

Taking the Pulse

A few Lessons Learnt on Reproducibility

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ACM Emerging Interesting Group on Reproducibility and Replicability



<https://reproducibility.acm.org>

- Mission

Foster a broad and inclusive intellectual community around the issues of reproducibility of computational research.

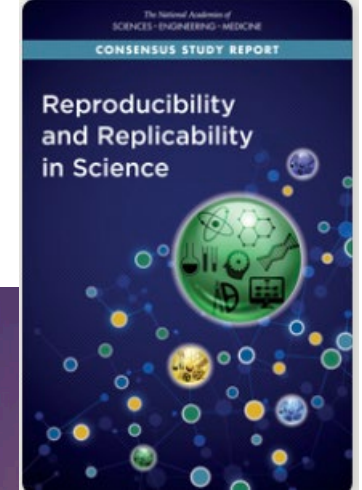
- Vision

EIG(/SIG)REPRO is a **forum for reproducibility practitioners** from all areas of computational research

- Focus on practices, i.e., the actual application or development of tools and methods.
- Exchange of views/experiences across communities.
- Services to a given community or ACM board wrt identified needs regarding reproducibility.

Definitions (2019)

<https://www.nap.edu/catalog/25303/reproducibility-and-replicability-in-science>



- **Reproducibility** means obtaining consistent results using the **same input data, code, computational steps, and conditions.**
- **Replicability** means obtaining consistent results across studies aimed at answering the same scientific questions **using different data.**

Engaging the SIGREPRO community

<https://reproducibility.acm.org/blog>

Taking the Pulse'21. Organized and edited by Limor Peer and Vicky Rampin.

PRINCIPLES	March 25	We will explicate ACM principles with respect to reproducibility.
SOLUTIONS	April 22	The current state of solutions and tools that support reproducibility.
TRAINING	May 20	How and where is scientific reproducibility taught?
PUBLISHING	June 24	Journals' and conferences' approaches to computational reproducibility.
PRESERVATION	July 29	Reproducibility in the long term requires curation and preservation.

Lessons Learned #1: Labor

Who is responsible for the work of reproducibility? How should that work be rewarded?

Reproducibility involves labor. It is an investment of time and expertise. Ideally, reproducibility labor is baked into the research process so that the effort it takes is indistinguishable from the research effort itself.

In reality, however, labor related to reproducibility often involves specialized actions that are treated as separate from the core research process.

This labor is often considered “extra” and the **responsibility for undertaking it gets shifted on to others in the research team, often graduate students** who may not receive appropriate training – or recognition – for the work.

In addition to reproducible practices incorporated in the research process itself, reproducibility also involves **labor on the part of users of the research**. That labor is even less rewarded, incentivized, or recognized. The archiving and preservation community is an important ally.

Research communities are exploring how to organize and reward reproducibility labor.
Need for conscious effort to strike balance between authors / reviewers / users.

Lessons Learned #2: Tools

Is there an inventory of reproducibility enabling or enhancing tools? What criteria do / can we use to assess tools and solutions? (e.g., wide-spread use, open source, interoperability, FAIR)

Resources for reproducibility tools were mentioned, including [ReproMatch](#) and [Reproducibility Rubric](#).

It was noted that the P-RECS Workshop, which focuses heavily on practical, actionable aspects of reproducibility, is inviting submissions for [P-RECS'21](#) and suggesting the following tools to automate experiments (not an exhaustive list): [CK](#), [CWL](#), [Popper](#), [ReproZip](#), [Sciunit](#), [Sumatra](#).

Participants expressed the opinion that **no single tool provides a comprehensive solution** for reproducibility due to the variety and complexity of issues and contexts, and that there is a **need to create an ecosystem** of reproducibility tools.

The time horizon for functional software is typically shorter than it is for data, with major implications for computational reproducibility. A [working group at the Research Data Alliance](#) is a good source of information about these issues.

No silver bullet, but preferences might emerge in a community.

Lessons Learned #3: Education

An important distinction needs to be recognized between the goals of instilling **basic values** and **ensuring good (or best) practices** on an ongoing basis.

- To instill basic values of responsible conduct, scientific rigor, and research integrity, the academy requires that researchers receive training (e.g., Responsible Conduct of Research at the [NIH](#)). In that context, reproducibility is often taught as a central concept and a guiding principle.
- When it comes to fixing good habits and ensuring that reproducible practices are widely implemented (and improved), training is often taught haphazardly and “on the job.” There are weak incentives for researchers to refresh their practical reproducibility skills and knowledge and generally weak enforcement mechanisms.

The observation that the daily grind of research practice, in some corners of the academy, sometimes works against some ethical norms (e.g., who gets authorship) in the race to publish is not new. In the community meeting, there was strong consensus that for ethical concepts to take hold they ought to be applied to the daily practice of research on an ongoing basis.

Training in automated and standardized data collection is a worthy investment and will facilitate reproducibility.

Lessons Learned #4: Preservation

In the context of reproducibility, we are interested in preserving the execution of a computational process, often as it relates to specific input and output data. This also requires the preservation of the various components that enable the performance or the process, including the data, the software, the state of the computer, and so on.

While repositories “do” preservation, it is better when all the stakeholders work toward this goal. Preservation is better supported when research is done with an eye toward reproducibility from the beginning, when proper data management is performed throughout, and when curators are involved before the research is shared, among other things.

Curators should be involved in the research process.

Take Aways

- Education and training is key.
- Curators should be identified, engaged and involved early.
- No silver bullet in terms of tools, but possible convergence within a community.
- Reproducibility labor should be consciously organized and rewarded, with a conscious effort to strike a balance between authors, reviewers and users.