Maeve Murphy Quinlan (she/her)

Research Software Engineer,
University of Leeds

Coding by whom?
Coding for whom?
Coding with whose interests in mind?

About me

- Research software engineer at the University of Leeds:
  - Designing workflows for reproducible and robust research
  - Teaching PhD students, researchers, professors, technical staff Python, R, git, bash, TDD etc.
  - Secondments to research groups

- PhD in planetary geophysics/cosmochemistry:
  - Crystallography and composition of pallasite meteorites
  - 3D numerical non-linear models run on the ARC4 supercomputer

- Undergraduate degree in natural science (Physics - Geology)
- Interested in accessibility, inclusion, and equity in technology: intersectional feminist
- Creative non-fiction

Why I'm interested in this conference

- I learned coding from outside computer science – from the discipline of geoscience
- I learned to code on my own as available workshops didn't suit my needs
- I discovered this was true of a lot of my friends who use coding across many disciplines
- I'm in a position of power now where I can make change
- I want to share what I've learned, and learn from all of you!

Please continue the discussion!

This is just part of a continually ongoing conversation!

- Only a nine-minute talk, but a very big topic: please come and talk to me after/get in touch:
  murphyqm.github.io | @murphyqm.bsky.social
- Please comment on/annotate my background reading on this topic [https://murphyqm.github.io/talks/code-for-whom/]
- I want to talk to you from a learner's perspective

Programming and computing

BCS diversity report (with data from the Office for National Statistics):

- Women make up only 21% of IT specialists in the UK
- Black women make up only 0.7% of tech sector workers (in contrast to 1.75-2 % across other sectors)

Who gets to build the world we live in?

- **Biased and harmful algorithms**
- **Problematic tech**

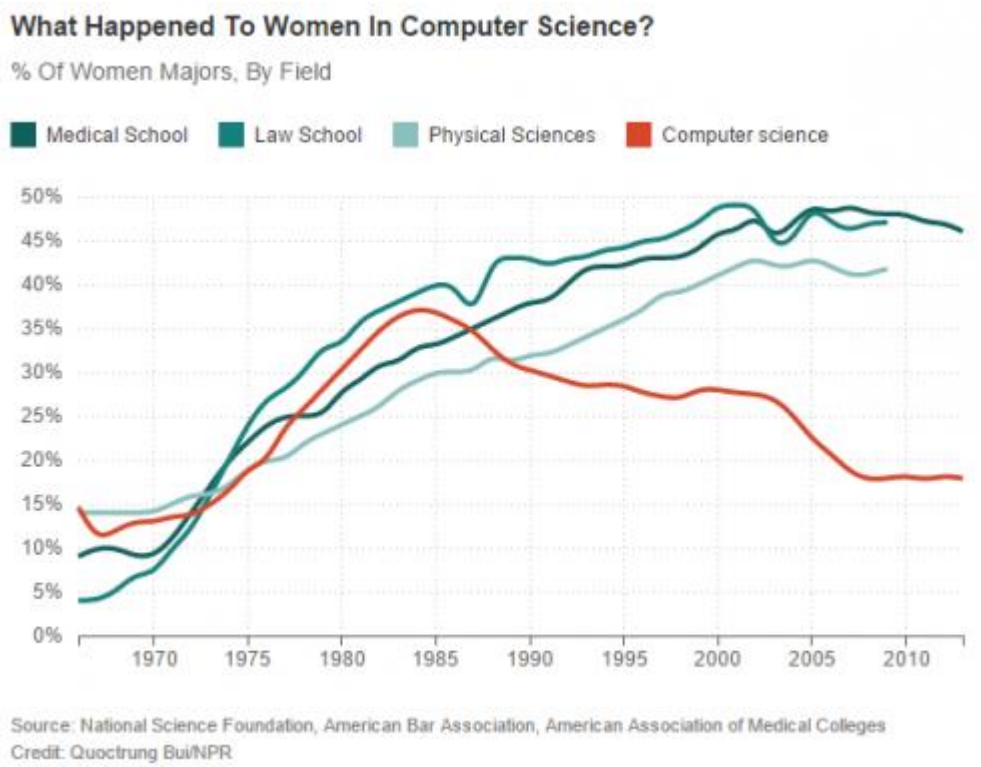

Chart from "Chart of the Week: What Happened to Women in Computer Science? - Sociological Images." Accessed January 4, 2025. https://thesocietypages.org/socimages/2015/01/10/chart-of-the-week-what-happened-to-women-in-computer-science/.

