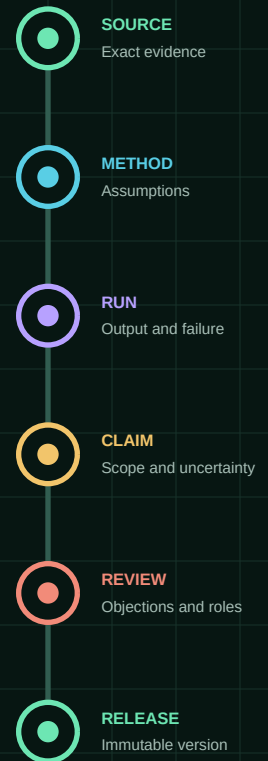


The Auditable Executable Paper

From evidence to claim, revision, review, and independent reconstruction



EDUCATION AND RESEARCH

A scholarly claim becomes answerable when it retains a navigable route to its evidence, assumptions, execution, contradictions, review, release, and reproduction path.

EVIDENCE BOUNDARY

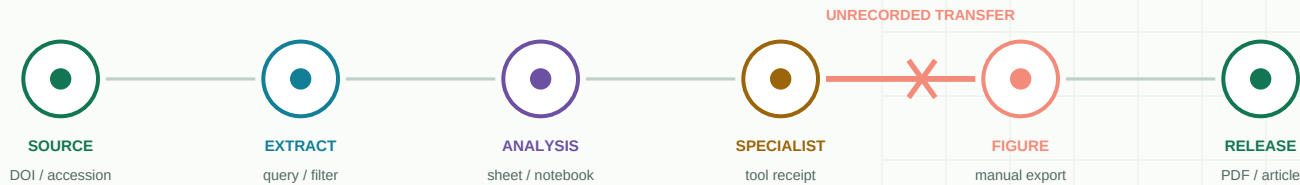
Research standards and public guidance establish scoped expectations for reproducibility, provenance, stewardship, and review. The Grid architecture and synthetic fixture are propositions for bounded evaluation - not evidence of scientific validity, peer review, standards conformance, institutional compliance, adoption, or outcome.

The Auditable Executable Paper

01 | COORDINATION PROBLEM

The paper breaks where the tools meet.

Sources, analyses, specialist systems, figures, reviews, and prose can each be locally correct while the accepted claim remains globally unreconstructable.



LOCAL OBJECTS

Useful tools remain authoritative

- Editors carry readable argument.
- Notebooks and sheets carry analysis.
- Repositories and specialist systems carry authoritative artifacts.

BROKEN RELATIONS

The failure is between them

- Classifications remain in private files.
- Exclusions and denominators drift.
- Pasted results detach review from computation.

CATEGORY POSITION

Connect the scholarship

- Preserve identity and revision.
- Bind claims to evidence and failure.
- Keep accepted releases immutable.

CATEGORY POSITION

Grids should not compete for the sentence, the cell, or the solver. It should compete for the connective tissue of scholarship.

02 | ANSWERABILITY CONTRACT

Six questions make a claim answerable.

Run the test against every consequential number, figure, and proposition. A missing answer is a named scholarly gap.

01

EVIDENCE

Where did this come from?

Exact source, stable locator, time, rights, and transformations.

02

METHOD

What assumptions produced it?

Definitions, exclusions, units, missing-data treatment, specification, and parameters.

03

REVISION

What changed?

Earlier and later revisions, reason, stale dependents, and successor release.

04

CHALLENGE

What contradicts it?

Counterevidence, failed runs, incompatible definitions, objections, and uncertainty.

05

AUTHORITY

Who reviewed and authorized it?

Role, evidence inspected, scope, approval, response, and remaining dissent.

06

REPLAY

Can another scholar reconstruct it?

Data identifiers, code and environment, parameters, seeds, order, status, and tolerance.

REPRODUCIBILITY LIMIT

Execution can strengthen computational reproducibility. It does not establish replication, causal identification, construct validity, or truth.

03 | CLAIM ANATOMY

A claim should carry its own receipt.

The receipt binds readable argument to source identity, method, execution, uncertainty, review, and the exact release readers received.

Receipt field	Recorded evidence	Question answered
Source identity	DOI, accession, archive object, instrument run, version, rights	Which exact evidence was used?
Method revision	Code commit, environment, protocol, selection rule, parameters	What transformed the evidence?
Execution	Inputs, tool identity, output, warnings, failures, status	What ran, and what failed?
Claim boundary	Population, interval, uncertainty, sensitivity, exclusions	What may the result mean?
Review state	Reviewer role, objection, response, approval, dissent	Who accepted which proposition?
Release identity	Immutable version, contributors, date, successor link	What did readers receive?

