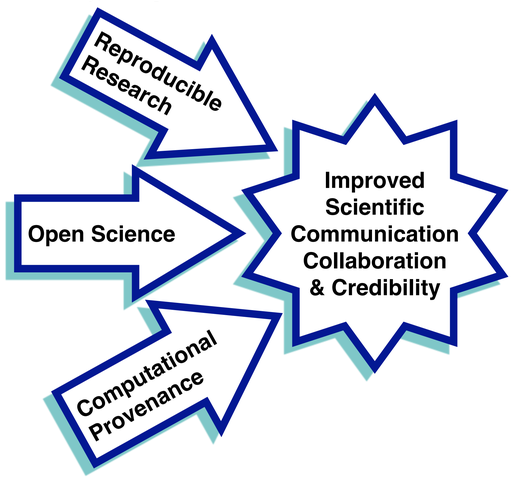
Identifying Communication Barriers to Scientific Collaboration

Credibility Problem

The lack of **availability of the majority of scientific artifacts reduces credibility and discourages collaboration**. To address this problem, some scientists have begun to advocate for computational provenance, reproducibility, and open science.



Little consensus currently exists the goals of an open science effort, and little understanding of the barriers. Hence, we need to understand the views of the key stakeholders - the scientists.

Research Questions

The goal of our research is to categorize the views of experimental scientists on the topics of reproducibility, credibility, scooping, data sharing, results sharing, and the effectiveness of the peer review process.

An **Experimental Scientist** is defined as a scientist who conducts experimental investigation of a testable hypothesis, in which conditions are set up to isolate the variables of interest and test how they affect certain measurable outcomes.

Study Design

The respondents came from the United States, Canada, the United Kingdom, and New Zealand, representing biology, life science, chemistry, medicine, physics, and psychology.

We collected the experimental scientists' views through a **qualitative questionnaire** of 20 free-form answers.

This qualitative methodology is well-suited for **exploratory investigation**, where a well-formed hypothesis is not present.

The use of free-form responses allowed for the respondents to express **their views in their own words**, which allowed the data to be analyzed in its purest form.

We analyzed the responses using **open and axial coding**.

Benefits of the Peer Review Process	
Paper Quality	**Journal Standard**
find errors improve language elements constructive criticism second eyes related work fact checking comments suggestions	weed out unimportant work minimize bad research maintain scientific merit reduce frequency of publication quality filter
Drawbacks of the Peer Review Process	
reviewer anonymity turn around time for submissions lack of discussion demand for new experiments competition lack of reviewer availability pushing trendy work suppressing innovation	

The table above illustrates the range in responses on the benefits and drawbacks of the peer review process. The benefits were divided into those that improve the quality of the paper and those that maintain the journal's standards.

Point in time scientists should make their data and results available:	
A.S.A.P.	
After Publication	
After Review	
Within Reason	

All respondents indicated that data and results should be freely shared with the public. Difference in views related to when this data should be shared. The table above shows this variation.

Legend	Number of Responses
	None
	A Few
	Some
	Several

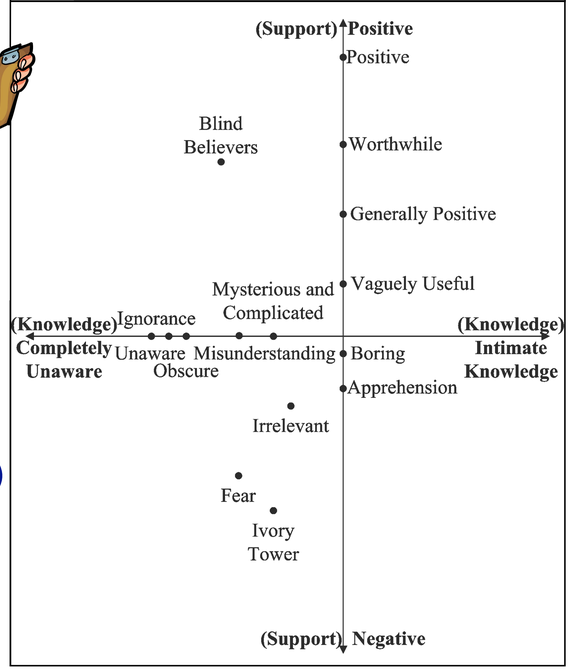
These results show the broad range of views among the respondents.

The figure on the right and table below show the respondents had diverse opinions on the general public's view of their work and the work of the scientific community. We did not see opinions of extensive public knowledge of science.

Percentage of experiments conducted in my field (are/should be) replicated.		
Percentages	**Are Replicated**	**Should be Replicated**
0 - 19%		
20 - 39%		
40 - 59%		
60 - 79%		
80 - 100%		

The table above shows that some respondents indicated that almost all experiments in their field are/should be replicated, and another group indicated that less than 60% are/should be replicated.

Axial coding of respondents answers to "How do you think the general public (non-scientists) views your particular field's research efforts?"



Axial coding of respondents answers to "How do you think the general public (non-scientists) views the efforts of the scientific community as a whole?"

	Positive	Negative
Engagement	awe, useful	caution, uninformed passion, unaware, boring, abstract, social misfits
Knowledge		unaware, uninformed, can't understand details
Subject Variability	medicine, cure, space, human impact	boring research, fruit flies
Support	positive, useful, important	bad, dangerous, mistrust, suspicious motives

Findings

Respondents' perceived:

- ☑ that the public was ignorant of most aspects of science;
- ☑ that public opinion of science varies depending on the field of science under discussion, with fields personally relevant to the public higher rated;
- ☑ that publications, raw data, and results should be available to everyone free of charge;

Our analysis showed that:

- ☑ the benefits of the peer review process could be divided into items that either improve the quality of the paper or maintain the standard of the journal;
- ☑ drawbacks of peer review were categorized as resulting from the process, resulting from reviewer anonymity, or occurring as a side effect of the benefits;
- ☑ opinions varied on what percentage of experiments should be replicated.

Future Work

We hope to explore four research paths:

- ☐ Understand the perceptions of the public on the credibility of scientific research and their interest in it.
  - ☐ How do you define good science?
  - ☐ How do you define credible science?
  - ☐ Which fields of science are favored, and why?
- ☐ Understand the interactions between stakeholders' goals (funders, publishers, academic institutions, governmental policy makers, scientists, and the general public) and how their goals will impact and be impacted by changes in science communication.
- ☐ Understand the differences between the groups of scientists (early adopters, trend followers, and skeptics) with respect to scientific communication.
- ☐ Understand how scientific culture varies by geographical region.

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