THE READER OF SCIENCE IS BECOMING AN AGENT

Agent-Native Research *Artifacts*

When the reader is an agent, the *paper* is the bottleneck.

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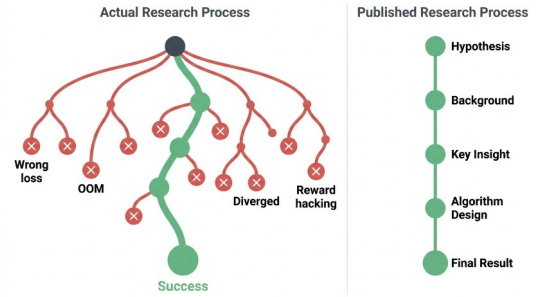
A multi-institution collaboration

A paper PDF is a *lossy compression* of the research.

Storytelling Tax



The branching exploration and dead ends are compressed into a single linear story.

Engineering Tax

An agent-executable spec is compressed into reviewer-sufficient prose.

45.4%

of reproduction requirements are fully specified in the PDF; the agent guesses the rest.

The bottleneck is the artifact, not the prompt.

Human AI co-scientist

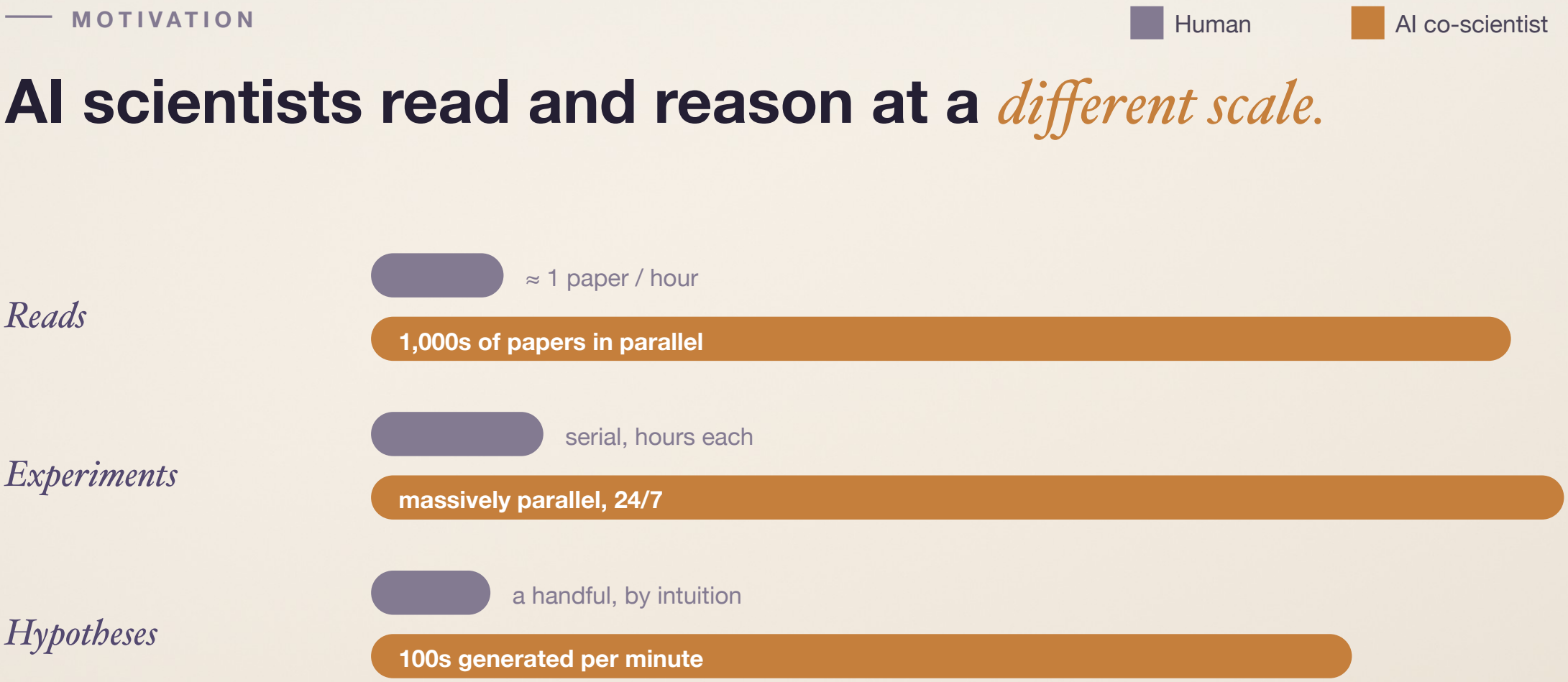
AI scientists read and reason at a *different scale.*

