# Assessing the Availability of Source Code in Computational Physics

M.S. Krafczyk, V. Stodden, Y. Zheng, D. Wong
National Center for Supercomputing Applications, University of Illinois at Urbana-Champaign

## Introduction

In recent years a few fields of science have been addressing new reproducibility issues. Precipitated by a few pioneering studies [1-3], efforts and awareness have expanded within fields such as psychological science [4], and cancer research [5].

Computational sciences are different from experimental sciences, they produce an inherently replicable record: the code [6]. A skilled practitioner may be capable of re implementing an article's methods, however this should not be necessary as a first step.

Availability of this computational record is low. Only 3/33 computationally based articles released source code in JASA in 2006 [7]. Only 44% of CS articles consented to releasing their source code in 2015 [8]. To gain insight into this phenomena, we conducted a study of source code and data availability within the Journal of Computational Physics (JCP), which some HPC projects use to publish their work.

## Methods

### 1. Inspect and Classify

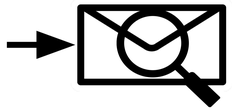
Articles were first inspected and classified according to how much information they disclosed about their code and data. Table 'Classification of Articles' shows our collected data.

### 2. Request Code and Data

Articles which did not contain enough code and data for replication, were sent a request by email (IRB #17329). Articles were divided into 'Informed' and 'Uninformed' groups. (see github in lower right for email templates)

### 3. Classify Responses

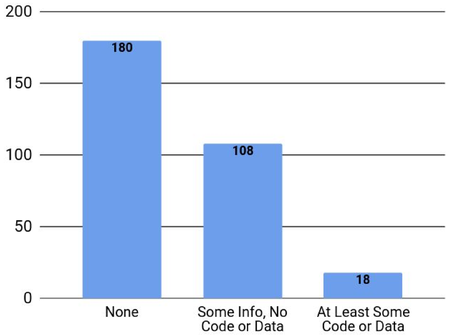
Email responses were classified according to how much code and data they disclosed, or indicated they may be willing to disclose. Table 'Classification of Email Responses' shows our collected data.



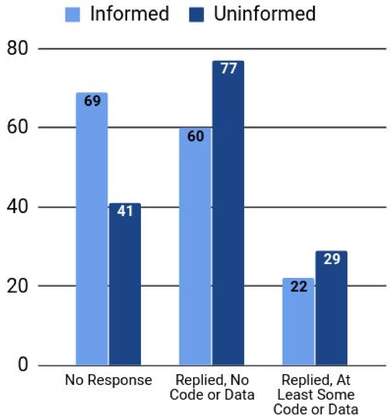
## Results

### Classification of Articles

- 306 articles with results based on code were inspected from volumes 322–331 of JCP
- 180 or 59% of articles gave no information about the code they used to get their results
- 108 or 35% of articles gave some information about their implementation such as library names, coding language, or hardware they used, but no actual code
- 18 or 6% of articles gave or indicated they would give at least partial source code




### Classification of Email Responses




- Authors in the 'Informed' group were told of this replicability study in the email request.
- 298 total emails were sent concerning 300 articles
- 110 or 37% of recipients did not respond to our request for source code.
- 137 or 46% of recipients responded but indicated that they could not, would not, wanted questions answered, or referred us to another person for the article's code.
- 51 or 17% of recipients responded with partial or full source code for their article.

## Conclusions

- 59% of articles give no information about their code/data.
- 6% of articles shared or gave an indication that they would share some data/code
- We received some form of code and data from 17% of authors we emailed.
- We received 34% more responses from the Uninformed group as from the Informed group. This represents a statistically significant increase for our sample size.
- Code disclosed was not significantly different between the groups. This implies authors in the informed group were not informing us if they weren't sharing.

More effort is necessary in the community to disclose source code and data, including any necessary input configuration information, processing scripts, and hardware info.

## Future Work

In order to study how code disclosure varies depending on demographic factors, publically available demographic information will be analyzed for the authors of these articles in conjunction with this data.

Collected source code and data will now be built and run to verify article results and form the basis of recommendations for making work more replicable.

## Literature Cited

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Download our source code and links to this content here: