



Public Meeting of the  
President's Council of Advisors on Science and Technology (PCAST)

September 8, 2023

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## Meeting Minutes

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### MEETING PARTICIPANTS

#### PCAST MEMBERS

- |                              |                          |                       |
|------------------------------|--------------------------|-----------------------|
| 1. Frances Arnold, Co-Chair  | 11. Sue Desmond-Hellmann | 21. William Press     |
| 2. Arati Prabhakar, Co-Chair | 12. Inez Fung            | 22. Jennifer Richeson |
| 3. Maria T. Zuber, Co-Chair  | 13. Andrea Goldsmith     | 23. Vicki Sato        |
| 4. Dan E. Arvizu             | 14. Laura H. Greene      | 24. Lisa Su           |
| 5. Dennis Assanis            | 15. Paula Hammond        | 25. Kathryn Sullivan  |
| 6. John Banovetz             | 16. Eric Horvitz         | 26. Terence Tao       |
| 7. Frances Colón             | 17. Joe Kiani            | 27. Phil Venables     |
| 8. Lisa A. Cooper            | 18. Jon Levin            | 28. Catherine Woteki  |
| 9. John O. Dabiri            | 19. Steve Pacala         |                       |
| 10. William Dally            | 20. Saul Perlmutter      |                       |

#### PCAST STAFF

1. Lara Campbell, Executive Director
2. Reba Bandyopadhyay, Deputy Executive Director
3. Bich-Thuy (Twee) Sim, Assistant Director for Transformative Medicine and Health Innovation
4. Kimberly Lawrence, Administrative Assistant

#### INVITED SPEAKERS (IN ORDER OF PRESENTATION)

1. Raj Chetty, William A. Ackman Professor of Economics and Director of Opportunity Insights at Harvard University
2. Josh Tucker, Professor of Politics, affiliated Professor of Russian and Slavic Studies, affiliated Professor of Data Science, Director of the Jordan Center for Advanced Study of Russia, Co-Founder and Co-Director of the Center for Social Media and Politics at New York University

3. Katy Milkman, James G. Dinan Professor and Co-Director of the Behavior Change for Good Initiative at the Wharton School of The University of Pennsylvania

**START DATE AND TIME:** FRIDAY, SEPTEMBER 8, 2023, 11:10 A.M. EASTERN TIME

**LOCATION:** Virtual Meeting via Zoom.gov

## **WELCOME**

**PCAST Co-chairs: Frances Arnold, Arati Prabhakar, Maria Zuber**

The PCAST co-chairs—Frances Arnold, California Institute of Technology; Arati Prabhakar, Assistant to the President for Science and Technology; and Maria Zuber, Massachusetts Institute of Technology—called the meeting to order.

## **SESSION: RECENT ADVANCES IN THE SOCIAL SCIENCES**

Prabhakar noted this is an opportune time to examine recent advances in the social sciences because the hard problems that we are contending with in the world are almost always at their root about humans, institutions, and organizations, how they behave and what their incentives are. In addition, the social sciences are changing in potentially powerful ways that will help solve some of these hard problems.

### **RAJ CHETTY, HARVARD UNIVERSITY**

Chetty discussed how large-scale data and new methods of analyzing those data are transforming the ability to answer important economic and social policy questions. For example, plotting data on the percentage of children earning more than their parents versus birth year shows that 92 percent of children born in the middle of the 20th century earned more than their parents did, an embodiment of the American dream. Since then, the idea of attaining the American dream has faded so that only 50 percent of children born in 1980 earned more than their parents did.

Chetty said this simple analysis reflects a fundamental change in the American economy worth studying, in part because this trend underlies much of the frustration that many Americans are expressing regarding the inability to get ahead even through hard work. This analysis also raises several questions of scientific interest: What is driving this trend? What are the drivers of economic opportunity? What can the nation do to give children, particularly those from lower-income and disadvantaged backgrounds, a better chance of realizing the American dream?