Reads — ≈ 1 paper / hour

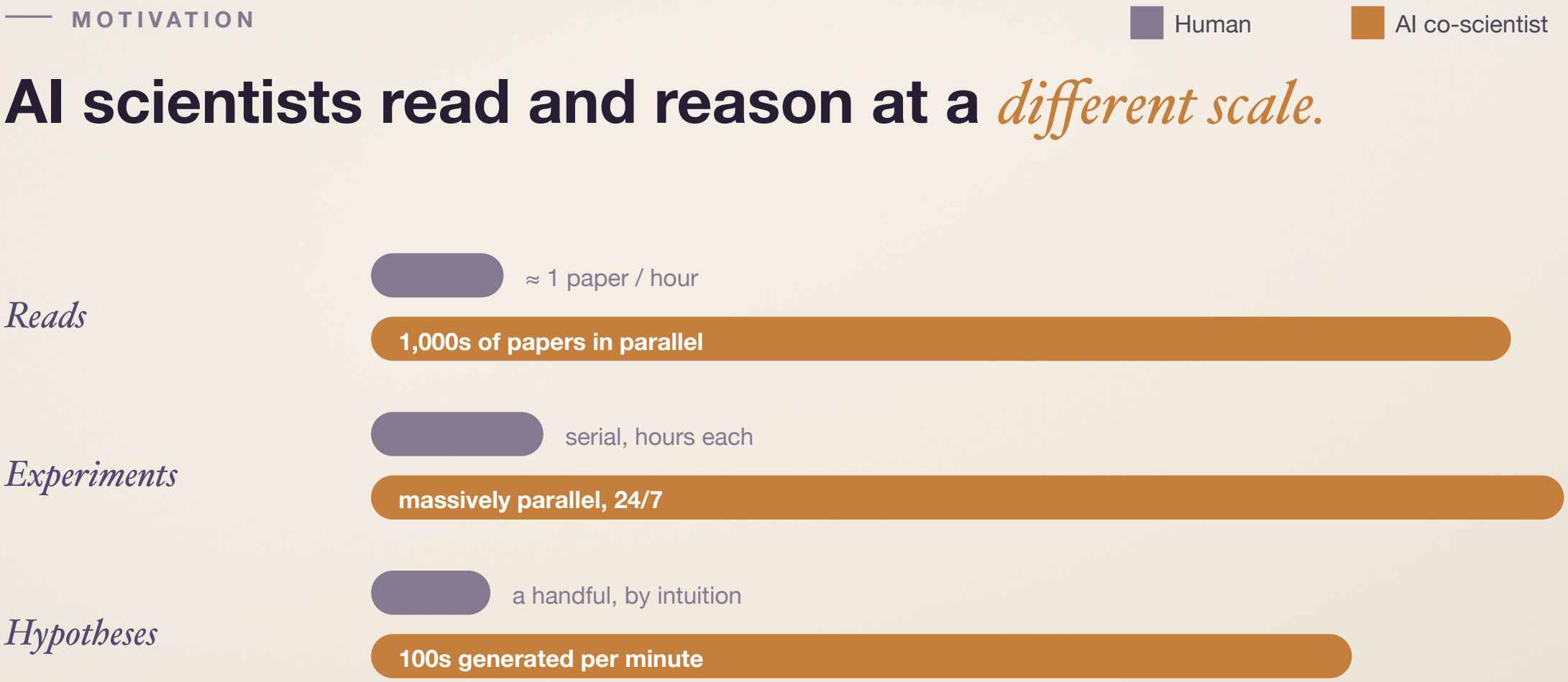
Experiments — serial, hours each

Hypotheses — a handful, by intuition

AI scientists read and reason at a *different scale.*



AI scientists read and reason at a *different scale.*



Different scale, different modality: AI wants structured, executable artifacts, not narrative.

Introducing ARA, *a research package built for agents.*

~/research/ara

/logic *the why*

Claims, hypotheses, lineage; typed and machine-readable.

/src *the how*

Code, configs with rationale, environment pins, seeds.

/trace *what was tried*

DAG of decisions, dead ends, pivots; the git log of research.

/evidence *the raw numbers*

Logs and results; separable for access control and verification.

Understandable

Hierarchical structure that preserves the full exploration trajectory.

