Big Science and Social Justice

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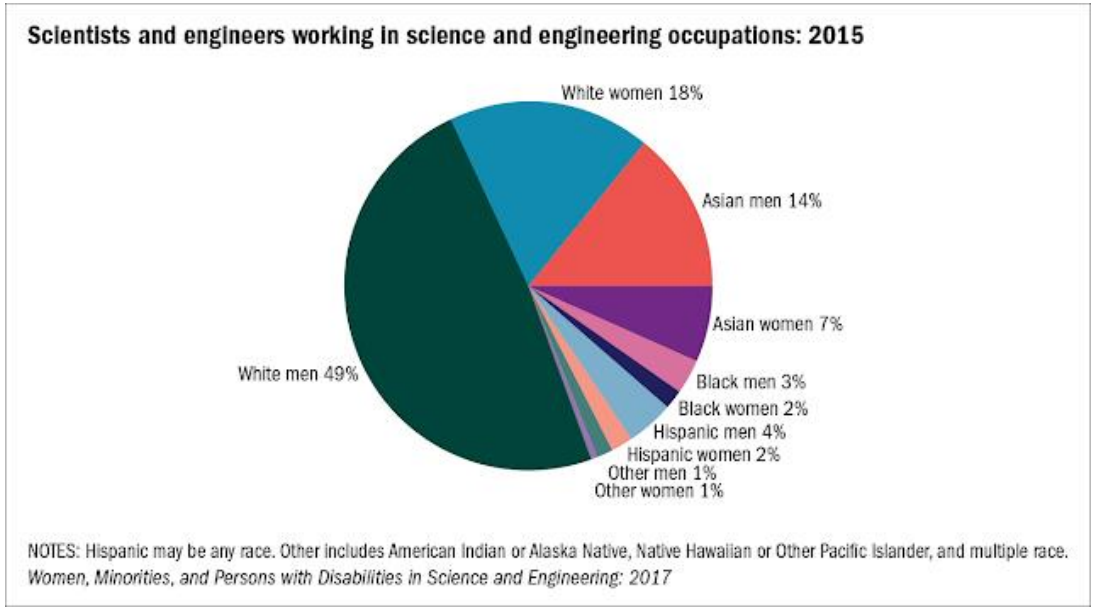
Perspectives on Big Science and the question of justice

Three loci of concern

1. Who gets to do big science
2. Who is impacted by big science
3. Funding big science & opportunity costs

1. Who gets to do big science

- Big science as "old boys' club"?



'Physics was built by men': Cern suspends scientist over remarks

Italian professor's presentation deemed 'unacceptable' by Geneva research centre

▲ A visitor centre at Cern, the European nuclear research in Geneva. Prof Alessandro Strumia said: 'Physics was invented and built by men, it's not by invitation.' Photograph: Cern

A senior Italian scientist has been suspended after he sparked fury during a presentation at Cern, the European nuclear research centre in Geneva, when he said physics was "invented and built by men, it's not by invitation".

Collaboration and Impact

- Why is it a problem if women are less welcome in big science?
- Higher number of collaborators, higher impact (citations)

The Increasing Dominance of Teams in Production of Knowledge

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META-RESEARCH ARTICLE

Differences in Collaboration Patterns across Discipline, Career Stage, and Gender