SAME REVISION, DECLARED OMISSIONS

RESEARCHER REVIEWER STUDENT INSTRUCTOR

Purpose-fit views may reveal different fields; each identifies the same accepted revision and what it omits.

RELEASE RULE

A live model is not automatically a publication, and a publication snapshot is not the whole research object.

04 | EPISTEMIC BOUNDARY

Execution does not make a claim true.

It can prove that the represented path ran and preserve evidence for challenge. Validity, interpretation, ethics, and scholarly merit require independent judgment.

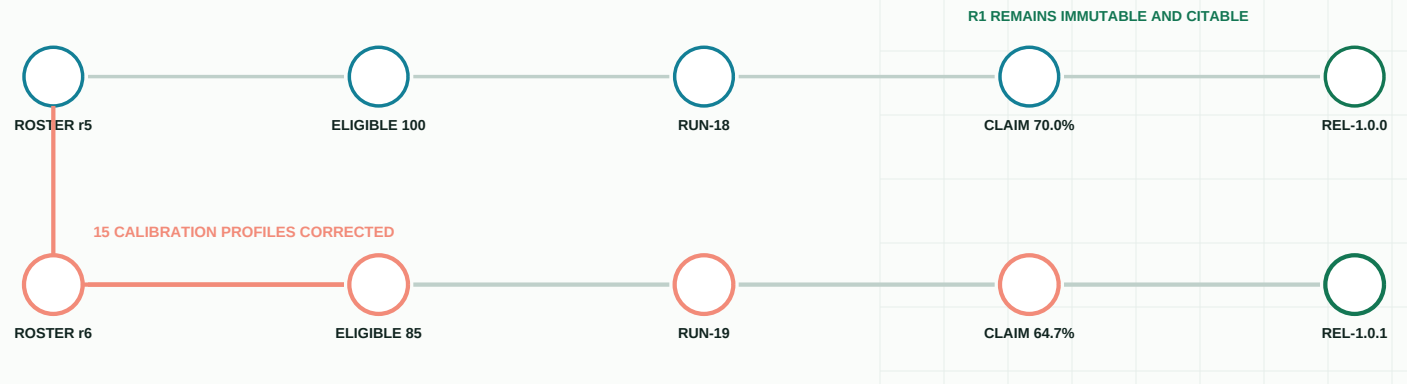
Evidence	It can establish	It cannot establish
Dependency replay	Declared inputs and transformation produced this output	Causal truth or model completeness
Same inputs and methods	The computational result can be reproduced	Independent replication or construct validity
Runtime validation	An artifact conforms to a declared technical contract	Scientific validity, fairness, ethics, or fit
Signature and review receipt	Identity, byte integrity, and accepted revision	Peer review, authority, understanding, or merit
Specialist-tool receipt	A solver, proof system, or instrument returned this bounded result	Real-world optimality, safety, meaning, or truth

TRUTH BOUNDARY

Reproduction can faithfully reproduce a flawed method. The defensible promise is answerability, not automated truth.

A correction should create a successor.

The fictional Cedar exercise shows how one accepted source correction changes a denominator, marks dependent claims stale, and preserves the earlier release.



State	Accepted record	Result	Downstream status
Release 1.0	100 eligible; 70 met threshold	70.0%; exact gate passes	Immutable and citable
Source correction	15 Cohort D calibration profiles	Remove 15 eligible and 15 met	D row, total, and claim stale
Corrected run	85 eligible; 55 met threshold	64.7%; exact gate fails	New table and claim need review
Release 1.0.1	Research lead accepts successor	Bounded descriptive correction	Links to 1.0; does not overwrite it

FIXTURE LIMIT

The fixture proves only change propagation and reconstruction inside declared synthetic cases - not that a finding is true, causal, important, generalizable, or publishable.

06 | DISCIPLINARY BREADTH

One invariant, three scholarly forms.

Executable does not mean only that Python runs. The same claim-to-evidence contract must survive very different methods and authority.

