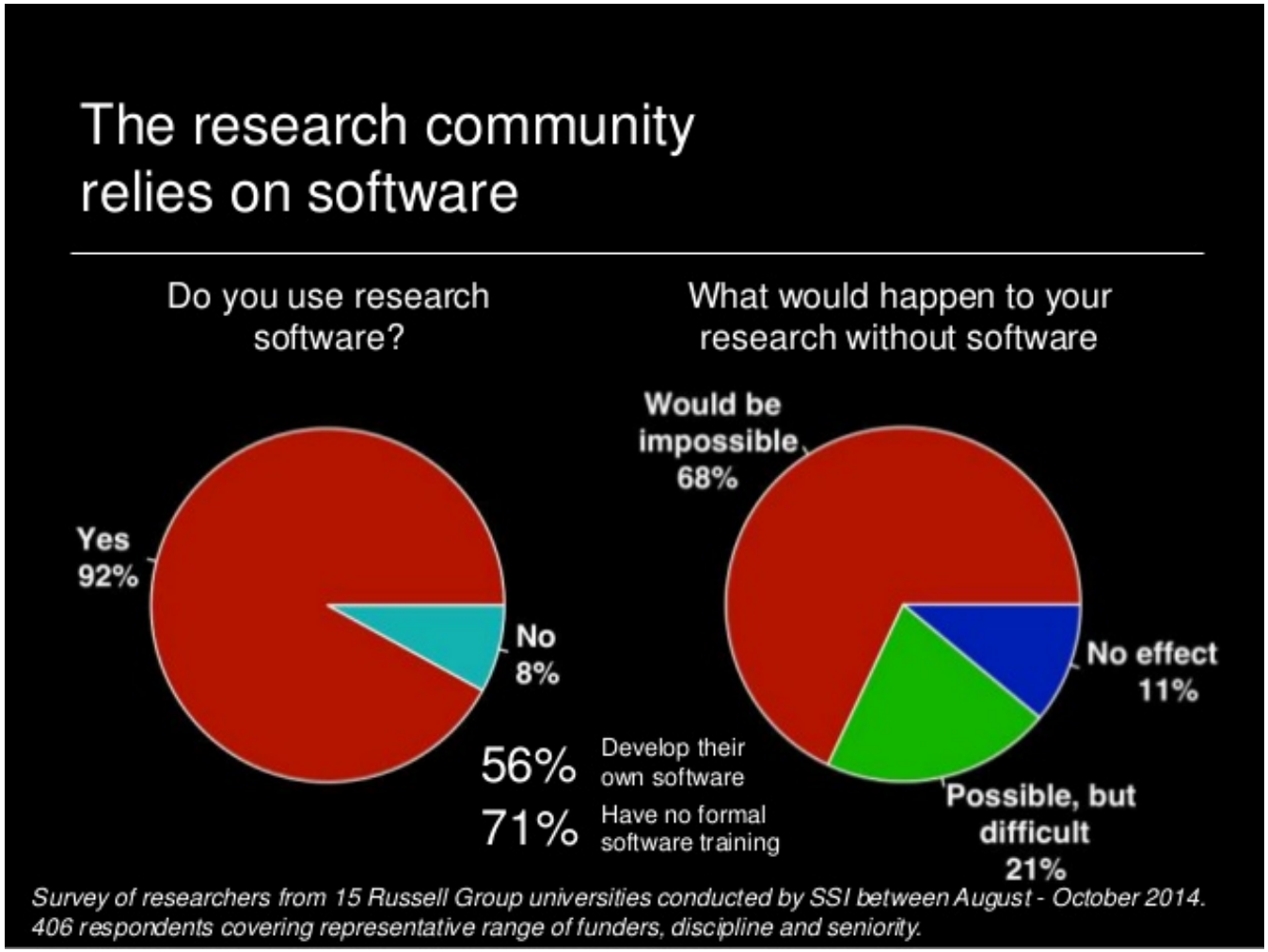
Lancaster University

Sustainable Software

or “Is your research software correct?”

Robin Long
26/01/26

Sustainable software



Sustainable Software

- Software is fundamental to research, 7/10 UK researchers say it is vital to their research.
- Better software leads to better research.
- Better software should be sustainable.
- Sustainable software needs less effort in the long run.

Is your research (software) correct.

- How do you know that your code does what it is meant to?
- We really on code, for science, but science is not always applied to our code.
- Can you reproduce what you did?
- How sure are you of your results?