Executable

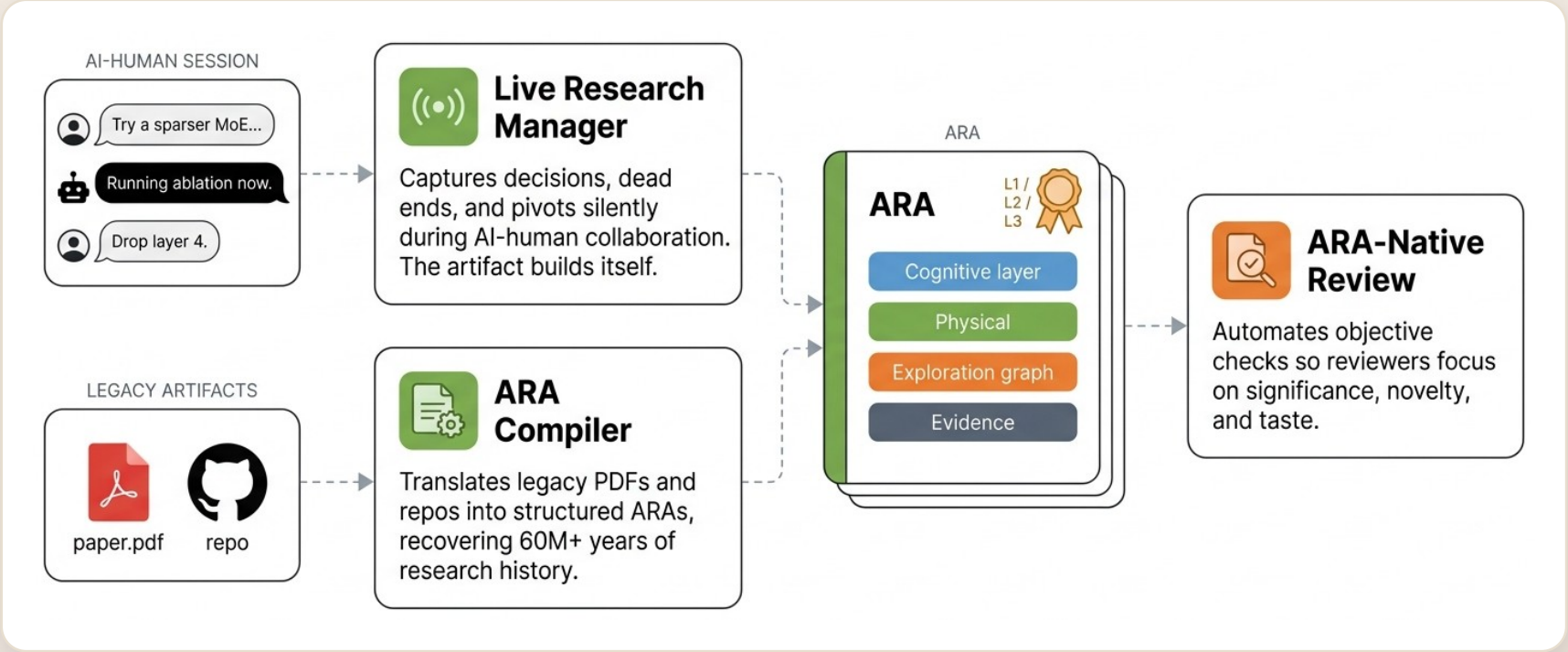
An agent reproduces the claim zero-shot, not reimplements it.

Verifiable

Every ARA is auditable and re-runnable by the community.

Agents author, verify, and *extend one artifact.*

Too rich to fill by hand, so agents author, verify, and render it as a byproduct of research.

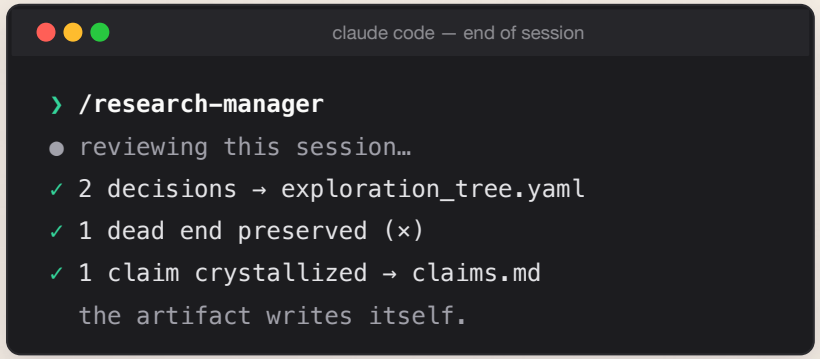


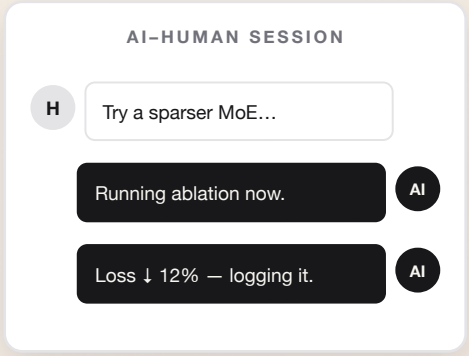
One loop, one persistent state: the ARA is the only thing humans and research agents share.

