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One Motivation: Prevent Loss of Knowledge

Every semester, graduate students around **the world** take an Empirical/Applied [...] Economics course. A typical assignment consists of reproducing the results of a paper and, possibly, testing the robustness of its results.

Stage	New Knowledge
Scope (select and verify)	Data and code exist?
Assess	Degree of reproducibility for specific part of the paper
Improve	E.g. fixed paths, libraries, added missing files, etc.
Test robustness	Results are robust to additional specifications

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Beyond Binary Judgments

Reproductions can easily gravitate towards adversarial exchanges.

- Early career researcher (ECR) have incentives to emphasize unsuccessful reproductions
- Original authors have a more senior position and can use it to deter in-depth reproductions from ECRs.
- The media also focuses on eye-catching headlines

Our approach:

We do not want to say

"Paper X is (ir)reproducible"

We do want to say

"Result Y in paper X has a high/low **level** of reproducibility according to **several** reproduction attempts. Moreover, **improvements** have been made to the original reproduction package, **increasing** its reproducibility to a higher level"

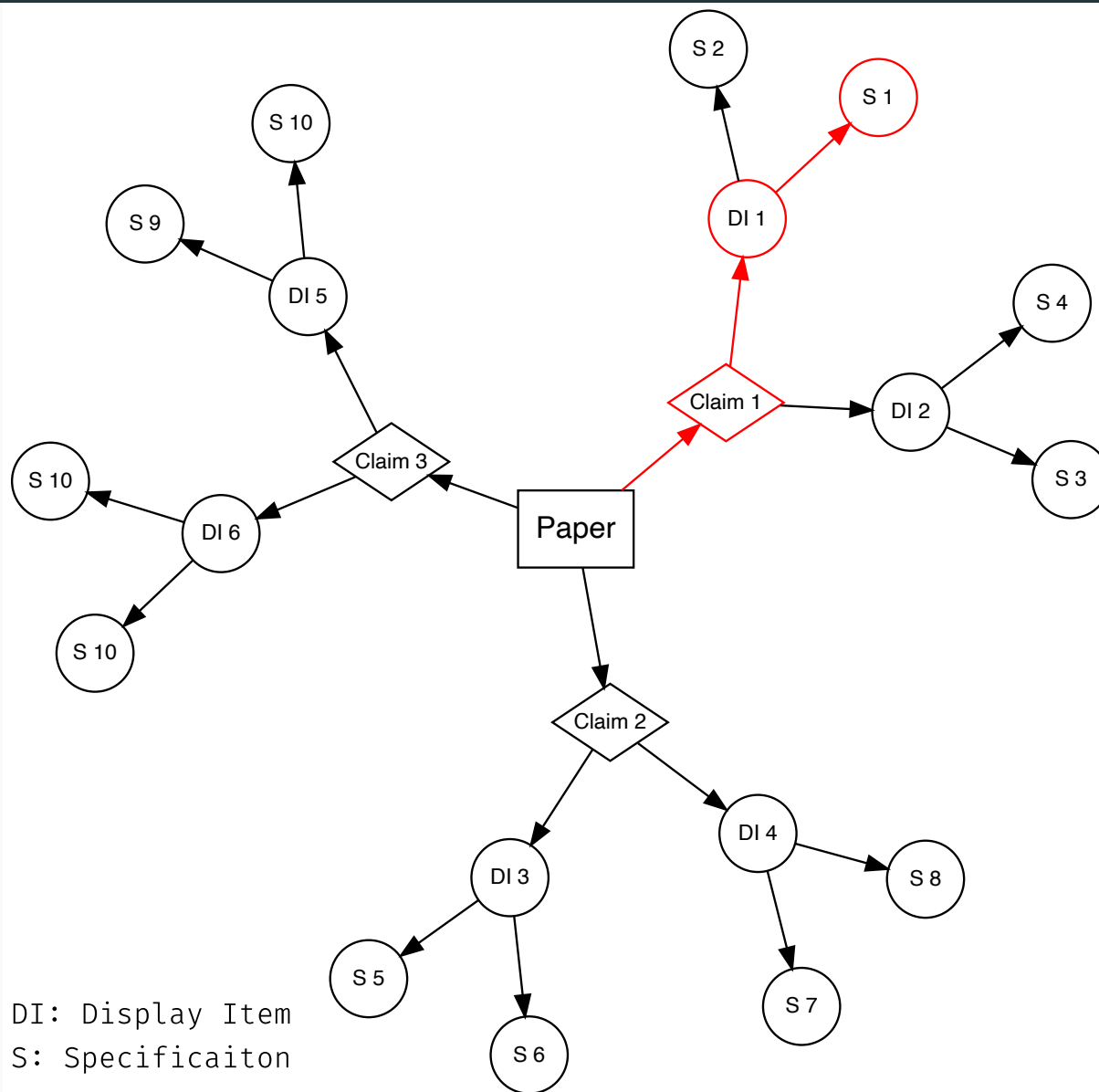
Our Framework

Each **reproduction attempt** is centered around scientific **claims**

One paper can contain several claims.