We have a problem

- A lot of these problems would have been caught with better software, but what does that mean?
- A different approach.
- Be more rigourous.
- Apply principles of testing and reproducability.

Are you sure you did that?

- How did you generate the results?
- Point, click, click, drag, click, drag, right click, click, drag, click, save.
- Are you sure you clicked the correct cell, or highlighted the correct column?
- How reproducable is a mouse click?

Are you sure you did that?

- Solution: automate.
- Many programs support scripting, use this instead.
- If it doesn't, find another program.
- Don't just automate the analysis, automate the whole chain: Data selection, manipulation and analysis.

Make you life easier

- We tend to write programs that are easy for computers to understand, but difficult for humans.
- How do you know it is correct if you struggle to read it?
- Use a high level language.

Why a high level language

"Programmers write roughly the same number of lines of code per unit time regardless of the language they use"
- Best Practices for Scientific Computing, PLOS Biology, Wilson Et Al

Go to ludicrous speed

- What about speed?
- Computing time is (relativly) cheap, researcher time is not.
- High level languages are usually more than fast enough.
- Get the code right first, then worry about speed later (if you even need to).

I didn’t mean that version

- myCode_version1
- myCode_version2
- myCode_version2_broken
- myCode_version2_fixed-ish
- myCode_version2_fixed
- myCode_version2_broken_again
- myCode_version2_fixed2
- myCode_version2_fixed_withChanges

I didn’t mean that version

- This is scary.
- Not even clear which the final version is.
- Are you sure of which version went into the paper.
- If the analysis was split, did you all use the same version?
- Version control helps.
- There are many options, if you are starting out from scratch, I recommend git.

Get a code buddy

- Does not even have to understand your research.
- Can tell you where things could be done better.
- Might spot mistakes that you cannot see.
- Problem: Can they even get the code to work on their machine
- Bonus points if it is on a different OS.

Share your code

- Let us assume that you have done all the changes so far:
- You have automated your analysis (one command and you get results).
- You have had someone look over it.
- It is in version control so you know what changes have been made.
- Why not upload it to a public github?

Share your code, Why?

- Science is (or should be) about openness and trasnparency, we shoudl share.
- Saves other people re-inventing what has already been done.
- People can use your code and cite it.
- Opens the door to more collaboration and impact.
- Others can view your code, and submitt modifications and even enhance your work.

Are you afraid of your code?

- How confident are you about making changes to your code?
- Are you sure it wont break.
- Even if it works do you know the answers are correct?
- This is where testing comes in.
- Most languages have a testing framework you can use.
- Unit, Functional, and Integration tests.

Are you afraid of your code?

- It can seem like a lot of work at the beginning, but it will be worth it.
- Looking back our first examples, testing could have prevented many of these issues.
- Integrate tests with version control.
- Automated testing, you write the tests, they are run periodically to check state of code.

Problems and solutions

- Reproducability - Learn to script and automate.
- Readability - Write in a high level language.
- Traceability - Use version control.
- Accuracy/Correctness - Testing.
- Reproducability / Correctness - Share your code / Get a code buddy.

Is your research software correct

Is your research software correct?
It might be, but can you be sure?

Help exists

Software Sustainability Institute

www.software.ac.uk

The Software Sustainability Institute

The Institute was founded to support the UKs research software community - a community that includes the majority of UKs researchers.

Our mission is to cultivate better, more sustainable, research software to enable world-class research (better software, better research). Software is fundamental to research: seven out of ten UK researchers report that their work would be impossible without it.

What is the Research Software Forum

- SSI Fellowship Program have provided funds to enage with and support researchers.
- Hopes to be a forum to gather those who use software together.
- Learn new skills, Share knowledge, Ask for help.
- Modelled on data conversations from the library.

Research Software Forum - the future

- Hope to continue this.
- Second part of today will be discussion on how we can do this.
- Just a forum?
- Provide training?
- Mailing list?
- Something else?

Research Software Forum - today

- series of lightning talks.
- Idea was/is for talks to take several forms:
  - to ask for help.
  - explain how you use software.
  - highlight something you use.
- Then we will have lunch and discussions.
- Small discussion groups.
- List of items are on the boards - put a tick under each one.
- 15 mins(ish) free discussion + lunch
- Break into small groups and discuss / eat lunch.
- Report back / Summary.