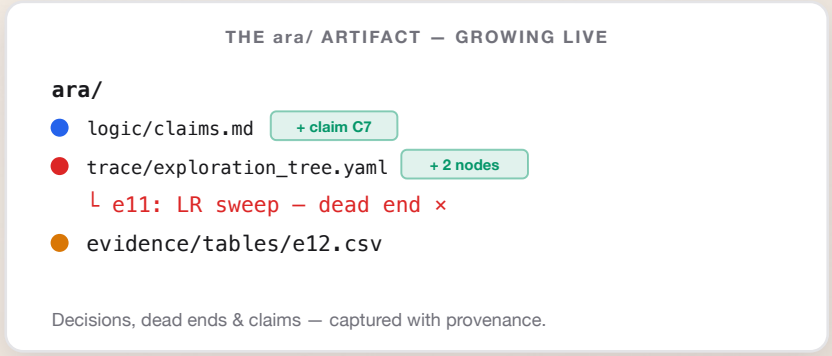
Capture live, or *compile the past.*

1 /research-manager

Rides along as an observer, documenting the ARA while the AI does the research.

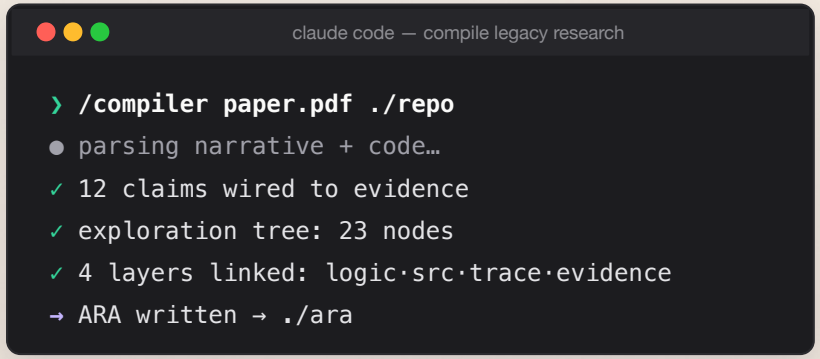


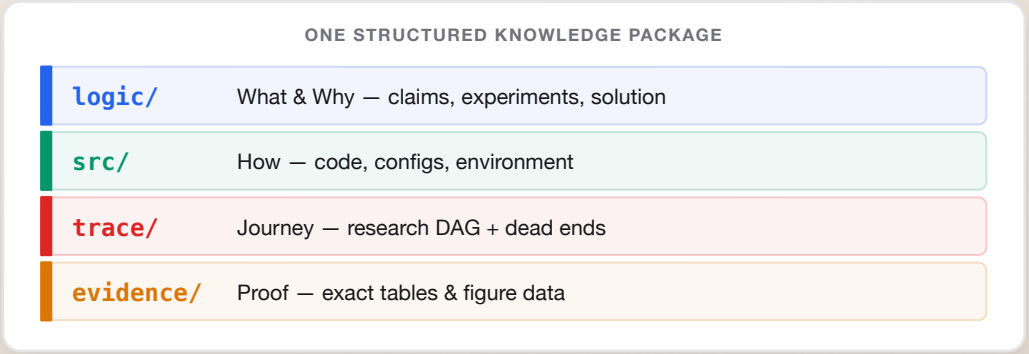




2 /compiler

Compile any paper, repo, or notes into a structured ARA.