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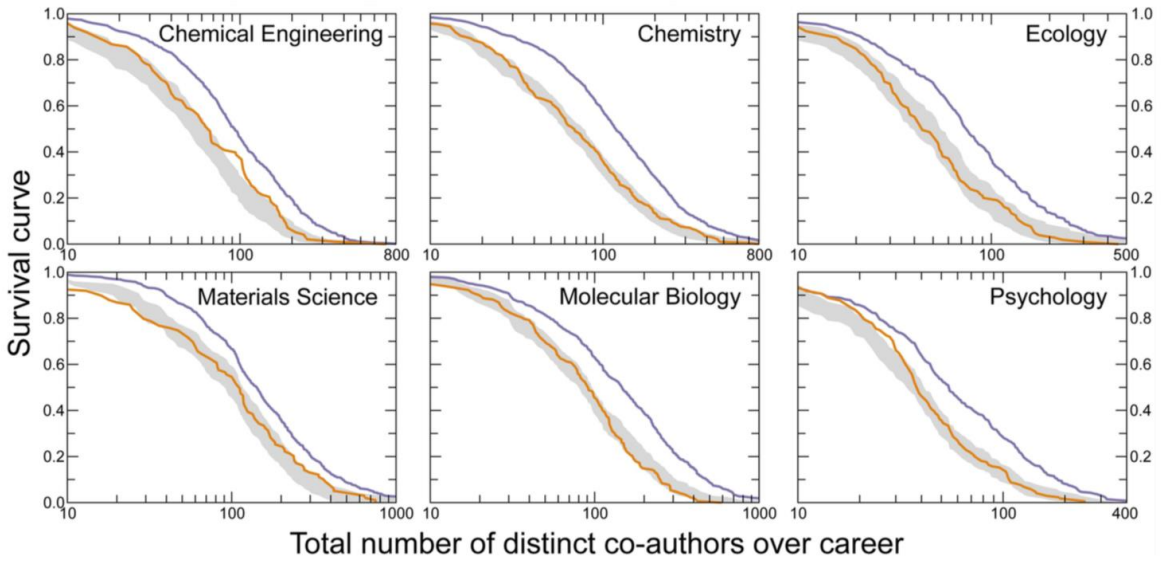


2. Who is impacted by big science

- Big science has a big footprint.
- Scientists are convinced of the value of these facilities.
  - To science
  - To society generally
- Concerns for impacted minorities goes unacknowledged.
  - Distribution of harms is crucial.
  - Overall benefits are not sufficient.
  - Must consider impacts on the least well-off!
  - Minimally, must get consent.

Mauna Kea's Astronomy Precinct

- 1970: First telescope (2.2 m) goes into service
- 1979: Three reflector telescopes added
- More added in 1980s, 1990s, 2000s
- By 2015, a total of 13 telescopes sat atop the mountain.

The significance of Mauna Kea

- Tallest mountain in Hawaii
- Telescopes situated at the peak
  - Best viewing conditions
- Sacred site for Native Hawaiians
  - Where the sky god met earth goddess, creating islands
  - Only chiefs are supposed to be on the peak
  - Also sacred burial sites, sacred lake on the mountain

Thirty Meter Telescope?

