Building a culture of open and reproducible science

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Culture: The norms, principles, and practices of an institution

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"Culture is created by the behaviors you tolerate" - Jacob Engel

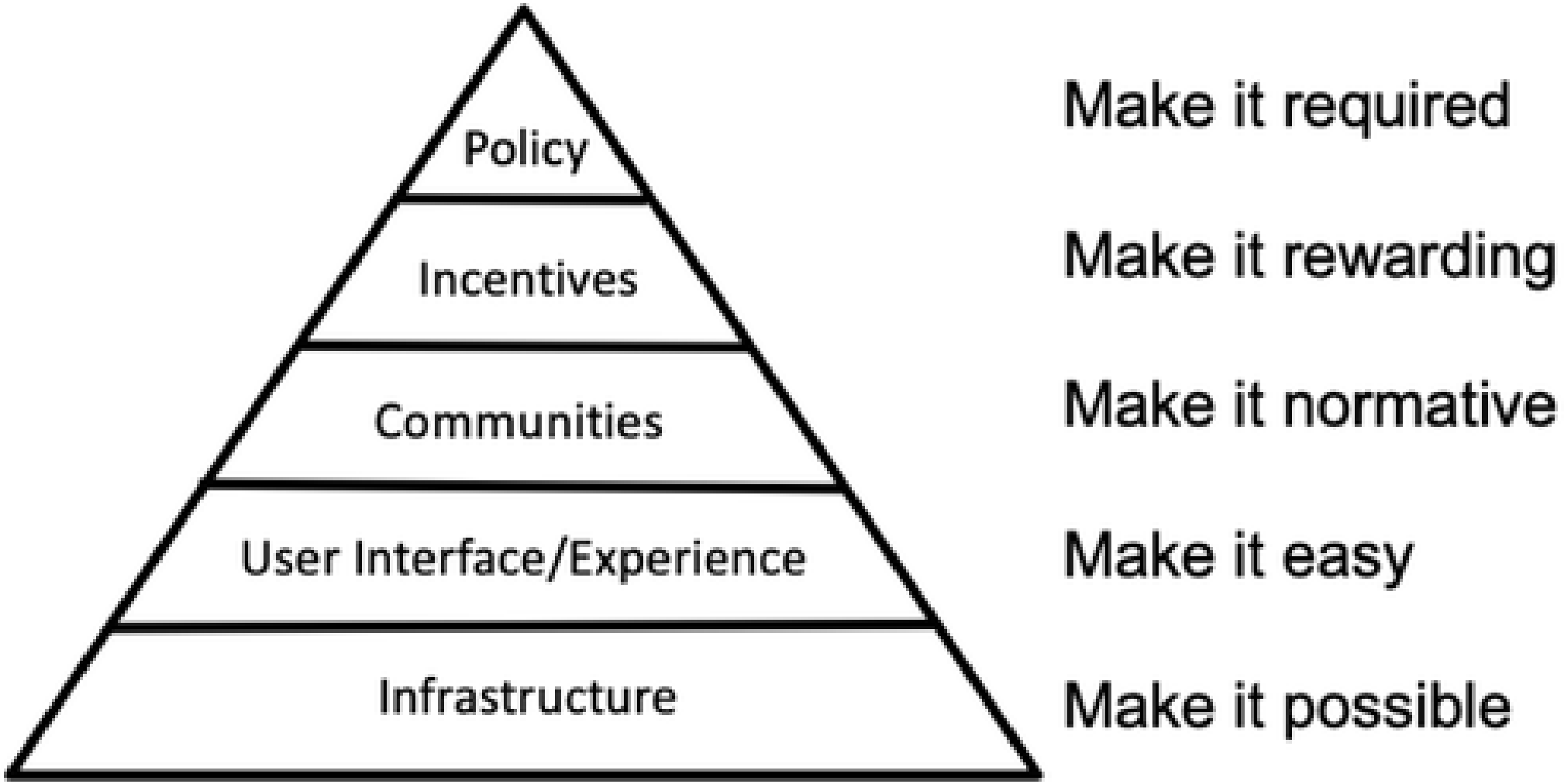
Closed-science lab culture

- Competitive atmosphere
- High level of secrecy and paranoia
- Pressure to find specific results
- Lack of trust

Open-science lab culture

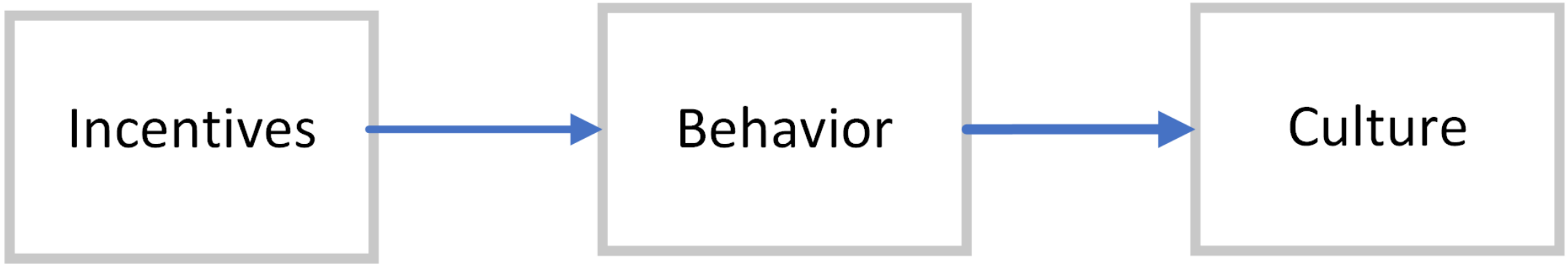
- Openness and transparency
- Collaborative atmosphere
- Trust

How can we move from closed to open science culture?



https://www.cos.io/blog/strategy-for-culture-change

Making open science normative



“Incentives drive behavior, and behavior spawns culture.” - Rob Asghar

Aligning the incentives

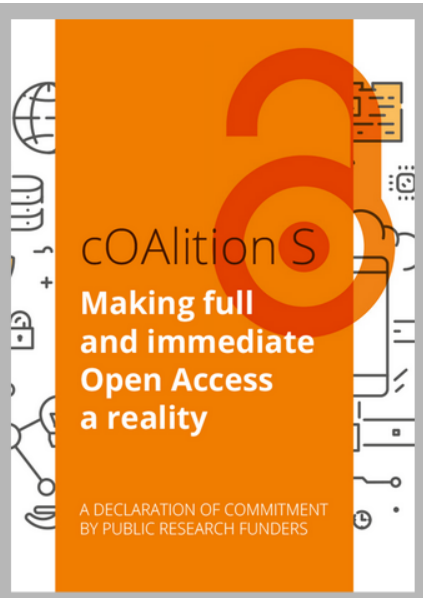
- Researchers should be rewarded for doing the right thing

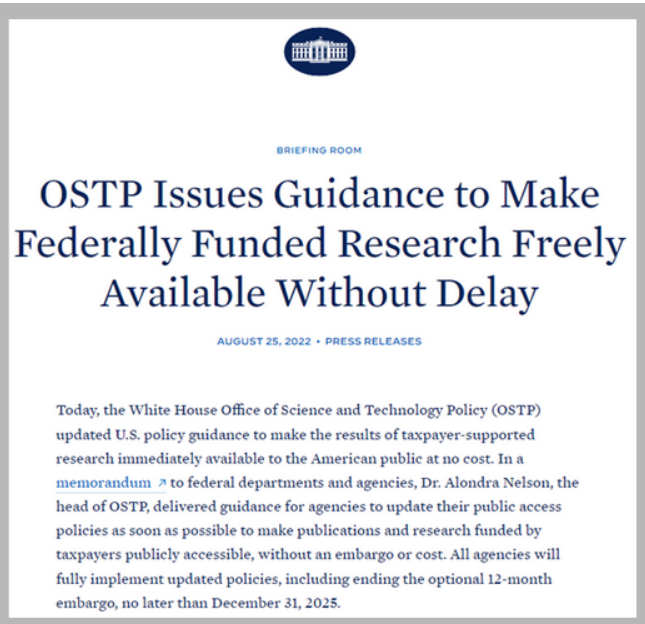
- Problem:
  - Who makes the decisions about hiring, tenure, and funding?