Each claim may be supported by various **display items**: tables, figures & inline results.

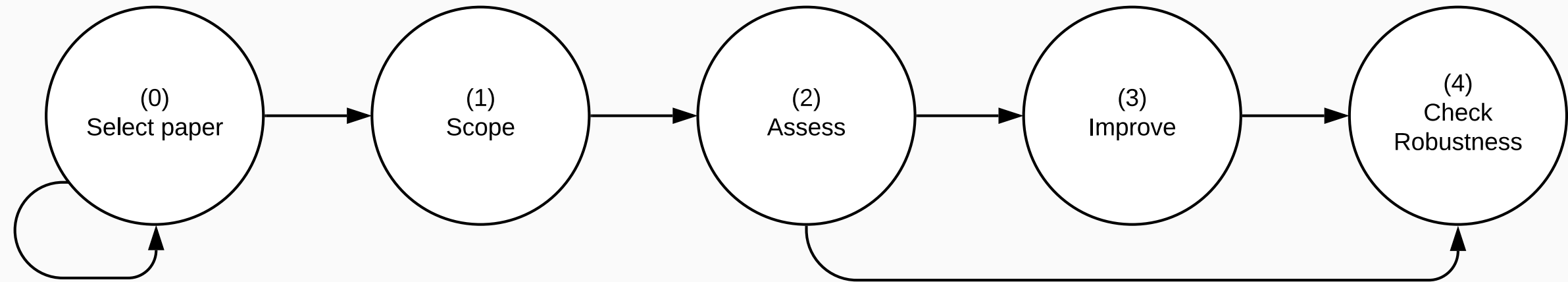
A reproduction attempt is at the claim level, and reproducers must record their **specifications** of interest.



Large part of this exercise is about standardization

- Computational Reproduction (or Reproduction)
- Replication (will not mention this term again!)
- Reproduction attempt
- Reproduction package
- Claim
- Display item
- Specification
- Preferred specification
- Raw data
- Analysis data
- Candidate paper
- Declared paper
- Reproduction tree
- Complete Workflow
- Computationally Reproducible from Analytic data (CRA)
- Computationally Reproducible from Raw data (CRR)
- Reasonable test
- Feasible test
- Minimal effort

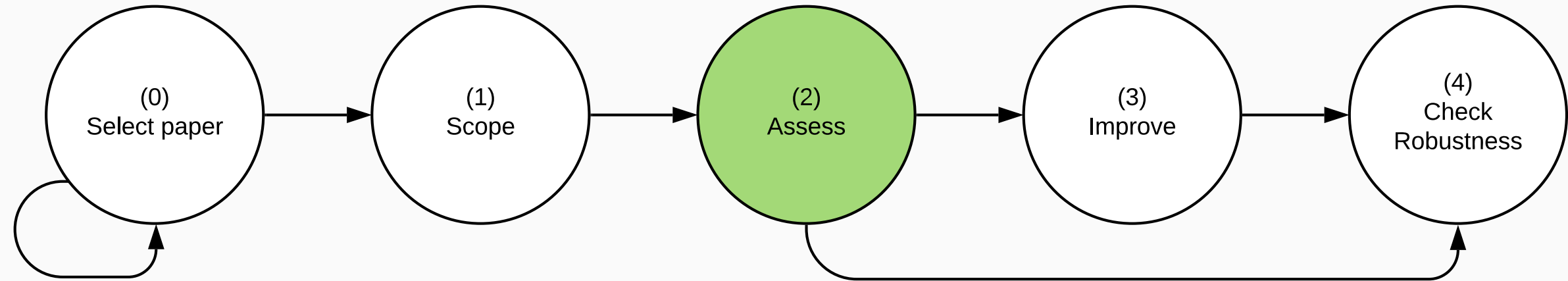
Stages



Assessment

Two main parts for assessment:

1. Find all the elements behind a display item
2. Score the reproducibility of that display item



Identify All the Elements Behind a Display Item

Reproducers will be asked to draw a clear connection to the raw data sources mentioned in the paper and the display item under reproduction.

Data sources

Connect the data sources in the paper's text with specific raw data files.

Analytic data sets

Describe each analytic data file.

Code files

Inspect all code files and record all their inputs and outputs.

With all the information recorded above, reproducers can use the **ACRE Diagram Builder** to generate a **reproduction tree**.