Part 1: The realities of the learning environment (Universities)

The realities of academia

- “Students of color who were STEM majors overheard [sexist and racist] comments and racial slurs while walking to class [...] STEM students of color described feeling both hyper-visible and invisible.” Lee et al. (2020)
- Dupas et al. (2021) found that across every interaction between presenters and their audience in hundreds of economics research seminars, “Women are asked [fewer] questions per seminar, and they are asked more patronizing and hostile questions, and those questions are more likely to be rated as unfair.”
- Men disproportionately dominate Q&A sessions at conferences – women feel less comfortable participating in Q&A sessions and more likely to fear backlash for their participation (Harris et al., 2022).
- Women audience members ask fewer questions during seminars, this effect is increased if a man was the first to ask a question (Carter et al., 2018)
- “Many researchers describe how academic workplaces can be challenging, anxiety-producing and toxic work environments, especially for people with disabilities [...] [is] common” (Lindsay et al., 2022)
- “About 10 per cent of women postgraduate researchers (PGRs) and 2 per cent of undergraduate students are subjected to staff-to-student sexual harassment in higher education, and those with minoritised sexual and gender identities are more likely to be targeted.” *THE* 2024

- **Sexual harassment**
- **Racism**
- **Ableism**
- **Sexism**
- **Microaggressions**

The realities of academia

- “Students of color who were STEM majors overheard racist jokes and comments in the classroom and racial slurs while walking to class [...] STEM students of color described feeling both hyper-visible and invisible.” Lee et al. (2020)
- Dupas et al. (2021) found that across every interaction between presenters and their audience in hundreds of economics research seminars, “Women are asked about 12% more questions per seminar, and they are asked more patronizing and hostile questions, and those questions are more likely to be rated as unfair.”
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The realities of academia - teaching

Student evaluations are influenced by the gender composition of academic departments: in higher-level courses, students tend to give worse evaluations to those in the gender minority (Aragón et al., 2023; Owen et al., 2024)

Where the gender identity of the instructor in online courses was manipulated, the instructors received lower ratings from both male and female students when they were led to believe they were women (Llorens et al., 2021; Khazan et al., 2019; MacNell et al., 2015).

"[M]any institutions persist in their use of teaching evaluations that study after study has demonstrated to be biased against women and faculty of color, with Black faculty receiving the lowest scores of any racial group. Despite widespread recognition that evaluations do not actually measure teaching effectiveness, colleges and universities rely on this sexist, racist and fundamentally flawed measure" Wu (2020)

- **Student feedback is biased**
- **Instructors believed to be women or faculty of colour received lower scores**
- **Compounding effect for women of colour**

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Coding for whom? How might these experiences impact learners?

- How do we recognise these effects when teaching coding?
- How do we strive for justice in teaching coding?
- How do we recognise our own positions of privilege (**note that these studies looked at people attending or working in universities: already a privileged position**) and how this impacts our teaching?

In what ways does privilege hazard prevent us from seeing the systems that we benefit from?

Part 2: Live coding viewed through the lens of these experiences

Live coding as a teaching pedagogy

What is participatory live coding?

- A **very popular, highly recommended method of teaching** novices to code
- The main teaching method in workshops organized by the global nonprofit The Carpentries (https://carpentries.org) and beyond
- Involves an instructor writing code and narrating their thought process, while learners code along in real time
- It is *perceived* to: model programming for novices, allows for exploration of errors and mistakes, participatory engagement (Nederbragt et al., 2020) **but limited research and lack of evidence of benefits**

"Live Coding Is a Skill." [online course notes] Accessed January 4, 2025. https://carpentries.github.io/instructor-training/17-live.
Nederbragt, Alexander, Rayna Michelle Harris, Alison Presmanes Hill, and Greg Wilson. 2020. "Ten Quick Tips for Teaching with Participatory Live Coding." PLoS Computational Biology 16 (9): e1008090.