In the past, said Chetty, economists reviewing these data would identify a list of changes over the past 50 years that might explain this trend, with little chance of testing the different plausible theories. Recently, much larger-scale data has become available, allowing economists to take a more microscopic approach to testing hypotheses. For example, Chetty and his colleagues constructed a map of upward mobility using data from 20 million children and their parents obtained from anonymized tax returns covering the entire U.S. population. As a measure of upward mobility, they used data on average household income at age

35 for children in 740 metro and rural areas who grew up in families earning approximately \$27,000 a year or less.

Chetty said the resulting map revealed tremendous variation geographically in children's chances of rising up in the United States. Children from low-income families growing up in much of the center of the country, for example, had a good chance of reaching the middle class or beyond, while children growing up in the U.S. southeast were more likely to be less well off than their parents. A more detailed analysis using additional data from Facebook and other sources revealed that locality has causal effects on upward mobility, with factors such as social capital and who one is connected to being key predictors of differences in economic mobility, access to high-quality education, and income inequality in an area.

Motivated by these findings, Chetty and his collaborators focused on three types of policy approaches to increasing upward mobility: reducing segregation by helping low-income families move to high-opportunity areas, making place-based investments to increase upward mobility in low-opportunity areas, and improving higher education to amplify its impact on upward mobility. Illustrating the first policy approach, analysis of the Seattle metro area revealed tremendous variation across neighborhoods in children's chances of earning more than their parents. One surprising pattern was that families receiving \$1,500 per month in rental assistance were concentrated in neighborhoods where children were more likely to earn less than their parents.

After becoming aware of this pattern, Chetty explained, Seattle and King County housing authorities designed a randomized trial to help families with housing vouchers move to higher opportunity neighborhoods by providing customized counseling, connections to landlords, and liquidity. The results were dramatic: 55 percent of families in the treatment group moved to high-opportunity places, compared to only 14 percent of families in the control group. Chetty estimated that children from the families in the treatment group would earn approximately \$200,000 more over their lifetime compared to those in the control group. Armed with these results, in 2018 Congress passed the Housing Choice Voucher Mobility Demonstration Act with bipartisan support to expand this program to nine other cities across the nation. Congress, again with bipartisan support, is now considering the Family Stability and Opportunity Vouchers Act that would expand the housing voucher program by \$5 billion a year.

Chetty said these issues matter, not only from the perspective of justice, fairness, and achieving the American dream, but also from the more practical perspective of trying to keep America at the frontier of economic growth and innovation. A different analysis he conducted looked at patent rates versus parental income, revealing that children with parents in the top 1 percent of income distributions were 10 times more likely to become an inventor than children with parents with earnings below the median U.S. income distribution. From this analysis, he estimated that if women, minorities, and children from low-income families were to become inventors at the same rate as high-income White men, the innovation rate in America would quadruple.

#### **JOSH TUCKER, NEW YORK UNIVERSITY**

Tucker said the focus of his social science research is studying the relationship between social media and politics. Research of this type aims to understand how social media affects political polarization, participation in politics, and confidence in democratic institutions. Other research examines if social media is creating filter bubbles that cause people to place themselves in echo chambers where they only

hear from people with similar views, the role social media plays in foreign influence campaigns, and online harms from social media. Social scientists are also studying how people identify the veracity of information in the new online environment and whether algorithms lead people to politically extreme ideological content when they were not searching for such content.

Tucker said political science has changed greatly from when he was a college student, a change driven by the massive increase in computing power that enables analysis of enormous troves of “digital trace data.” Digital trace data refers to the digital traces people leave behind through their daily interactions with the world. Tucker is interested in digital trace data associated with social media and linking those data with surveys, administrative data, and text and image data. The advent of text and images as data gives rise to methods such as machine learning and the large artificial intelligence-powered language models and chatbots.

Tucker discussed work showing that contrary to popular belief, hate speech did not increase steadily throughout the 2016 election campaign. Rather, data from over 1.2 billion tweets from 2015 to 2017 found that hate speech was “bursty”—it increased significantly in reaction to specific events, and then returned to baseline levels. Another commonly held belief is that when someone comes across information they are not sure is correct, they should then search for additional information that may confirm or debunk the initial information. However, Tucker and his collaborators found that searching for information online makes people more likely to believe that false news is true.