Reproduction Tree

```
table1.tex
|___[code] analysis.R
|___analysis_data.dta
|___[code] final_merge.do
|___cleaned_1_2.dta
|   |___[code] clean_merged_1_2.do
|   |   |___merged_1_2.dta
|   |   |___[code] merge_1_2.do
|   |   |___cleaned_1.dta
|   |   |   |___[code] clean_raw_1.py
|   |   |   |___raw_1.dta
|   |   |___cleaned_2.dta
|   |   |___[code] clean_raw_2.py
|   |   |___raw_2.dta
|___cleaned_3_4.dta
|   |___[code] clean_merged_3_4.do
|   |___merged_3_4.dta
|   |___[code] merge_3_4.do
|   |___cleaned_3.dta
|   |   |___[code] clean_raw_3.py
|   |   |___raw_3.dta
|   |___cleaned_4.dta
|   |___[code] clean_raw_4.py
|   |___raw_4.dta
```



Levels: Proprietary/Confidential Data

Levels of Computational Reproducibility
with Proprietary/Confidential Data
(P denotes "partial", C denotes "complete")

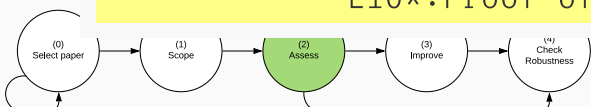
Availability of materials, and reproducibility											

		Instr.				Instr.					
Analysis		Analysis				Cleaning		Raw			
Code		Data		CRA		Code		Data		CRR	
P	C	P	C			P	C	P	C		

L1: No materials.....		-	-	-	-	-	-	-	-	-	-

L2: Only code		✓	✓	-	-	-	-	-	-	-	-
L3*: Partial analysis data & code		✓	✓	✓	-	-	-	-	-	-	-
L4*: All analysis data & code....		✓	✓	✓	✓	-	-	-	-	-	-
L5*: Proof of third party CRA....		✓	✓	✓	✓	✓	-	-	-	-	-

L6: Some cleaning code.....		✓	✓	✓	✓	✓	✓	-	-	-	-
L7: All cleaning code.....		✓	✓	✓	✓	✓	✓	✓	-	-	-
L8*: Some instr. for raw data....		✓	✓	✓	✓	✓	✓	✓	✓	-	-
L9*: All instr. for raw data.....		✓	✓	✓	✓	✓	✓	✓	✓	✓	-
L10*:Proof of third party CRR....		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓



Promoting a Constructive Exchange

- 1 - Contacting the original author(s) when there is no reproduction package
- 2 - Contacting the original author(s) to request specific missing items of a reproduction package
- 3 - Asking for additional guidance when some materials have been shared
- 4 - Response when the original author has refused to share due to *undisclosed reasons*
- 5 - Response when the original author has refused to share due to legal or ethical restrictions of the data
- 6 - Contacting the original author to share the results of your reproduction exercise
- 7 - Responding to hostile responses from original authors

For original authors responding to requests from reproducers

- 1 - Responding to a repeated request that has been addressed in an earlier interaction
- 2 - Acknowledging that the author no longer has access to certain part(s) of the reproduction package
- 3 - Acknowledging that some material is still embargoed for future research
- 4 - Responding to incomplete/unclear requests

Example 1: Following up on additional materials

Template email:

Subject: Clarification for reproduction materials for ["Title of the paper"]

Dear Dr. [Lastname of Corresponding Author],

Thank you for sharing the materials. They have been immensely helpful for my work.

Unfortunately, I ran into a few issues as I delved into the reproduction exercise, and I think your guidance would be helpful in resolving them. **[Describe the issues and how you have tried to resolve them. Describe whatever files or parts of the data or code are missing. Refer to examples 1 and 2 below for more details]**.

Thank you in advance for your help.

Best regards,

[Reproducer]

An example of well described issues:

Specifically, I am attempting to reproduce [display item X (e.g., table 1, figure 3)]. I found that the following components are required to reproduce to reproduce [display item X]:

```
display_item_X
├── [code] formatting_table1.R
│   ├── output1_part1.txt
│   │   ├── [code] output_table1.do
│   │   │   ├── [data] analysis_data01.csv
│   │   │   ├── [code] data_cleaning01.R*
│   │   │   └── [data] UNKNOWN
│   └── output1_part2.txt
│       ├── [code] output_table2.do
│       │   ├── [data] analysis_data02.csv
│       │   ├── [code] data_cleaning02.R
│       └── [data] admin_01raw.csv*
```

I have marked with an asterisk (*) the items that I could not find in the reproduction materials: **data_cleaning01.R** and **admin_01raw.csv**. After accessing these files, I will also be able to identify the name of the raw data set required to obtain output1_part1.txt. This is to let you know that I may need to contact you again if I cannot find this file (labeled as **UNKNOWN** above) in the reproduction materials.