Research on Live Coding

- Frequent findings of no statistically significant difference between control groups with static code (Shah et al., 2023; Rubin, 2013; Watkins et al., 2024, and many others)
- Cognitive apprenticeship and its efficacy frequently mentioned in studies, but usually only the “modelling” stage, with no mention of scaffolding or fading (as noted by Selvaraj et al., 2021)
- “Student feedback suggests that more students in the live-coding group reported **that lectures were too fast and failed to facilitate note-taking**, potentially mitigating the perceived benefits of live coding.” (Shah et al., 2023)

My experience with participatory live coding

I've always found live coding very stressful.

As a learner:

- Found it very difficult to keep up;
- Made numerous typos;
- Couldn't absorb anything beyond frantic transcription;
- Don't want to slow the entire class down by asking for a change of pace.

As a lecturer/teacher/instructor:

- Found it difficult to prepare;
- Difficult to juggle different abilities/speeds.

I thought that I was the odd one out, but many people share this feeling.

Live Coding: the takeaway

"Live coding alone **may not lead to many of the perceived and intended benefits** that prior work identifies, but future work may investigate how to realize these benefits while minimizing the drawbacks we identified."
Shah et al. (2023)

- **Who is most likely to suffer due to the negative effects? (Moving too quickly, difficult to concentrate and take notes, easy to fall behind unless you're willing to slow entire class's progress)**
- **How can we take the beneficial parts, and leave behind some issues?**

Live Coding: the takeaway

*Please don't take this as an attack on live coding, more a critique of the way we frequently share this as the **best method.***

Live coding is frequently effectively embedded in very well-designed, thoughtful, inclusive training courses.

Just question **who is benefitting** from a certain technique; how you can foster an inclusive learning environment; and when it might be time to step away from the keyboard.

How can we take the beneficial parts, and leave behind some issues?

Part 3: Possible paths forward (an imperfect path)

Post-degree teaching:

- Graduate students
- Researchers
- Technical Staff
- Public (Open-Access material)

Listening to those who *aren't* served by the status quo

Accepting critique and comments as constructive feedback and an opportunity to improve, not as an attack

- Iterative design
- Flexibility
- Evolution and change as positives

Listen to voices that have been/are excluded:

- People of colour, queer people, disabled people, minoritised genders.

Flipped Learning/Flipped Classroom and Blended Learning

Providing course content for asynchronous learning, with synchronous sessions to build on/deepen that learning.

Malkoc et al., 2024; Gan and Ouh, 2022; Campbell et al., 2024 and others.

- Flexibility with regards to timing
- Preparation in your own time: increased likelihood of engagement with synchronous activities

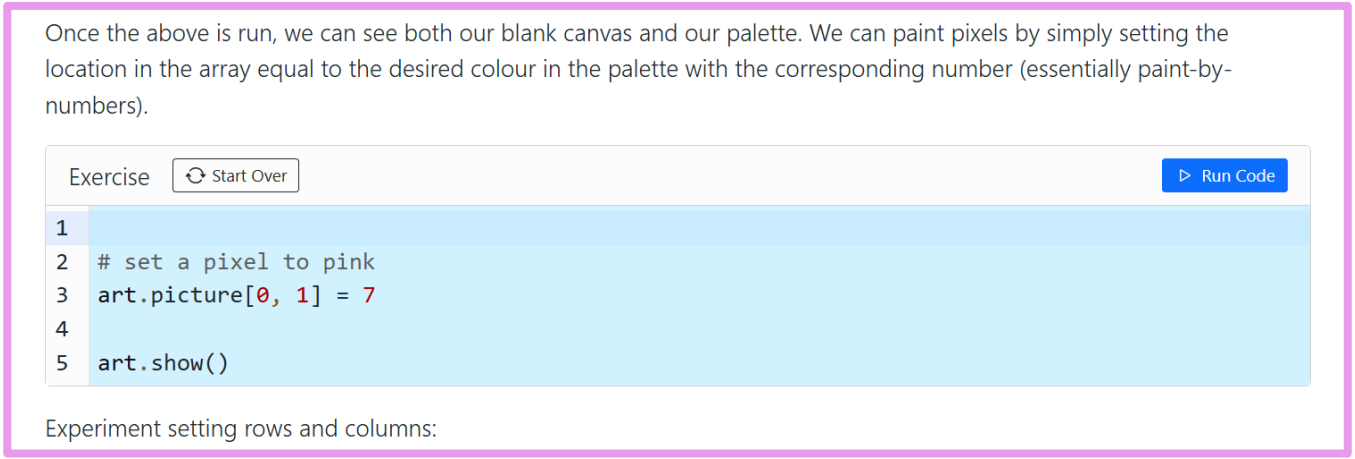
Stand-alone open-source asynchronous materials: a wider audience