ACCOUNTING

Filing accession to table cell

- Accession and amendment state
- Sample waterfall and exclusions
- Variable and estimator revision
- Statistics receipt and accepted cell

HISTORY

Archival region to inference

- Object, region, and rights
- Transcription and translation
- Uncertain dates and identity
- Counterevidence and interpretation

COMPUTER SCIENCE

Run matrix to claim gate

- Commit, build, and hardware
- Workloads, seeds, and timeouts
- Raw logs, including failures
- Figure point and accepted claim

Field	Executable event	Authority outside the runtime
Accounting	Recompute after an amended filing	Accountants and methods reviewers
History	Invalidate a chronology after an identity split	Archivists, custodians, and historians
Computer science	Rerun a pinned experiment stratum	Authors, reviewers, and operators

DISCIPLINARY BOUNDARY

Other tools remain authoritative. The research object connects their artifacts and receipts; it does not reimplement disciplinary expertise.

The research object needs an open skeleton.

Provenance, identity, contributor roles, packaging, rights, and journal exchange must survive export. Standards are exit paths, not badges.

Standard	Role in the object	Acceptance question
PROV-O	Entities, activities, agents, derivation, attribution, revision	Can export preserve roles and activities?
RO-Crate 1.3	Package artifacts, people, software, equipment, citations, licenses	Can a third party reconstruct the crate?
DataCite + CFF	Identify and cite releases, data, and software	Does citation resolve to the exact version?
CRedit	Structured contributor roles	Can contributors review role assertions?
JATS	Journal article interchange	Does the snapshot resolve to the accepted object?
FAIR	Findability, explicit access, interoperability, reuse metadata	Can restricted data stay governed?

PDF / JOURNAL

Immutable accepted view

- Readable release
- Stable citation

REPOSITORY / CRATE

Portable artifacts

- Files and manifests
- Rights and identities

LIVING OBJECT

Governed successor

- New state and stale claims
- Review before release

CONFORMANCE RULE

A reactive model, history view, or signed package does not establish standards conformance until mappings pass documented round-trip tests.

The first proof is reconstruction.

Start with one completed paper, frozen inputs, an accepted reference implementation, and no live participant, grading, publication, or policy consequence.

FREEZE THE RECORD

Before configuration

- Manuscript and source manifests
- Code, environment, and tool outputs
- Expected numbers and tolerances
- Methods, roles, and access boundaries

SEED THE BREAKS

Try to falsify continuity

- Corrected source and changed exclusion
- Stale calibration and missing dependency
- Fabricated citation and failed run
- Unresolved objection and wrong-purpose view

Acceptance question	Passing evidence	A pass still does not show
Can a reviewer rebuild the selected result?	Exact value within tolerance; every manual step named	Scientific validity or replication
Does one controlled change find every dependent?	Stale calculations, claims, views, and prior release identified	Scalability or workflow benefit
Do contradiction and failure stay visible?	Negative, missing, failed, and disputed states retained	Good interpretation or peer review
Do purpose-fit views preserve one record?	Same revision shown; omissions and access states declared	Privacy, IRB, accessibility, or compliance

EVIDENCE LIMIT

Passing supports a bounded product-demonstration claim for this paper and environment - not adoption, instructional effectiveness, research productivity, or scholarly outcome.

09 | LIMITS AND SOURCES

The PDF is a release. The research object is the paper.

Keep each accepted release immutable and citable. Use the canonical web paper for the full discussion, current links, corrections, and complete references.

01 NATIONAL ACADEMIES	Reproducibility and Replicability in Science nap.nationalacademies.org/catalog/25303/reproducibility-and-replicability-in-science
02 W3C	PROV-O: The PROV Ontology www.w3.org/TR/prov-o/
03 GO FAIR	The FAIR Guiding Principles www.gofair.foundation/fair-principles
04 RO-CRATE	Research Object Crate 1.3 www.researchobject.org/ro-crate/specification/1.3/introduction.html
05 DATACITE	DataCite Metadata Schema schema.datacite.org/
06 NISO	CRedit Contributor Role Taxonomy credit.niso.org/
07 ELIFE / STENCILA	Welcome to a New ERA of Reproducible Publishing elifesciences.org/labs/dc5acbd/welcome-to-a-new-era-of-reproducible-publishing
08 PIMENTEL ET AL.	A Large-scale Study about Quality and Reproducibility of Jupyter Notebooks leomurta.github.io/papers/pimentel2019a.pdf

FINAL BOUNDARY

Grid does not establish scientific validity, independent replication, peer review, authorship, research-integrity or privacy compliance, accessibility, standards conformance, institutional adoption, instructional effectiveness, or research impact.