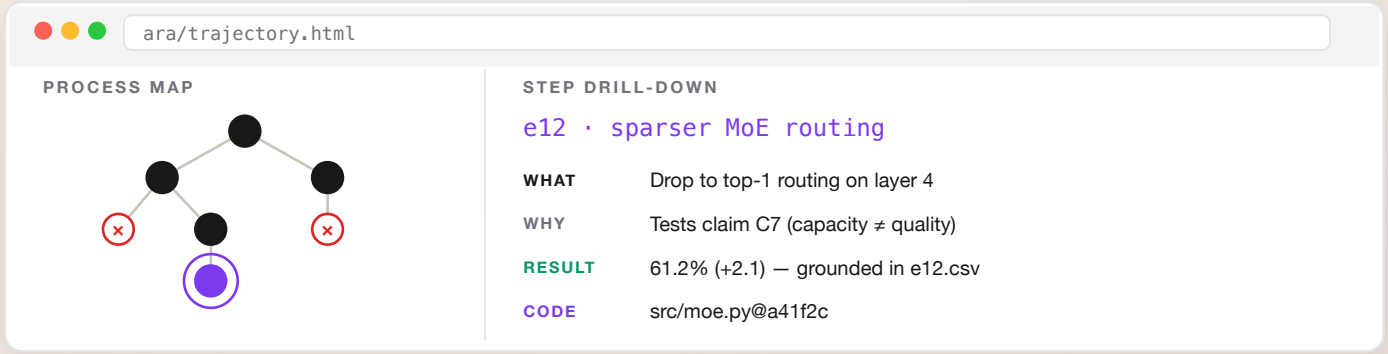
Replay it, then *audit its rigor.*

3 /research-visualizer

Watch the whole trajectory, every branch and dead end, in one interactive map.

```
claude code — render trajectory

❯ /research-visualizer ./ara
● reading exploration graph…
✓ 23 steps · 4 dead ends mapped
✓ trajectory.html — one file, interactive
→ open in browser to replay the research
```

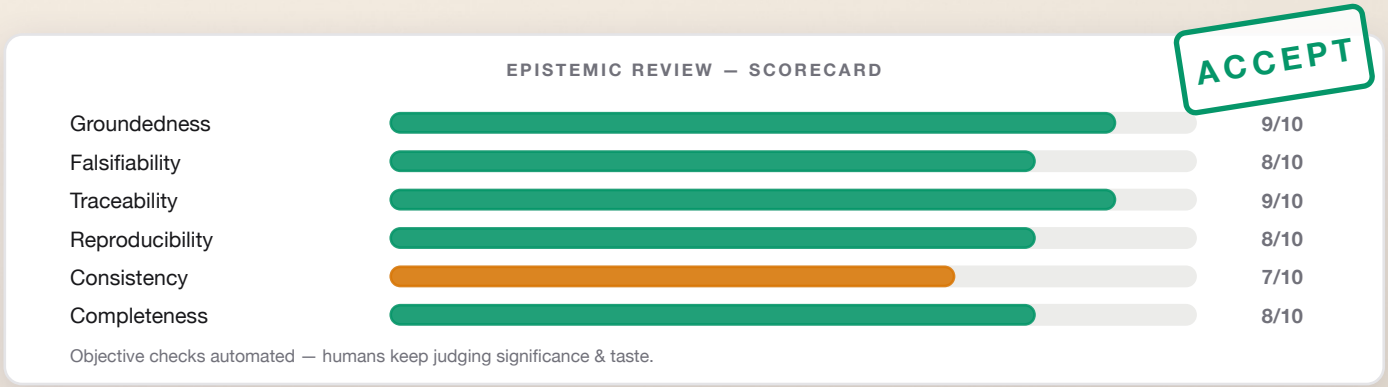


4 /rigor-reviewer

Audit an artifact's epistemic rigor before you trust or publish it.

```
claude code — seal level 2

❯ /rigor-reviewer ./ara
● level-2 semantic review…
✓ 6 epistemic dimensions scored
⚠ 2 findings (minor severity)
→ recommendation: Accept
```



How we test it: *three layers, two benchmarks.*

TWO BENCHMARKS SUPPLY WHAT PDFs LACK

PaperBench

Fine-grained rubrics decomposing paper reproduction into gradable requirements.
54.6% are underspecified in the source PDF.

RE-Bench

Close-ended AI R&D hill-climbing tasks on well-defined objectives, spanning engineering and research.
90.2% of agent effort is spent on discarded dead ends.

THREE LAYERS WE TEST

I	*Understanding* Can an agent extract knowledge?	`450 paired QA`
2	*Reproduction* Can it execute the research?	`PaperBench · 1,743 reqs`
3	*Extension* Can it build on prior work?	`RE-Bench · 5 tasks`

Every comparison is ARA vs. PDF + repo with agent, task, and ground truth held fixed · Claude Sonnet 4.6 · blinded judge · ARAs auto-compiled.

ARA wins on *all three layers.*

UNDERSTANDING

72.4 → 93.7%

QA accuracy

+65.7% on failure knowledge, where the PDF baseline has no source

REPRODUCTION

57.4 → 64.4%

success rate

lead grows monotonically with task difficulty

EXTENSION

5 / 5

faster first move

reaches a useful first move earlier on all five; wins 3/5 on final score

THE TAKEAWAY

Don't write the paper. Ship the *artifact.*

Research that agents can read, run, and verify.

`github.com/ARA-Labs/Agent-Native-Research-Artifact`

Scan: code + spec