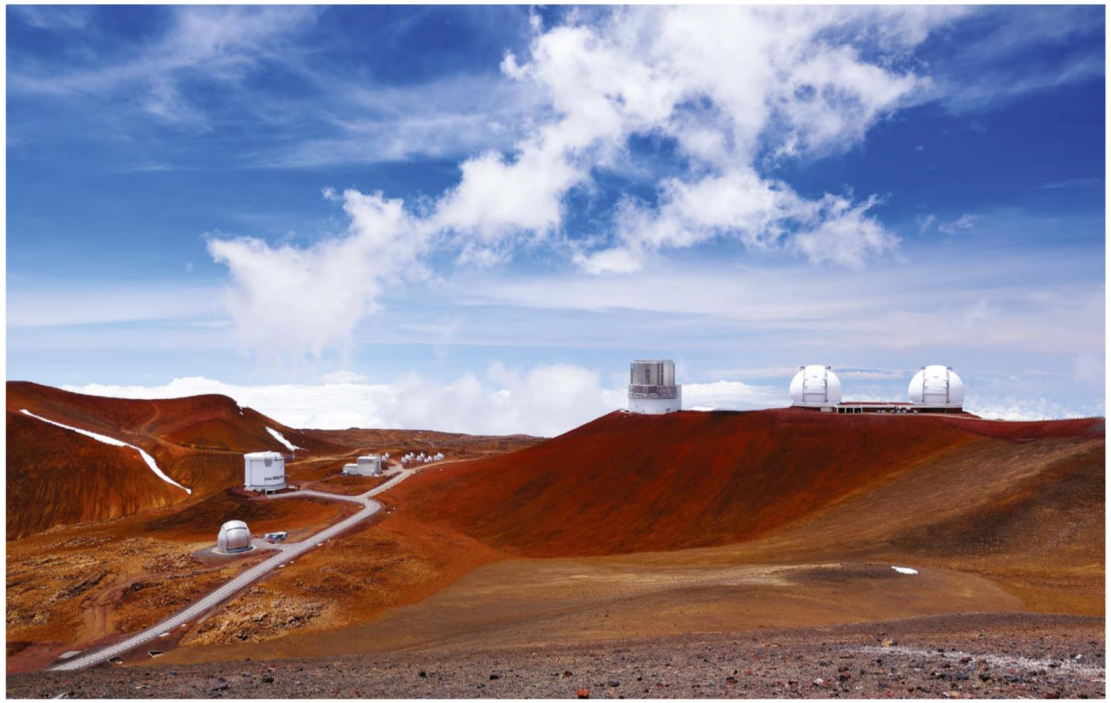
Proposed in 2009

US, Japan, India, China, Canada have pledged $1.4 billion.

Native Hawaiians say there are too many telescopes on the peak already.

Past promises that next telescope would be the last have been broken.

Fate of astronomy lease for the mountain uncertain (it expires in 2033)



GETTY

The summit of Mauna Kea in Hawaii already hosts 13 telescopes.

HOW THE FIGHT OVER A HAWAII MEGA-TELESCOPE COULD CHANGE ASTRONOMY

Thirty Meter Telescope controversy is forcing scientists to grapple with how their research affects Indigenous peoples.

A history of lack of respect

PUBLICATIONS OF THE
ASTRONOMICAL SOCIETY OF THE PACIFIC

Vol. 85 June 1973 No. 505

EVALUATION OF MAUNA KEA, HAWAII, AS AN OBSERVATORY SITE

D. MORRISON, R. E. MURPHY, D. P. CRUIKSHANK, W. M. SINTON, AND T. Z. MARTIN
Institute for Astronomy, University of Hawaii

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The Thirty Meter Telescope (TMT): An International Observatory

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A possible future?

- Native Hawaiians are open to renewing the lease.

- "But attitudes have to change. Astronomers look at us like we're the bad guys, like we're intruding in their space. It's quite the opposite: they're in our space." – Noe Noe Wong-Wilson (*Nature* 2020)

3. Funding & opportunity costs

- Resources from other big science
- Resources from more diverse, smaller research projects
- Resources from public-interest science
- Resources from other pressing societal problems

Opportunity costs within science

- Big science can monopolize shared equipment.
  - E.g., a suddenly well-funded SETI and time on radio-telescopes
  - *Breakthrough Listen* buying up 20-25% of time on some telescopes.
  - "It leaves less time to do astronomy"– Fernando Camilo, *Nature* 2020
- Big science can eat up funds from a wider array of smaller projects.
- Big science can draw attention and resources away from public-interest science.