I understand that this request will require some work for you or somebody in your research group, but I want to assure you that I will add these missing files to the reproduction package for your paper on the ACRE platform. **Doing this will ensure that you will not be asked twice for the same missing file.**

Easy to grade: report 1

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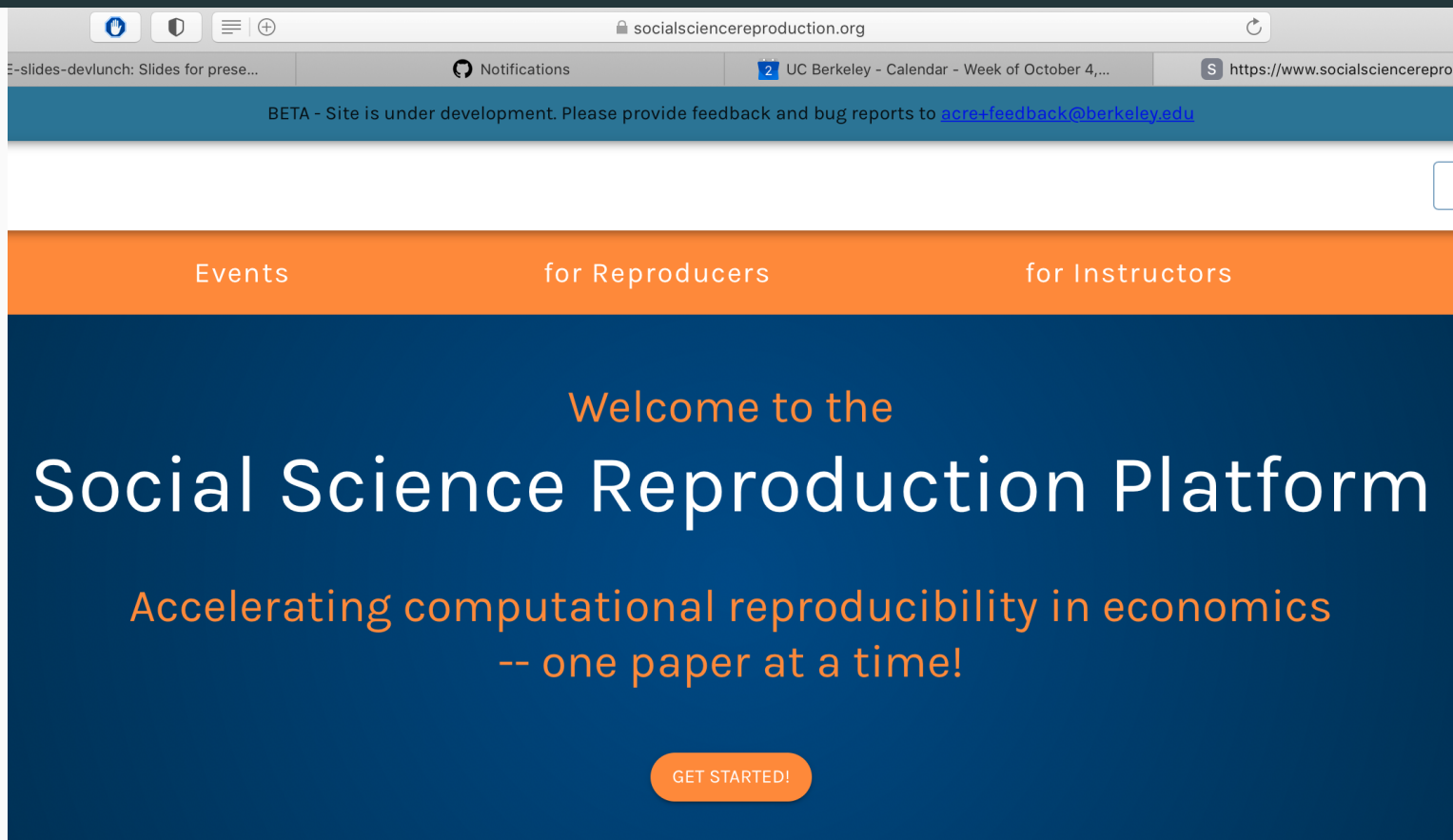
Easy to grade: report 1

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Purpose

On the Social Science Reproduction Platform, you can record and review **verifications and improvements** to the **computational reproducibility** of published social science work.

This open source platform was developed by the Berkeley Initiative for Transparency in the Social Sciences ([BITSS](#)) in collaboration with the [American Economic Association Data Editor](#).

Acknowledgements

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Ted Miguel's Graduate Development Economic Course (2019, 2020) - UC Berkeley

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Undergraduate RAs at BITSS beta testing the platform