PRIMM: Predict, Run, Investigate, Modify and Make

"PRIMM helped [instructors] to teach effectively in mixed-ability classes, enabling all learners to make progress." Sentance et al. (2019)

- Relatively easy to implement (tabsets with exercises)
- Building understanding of documentation and errors in a structured way
- Active learning technique

Flexibility (Pyodide, cloud solutions, local solutions)



Pyodide allows Python to be installed and run directly in the browser, very low barrier to entry.

Screenshot from murphyqm.github.io

Also have had success with various cloud-based solutions (free tier):

- Google Colab; GitHub codespaces

But! Internet access an issue. Also provide detailed instructions for local installs:

- Always free, open source where possible
- Always user-level installs, no admin access required

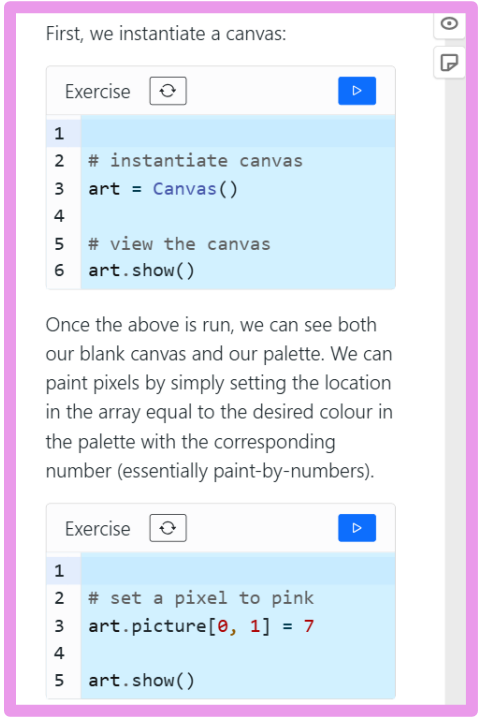
Feminist Pedagogy and Data Feminism

Using Feminist Pedagogy to Design Learner Centred Learning Experience Online,
Dr Liv Newman Tulane & Dr Jaqueline Thoni Howard
[SUNY Online Teaching YouTube channel]

- Feminist pedagogy is a framework for addressing power in teaching and learning; becomes intersectional when using multiple social frameworks (race, class, sexuality, disability) as a rubric
- Critiques traditional notions of teaching and learning https://feminists-teach-online.tulane.edu/
- *Data Feminism:* Catherine D'Ignazio and Lauren Klein. 2020.