Big science failure: The Mohole Project

Phase 1: 1958-1961, $1.8 million

Successful drilling in 2 mile deep ocean floor

601 Feet! But Mohorovicic discontinuity at 15,000 feet...

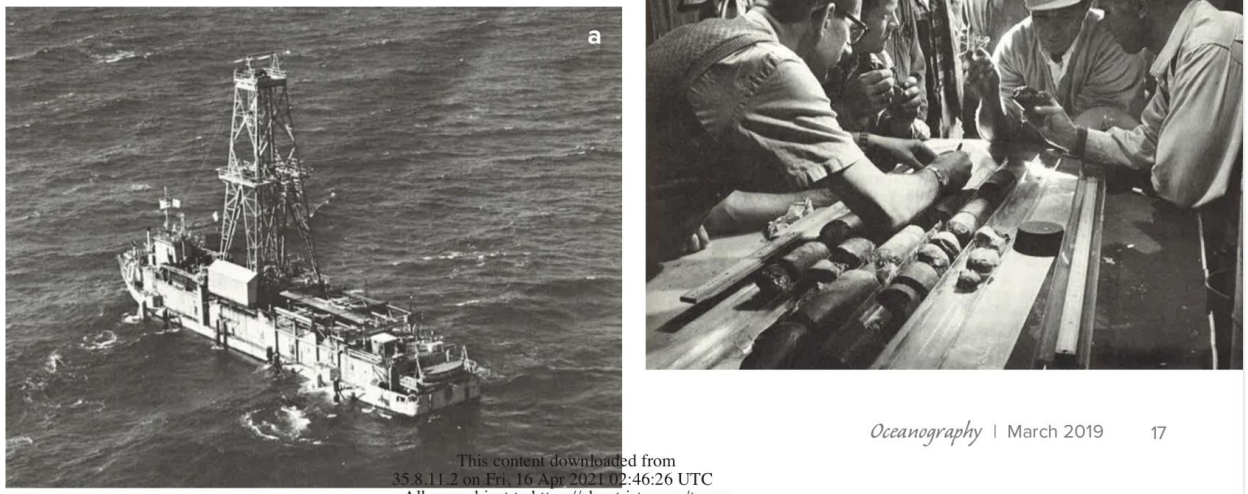
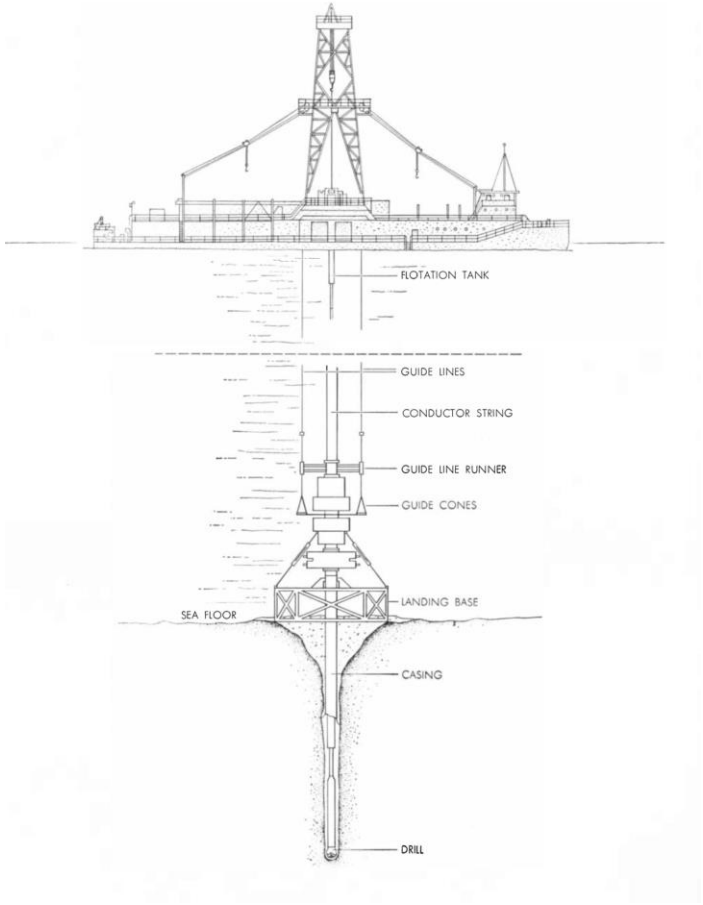


FIGURE 1. (a) The drilling vessel *CUSS I* as used during phase 1 of Project Mohole. (b) A first examination of cores onboard ship during Project Mohole. *Photographs from National Research Council (1961)*



The Mohole Fiasco

- Phase 2: 1961-1966
- Over $50 million spent (over $400 million in 2021 funds)
  - Estimated costs of success had risen over $100 million
- Nothing accomplished!
- Congress cancels project after key Congress booster dies.
  - Argument that the $20 million of 1966 appropriations could be better spent elsewhere by NSF
  - NSF budget total = $480 million in 1966

Recall funding & opportunity costs

- Resources from other big science
- Resources from more diverse, smaller research projects
- Resources from public-interest science

- Resources from other pressing societal problems
  - $400 million wasted is no small thing.

Conclusions

- Deciding which science to fund, and how much, is difficult.
  - There is lots of uncertainty (inherently) about what will pan out, and what won't.
  - A diversity of projects ameliorates this.
  - Big science can make such a diversity difficult to achieve.
  - Scientists are generally the biggest supporters of their own research.
- Big science can have big impacts.
  - It can be worth the investment. Is it, not just for scientists?
  - It must be respectful of the local communities it impacts.
- Big science needs to pay attention to distributional impacts.
  - It should not make the already less well off, worse off.