Mutually reinforcing vectors for change

https://www.heliosopen.org/about

Increasing high-level support for open science





Translating open science into institutional policy

- At a high level, engagement from colleges and universities has three core components:
  - Presidential Commitment
  - Campus Engagement
  - Community of Practice

Higher Education Leadership Initiative on Open Scholarship

Institutional change will take time

- What can we do on our own in the meantime?
- Two case studies:
  - 1: Changing norms around errors
  - 2: Building infrastructure for collaborative software development

Case study #1: Changing norms around errors

- No human enterprise is free from errors
  - E.g. professional software developers make 1-50 errors per 1000 lines of code
- Rather than viewing errors as a sign of incompetence, we should view them as teachable moments

Normalizing the discussion of errors

Wednesday, February 20, 2013

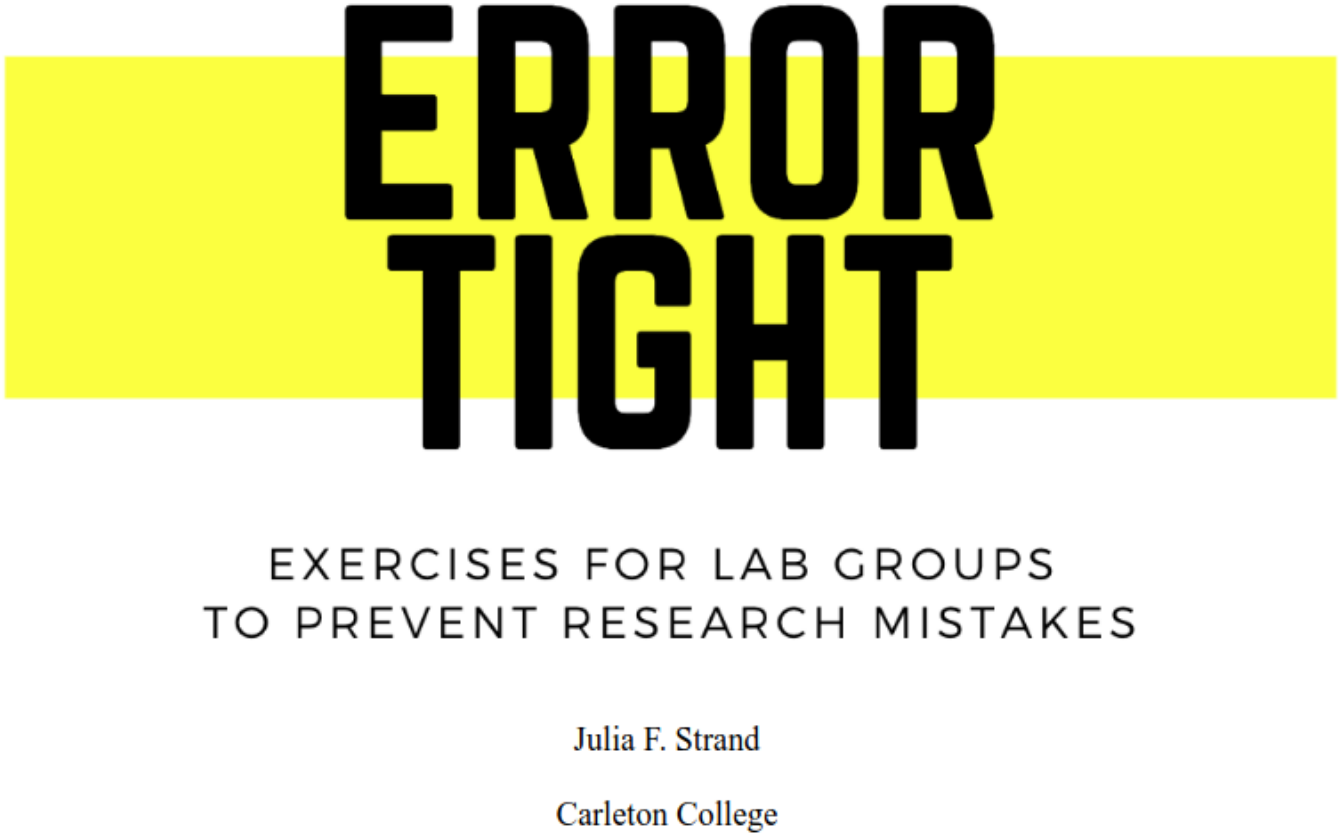
Anatomy of a coding error

A few days ago, one of the students who I collaborate with found a very serious mistake in some code that I had written. The code (which is openly available through my github repo) performed a classification analysis using the data from a number of studies from the openfmri project, and the results are included in a paper that is currently under review. None of us likes to admit mistakes, but it's clear that they happen often, and the only way to learn from them is to talk about them. This is why I strongly encourage my students to tell me about their mistakes and discuss them in our lab meeting. This particular mistake highlights several important points:

1. Sharing code is good, but only if someone else actually looks at it very closely.
2. You can't rely on tools to fail when you make a mistake.
3. Classifiers are very good at finding information, even if it's not the information you had in mind.

https://russpoldrack.blogspot.com/2013/02/anatomy-of-coding-error.html

Normalizing the discussion of errors



https://psyarxiv.com/rsn5y/

Errors as a teachable moment: The Morbidity and Mortality Conference as a model

- Aims to identify the root causes of poor outcomes or near-misses
- Focuses on the system, with no blame or finger-pointing

https://hawaiiresidency.org/ob-gyn-residency/morbidity-and-mortality-m-m

Finding and fixing errors early

New Results

Follow this preprint

Design issues and solutions for stop-signal data from the Adolescent Brain Cognitive Development [ABCD] study

Patrick G. Bissett, McKenzie P. Hagen, Henry M. Jones, Russell A. Poldrack

doi: https://doi.org/10.1101/2020.05.08.084707

Finding and fixing errors early

Coding error postmortem

August 10, 2020

We had posted a preprint describing some issues that we had identified with the stop-signal task in the ABCD Study, along with the code used for all of the analyses. The ABCD stop-signal team performed a detailed review our code and notified us of an error in the code that resulted in inaccurate estimation of one of the basic behavioral

Finding and fixing errors early

RESEARCH ARTICLE

Design issues and solutions for stop-signal data from the Adolescent Brain Cognitive Development (ABCD) study

Patrick G Bissett*, McKenzie P Hagen, Henry M Jones, Russell A Poldrack

Acknowledgements

We would like to thank Sage Hahn, Hugh Garavan, and their team for identifying an error in a previous version of our manuscript and code that resulted in an inflation in our stop-failure RT estimates.

Root cause analysis

1. Flawed code review process

- The person who initially reviewed the code focused on the analysis code, rather than the preprocessing code where the error occurred

2. Time pressure

- We were pushing to complete the work quickly, and our speed-accuracy tradeoff was not as focused on accuracy as it should have been

