take a break

Please get up and move! Let your emails rest in peace.



rbtl-fs25.github.io/website/

15:00

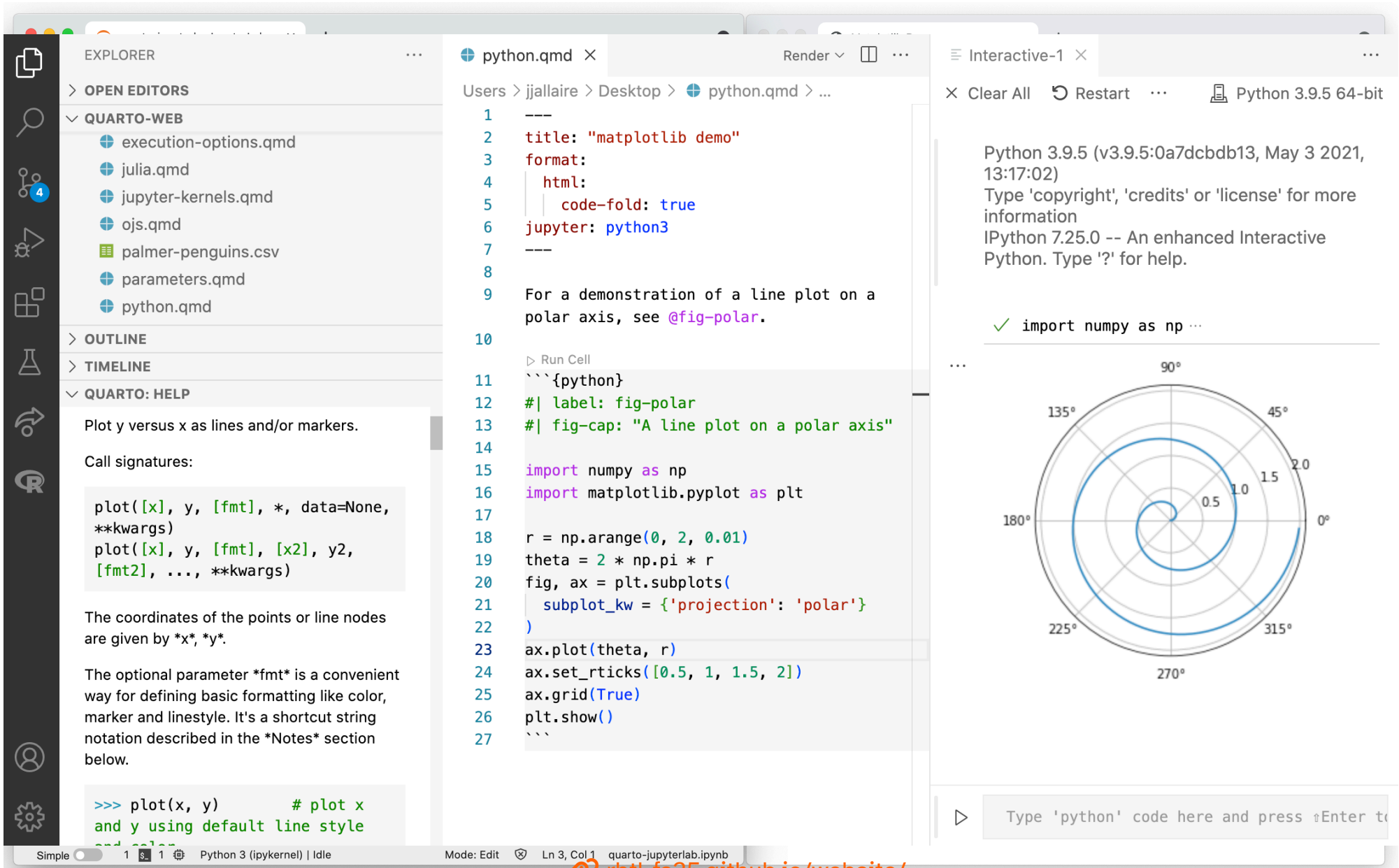
Your turn: md-01-exercises

1. Open posit.cloud in your browser (use your bookmark).
2. Open the rbt-fs25 workspace for the course.
3. Click `Start` next to `md-01-exercises`.
4. In the File Manager in the bottom right window, locate the `hello-quarto.qmd` file and click on it to open it in the top left window.
5. Render the document.
6. Add your name to the `author:` key in the YAML header
7. Render the document
8. Inspect components of the document and make one more update and re-render.
9. Discuss notes about updates you've made with your neighbor. Note any aspects of the document that are not clear after the tour and your first interaction with it.

rbtl-fs25.github.io/website/

05:00

From the comfort of your own workspace



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Quarto formats

One install, “Batteries included”

- RMarkdown grew into a large ecosystem, with **varying syntax**.
- Quarto comes **“batteries included”** straight out of the box
  - HTML reports and websites
  - PDF reports
  - MS Office (Word, Powerpoint)
  - Presentations (Powerpoint, Beamer, `revealjs`)
  - Books
- Any language, *exact* same approach and syntax