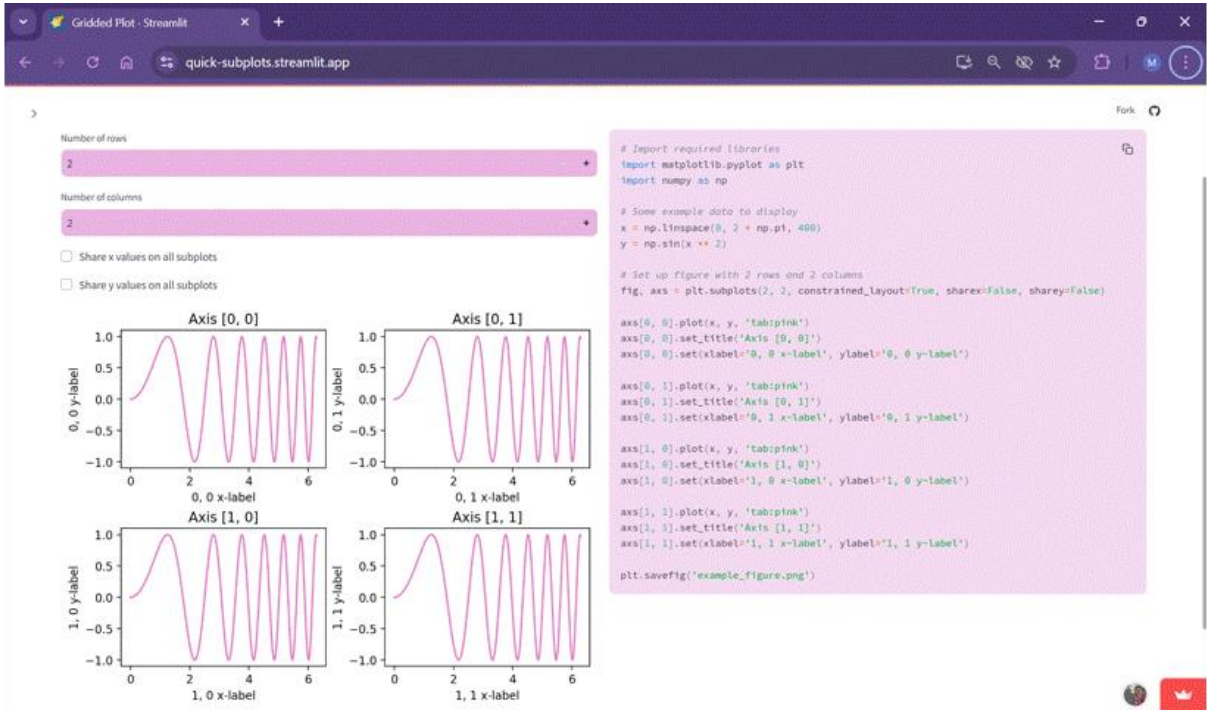
1: Modelling the coding process

- Runnable interactive documentation that externalises the thought process/workflow
- Non-runnable code snippets that showcase non-linear approach
- Animated copy/pastable terminal/code blocks
- Key: the “active learning” portion is related to PRIMM and not typing
- Screenshot (mobile) of interactive Pyodide exercise (murphyqm.github.io)



2: Scaffolded exploration with templates

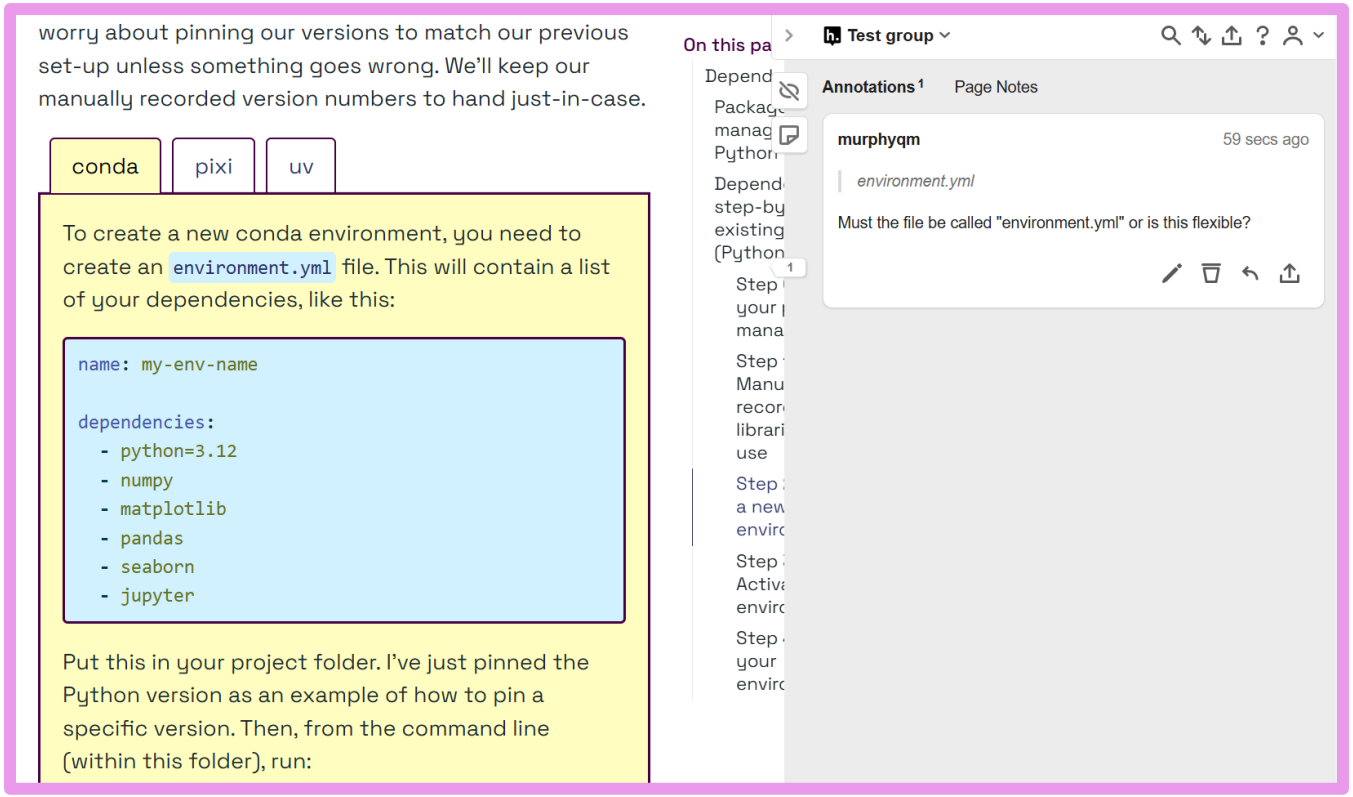
- Introduction to documentation
- Exploration of the effects of different arguments in a controlled sandbox
- Code can be copied and pasted for more modification
- PRIMM