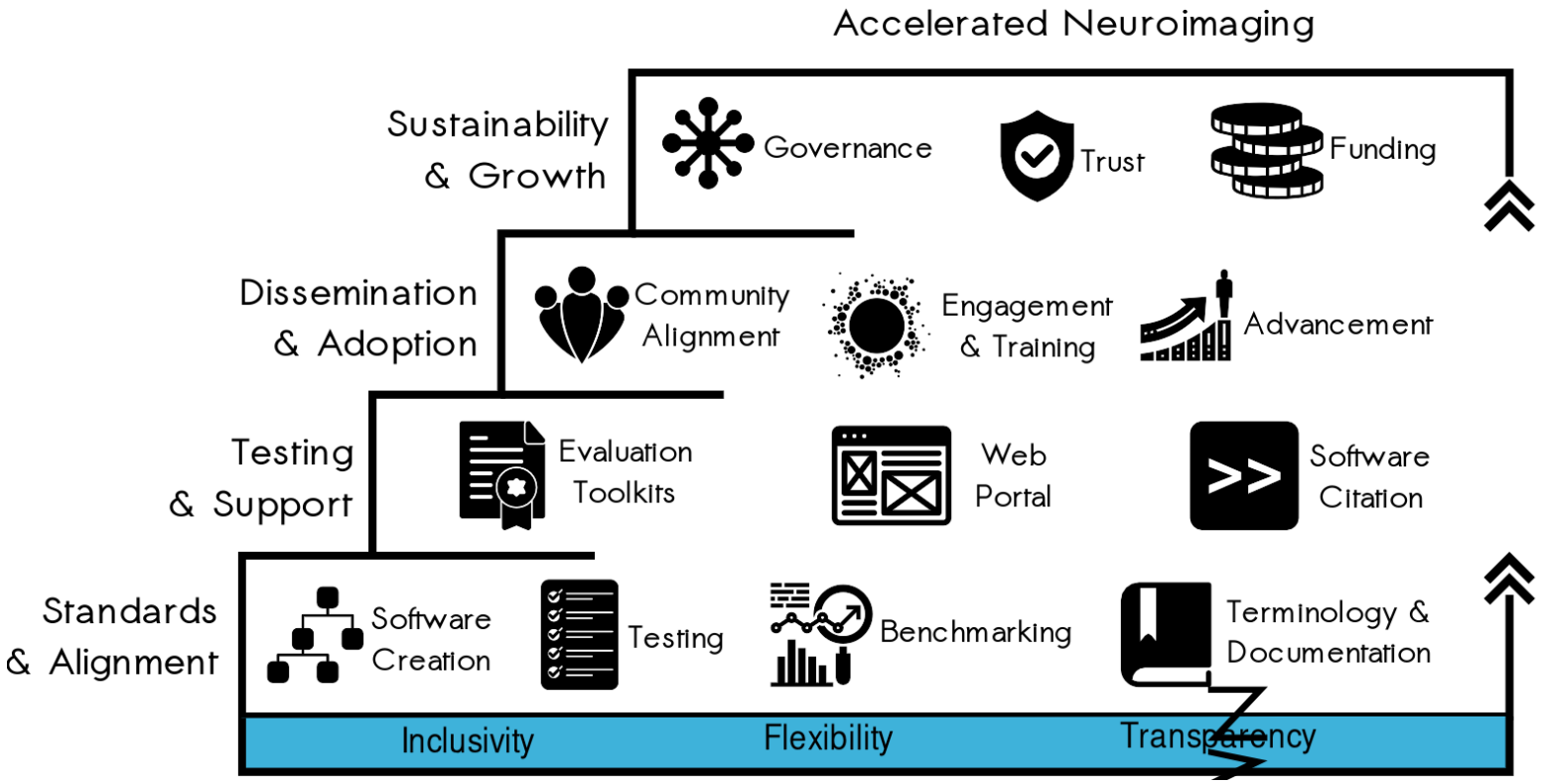
Case study #2: Infrastructure for collaboration across labs

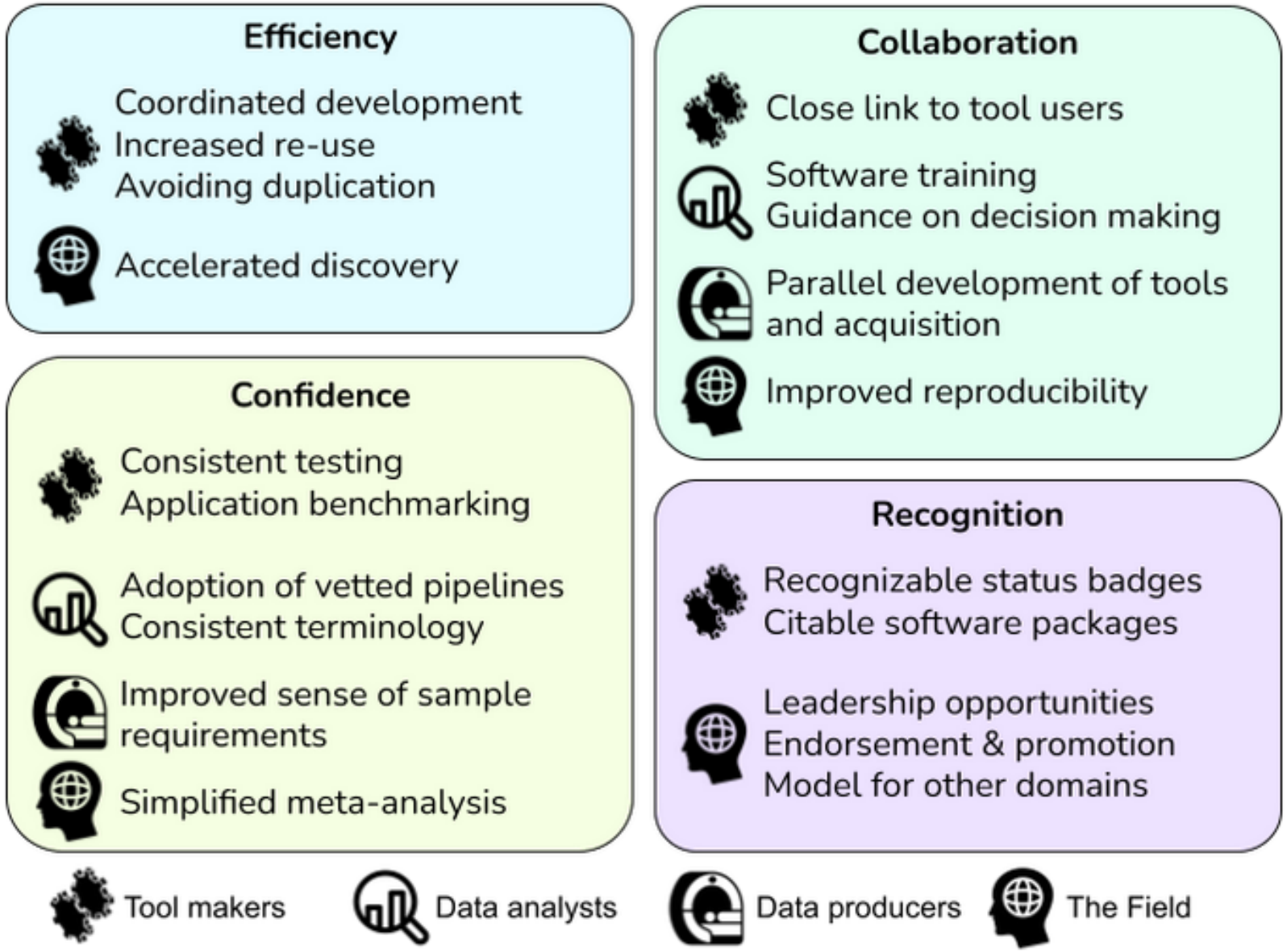
- There are many labs developing tools for neuroimaging analysis
  - Most of these groups write code to solve the same problem, duplicating effort
- We could reduce the wasted time and effort by working together