Many Quarto formats

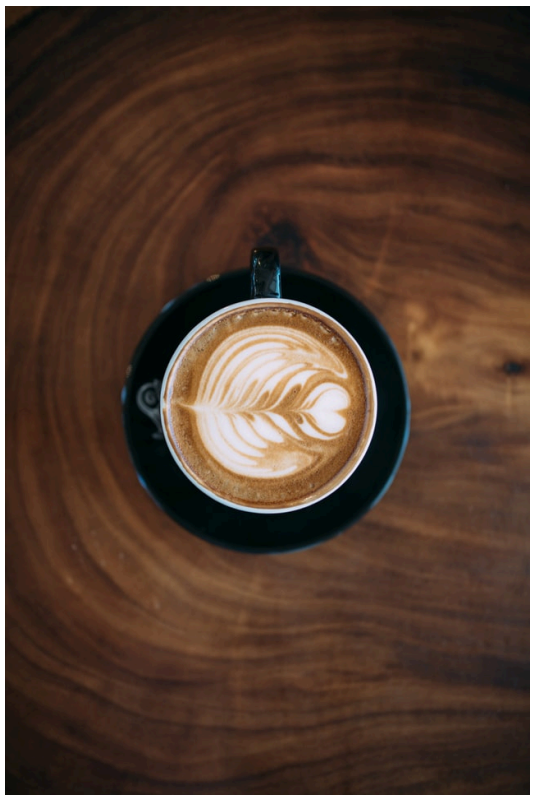
Feature	R Markdown	Quarto
Basic Formats	html_document	html
	pdf_document	pdf
	word_document	docx
Beamer	beamer_presentation	beamer
PowerPoint	powerpoint_presentation	pptx
HTML Slides	xaringan	revealjs
	ioslides	
	revealjs	
Advanced Layout	tufte	Quarto Article Layout
	distill	

Many Quarto formats

Feature	R Markdown	Quarto
Cross References	html_document2 pdf_document2 word_document2	Quarto Crossrefs
Websites & Blogs	blogdown distill	Quarto Websites Quarto Blogs
Books	bookdown	Quarto Books
Interactivity	Shiny Documents	Quarto Interactive Documents
Journal Articles	rticles	Journal Articles
Dashboards	flexdashboard	Quarto Dashboards

Take a break

Please get up and move! Let your emails rest in peace.



rbtl-fs25.github.io/website/

15:00

Course information

rbtl-fs25.github.io/website/

Weekly Structure

Assignment submission: Wednesdays, latest by 23:59.

Monday	Student hours from 13:00 to 14:30 (CET)
Tuesday	
Wednesday	Assignment submission, latest by 23:59 (CET)
Thursday	Lecture from 12:15 to 15:00 (CET)
Friday	

Performance assessment

- End-of-semester exam: 50 points
- Compulsory continuous performance assessment: 50 points, of which
  - Homework assignments: 20 points (n = 10)
  - Capstone project: 30 points, of which
    - Technical parts of submitted report: 15 points (we will communicate what we expect)
    - Intellectual framing of results: 15 points (we will communicate what we expect)

Grading scheme

Table Table 1 shows the conversion from points to grades. Grades follow the ETHZ's Grading System. Points are rounded to the nearest grade, for example:

- 97 points = 5.75
- 93 points = 5.75
- 92 points = 5.50
- 45 points = 4.00
- 44 points = 3.50

Table 1: Conversion from points to grades.

grade	points
6.00	100

grade	points
5.75	95
5.50	90
5.25	85
5.00	80
4.75	75
4.50	70
4.25	60
4.00	50
3.50	40
3.00	30
2.50	20

grade	points
2.00	10
1.00	0

End-of semester exam

- 2-hour final written exam
- 50 points
- all material allowed (incl. internet)
- for the use of AI tools we expect you to add a link to the prompt
- programming exercises using the R programming language
- success depends on the effort put into the compulsory continuous performance assessment

Compulsory continuous performance assessment

Homework assignments:

- 10 assignments
- assessed as pass/fail
- 2 points each
- 20 points in total
- submitted as rendered Quarto documents on GitHub

Compulsory continuous performance assessment

Capstone Project

- Data analysis project report with a dataset generated by you
- Method: Survey or Observational Study using Google Forms and Sheets
- 1 project per student, submitted as rendered Quarto document on GitHub
- 30 points in total
  - 15 points for the technical parts of the submitted report
  - 15 points for the intellectual framing of results

Readings

- Some required for homework assignments
- Additional readings provided to support learning
- Not graded

Policies

Class attendance

- Can’t attend in person? Inform us before the lecture
- Live streaming recording available
- Missed classes: work through the material using the recording

Policies

Use of AI tools

- Use it! (e.g. perplexity.ai has useful free features)
- Refine your prompts to get good outcomes
- Don’t trust anything it says
- Include links to your prompts
- Be thoughtful about when this tool is useful

Policies

Code of Conduct

- Follow the ETH Respect Code of Conduct
- If you experience inappropriate behaviour from us or any of your classmates, you will find contact and advice services here: respekt.ethz.ch/en/contact-and-advice-services.html

Homework assignments module 1

rbtl-fs25.github.io/website/

Module 1 documentation

rbtl-fs25.github.io/website/modules/md-01.html

Module 1

Welcome & get ready for the course

This first week will be used to get you set up for the course.

Learning Objectives

1. Learners can access the Posit Cloud workspace for the course.
2. Learners can open an issue on GitHub and tag the course instructor.
3. Learners can clone a repository from GitHub and use the GitHub PAT to push a commit from their local repository to GitHub.
4. Learners can navigate the course website and understand the learning objectives of the course.

Slides

View slides in full screen | Download slides as PDF

Homework due date

- Homework is a pre-requsite for active participation in Module 2
- Homework assignment due: Wednesday, 26th February

Wrap-up

Thanks! 🌻

Slides created via revealjs and Quarto: https://quarto.org/docs/presentations/revealjs/ Access slides as PDF on GitHub