3. Alternative outlets for feedback

- Digitized version of the traffic-light post-it system: persistent, visible only to instructors – online poll
- Anonymous questions facilitated by online tools even in in-person events
- Continued discussion space to supplement flipped learning: GitHub Discussions; Hypothes.is.
- Asynchronous feedback especially important

Asynchronous Feedback *(Hypothes.is, Quarto and GH Pages)*



Detailed course notes (shared before the course) with a private Hypothes.is group set up for the workshop attendees allowing annotation and commenting (username can be anonymised).

Screenshot from murphyqm.github.io

4. Making work visible: a work in progress

- **Citation, citation, citation**
- Citing teaching materials, suggestions, ideas from others
- Embedding code sharing and citation in courses: acceptance rate of GitHub pull requests goes down when the user is perceived to be a woman – exclusion from Open Source (Terrell et al., 2017)
- Version control as a feminist act to make work visible: D'Ignazio & Klein, 2020.

Please talk to me and share ideas

A work in progress: I'm still learning; accessibility is a journey, not an outcome.

- murphyqm.github.io
- @murphyqm on BlueSky
- work.maeve.quinlan@gmail.com

Thank you for listening!

End of presentation

Additional slides

Additional slides that didn’t make it into the talk, but might be interesting to read.

Research on Live Coding

“Based on our results, we conclude that teaching via live-coding is as good as if not better than using static code examples. [...] It is our hope that these results will provide other instructors with ample evidence to consider using live-coding to teach programming at their institutions.” Rubin, 2013

‘When we are not specific about who “the good” is for, we mean that the good is for the dominant social group.’ – Catherine D’Ignazio, on the Good Robot Podcast 2021

Colorado School of Mines, 2011: CSCI 261; requirement for undergraduate computer science and engineering.

Mathematical and Computer Science, CSM 2011: 18% female, 16% ethnic minorities, zero international students.

Note: the study is very clear about its limitations and mentions that demographics would have been useful to collect but were out of scope.

The (un)comfortable leather chair

Imagine sinking into a comfortable leather chair that's sat by your fireside for decades: it's molded to your shape, supports you in all the right places; you can't imagine a more comfortable armchair.

You also probably won't be able to imagine all the ways it might be uncomfortable for someone else: you can't know where it will dig into someone's back, or leave them unsupported.

Privilege hazard: the fact that it is difficult to recognise the advantages you hold from a position of power.

Sara Ahmed, "Making Feminist Points," *Feministkilljoys* (blog), September 11, 2013.
Catherine D'Ignazio and Lauren Klein. 2020. "7. Show Your Work." In *Data Feminism*. MIT Press.