NMIND: Nevermind, this Method is Not Duplicated

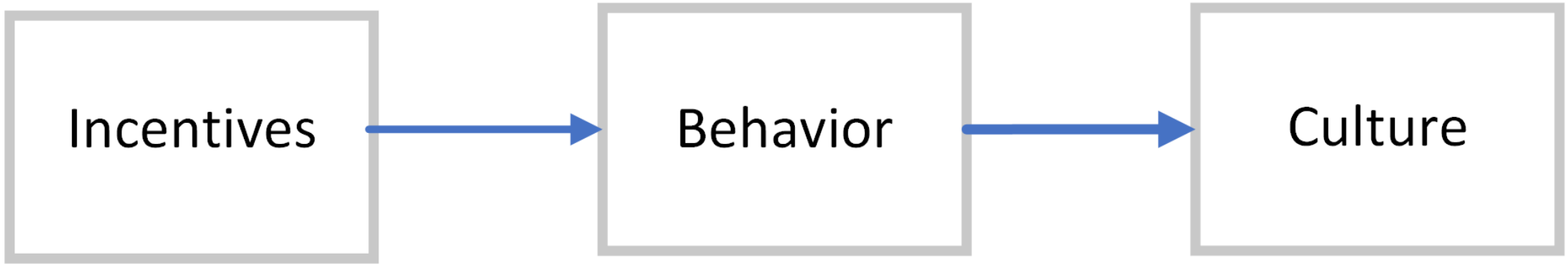







Efficiency
Coordinated development
Increased re-use
Avoiding duplication
Accelerated discovery
Collaboration
Close link to tool users
Software training
Guidance on decision making
Parallel development of tools and acquisition
Improved reproducibility
Confidence
Consistent testing
Application benchmarking
Adoption of vetted pipelines
Consistent terminology
Improved sense of sample requirements
Simplified meta-analysis
Recognition
Recognizable status badges
Citable software packages
Leadership opportunities
Endorsement & promotion
Model for other domains
Tool makers
Data analysts
Data producers
The Field

Conclusion



- We must all work to change the incentive structures of science
- We can all start now to establish the practices that will give rise to a culture of open and reproducible science

What are the norms that we want to encourage?

- Intellectual humility
- Community over competition
- Interpersonal respect and trust
- Openness and transparency