In a third example of modern political science research showing that conventional wisdom was wrong, to examine the assertion that YouTube algorithms are driving users towards extremist content, Tucker and his collaborators developed a method for creating a “digital footprint” of a YouTube traversal when following the recommendation algorithm. Using large datasets from Reddit combined with links to YouTube videos, they estimated the ideological placement of a video and then used human volunteers to show that so-called “rabbit holes” are rare. This finding does not mean that worrying about extremist content on YouTube is unwarranted. Rather, it suggests that focusing on algorithms may be misguided, that it would be more effective to focus on questions such as how YouTube serves as a repository for extremist content that people actively trying to radicalize others can use.

There are challenges to using 21<sup>st</sup> century social science to answer questions about social media, politics, and society, said Tucker. One challenge is that while conducting research in a lab-based format yields extreme efficiency gains, the funding structures to enable lab-based political science research are lacking. A second challenge is that private actors own the social media data needed for these analyses, leaving researchers who want access to the data at the whim of the social media platforms. Facilitating this research requires thinking about how to make these data more readily accessible.

#### **KATY MILKMAN, UNIVERSITY OF PENNSYLVANIA**

Milkman defined two types of social science tools for addressing policy challenges. Economic insights are used to address policy challenges by changing tangible costs and benefits, such as increasing fines to get people to pay their taxes on time. Behavioral insights do not change those cost-benefit tradeoffs, but instead try to address psychological barriers to following through on an action or decision.

Milkman discussed one use of behavioral insights to address the policy challenge of encouraging people to save for retirement in a 401(k) plan. The traditional approach provides paperwork that enables an employee to easily enroll in a company's 401(k) plan. However, research showed that what works better is to automatically enroll employees in the company retirement plan and allow them to opt out by checking a box on a form. This change increased enrollment by 76 percent by making participation the path of least resistance.

In another example, Milkman's team examined two approaches of notifying employees that their company would offer free flu shots. The standard approach provided information about when and where the flu shots would be available, while the experimental approach added a planning prompt to the notice—boxes in which the employee could write when they intended to get their flu shot. The second approach, said Milkman, increased vaccination rates by 12 percent.

Milkman said there is a thriving global industry of behavioral insights units trying to use these techniques to change behavior, primarily for the better and sometimes to increase profits. However, while a recent analysis of the United Kingdom's behavioral insights units found there were meaningful benefits, they were not large—about 8 percent—prompting Milkman to caution against getting too excited about their potential. At the same time, leveraging even small behavioral insights to promote policy goals proved to be cost effective on a benefit per dollar spent basis.

One challenge with using behavioral insights, said Milkman, is deciding which approach will be most useful. The gold standard for making that decision is to use traditional field experiments. Milkman's team uses a new methodology that enables testing many more ideas simultaneously in what she called mega studies. When a particular question arises, she solicits ideas from 160 scientists from diverse disciplines and tests them simultaneously against the same outcome. Her team has conducted mega studies to increase gym attendance, vaccinations, and the time students spent on an online math platform.

As an example, Milkman discussed a study conducted to determine how to encourage those who intended to get one of the COVID-19 vaccines to follow through at a higher rate. Her team ran two studies in the fall of 2020—one involving about 50,000 people with an upcoming well visit with a doctor, the other encouraging almost 700,000 Walmart pharmacy clients to come in for a vaccination—to inform messaging efforts via texting. Since this was before a COVID-19 vaccine was approved, the experiment used the flu vaccine, assuming the findings would be useful for the COVID-19 vaccine.

Milkman said the doctor's appointment study tested 19 text messaging strategies and found that 46 percent of those who received the most effective text message—a flu vaccine has been reserved for you—received the vaccine. Only 42 percent of the control group that did not receive a text message got their flu shot. This study also found that all the reminders produced some benefit, but those that used ownership language and more formal language were the most effective. Messages that used humor underperformed expectations.

The Walmart pharmacy experiment, which tested 22 text messaging strategies, produced similar results, said Milkman, with ownership messages being the most effective. Repeated reminders also proved useful. When the team tested messaging at the beginning of the COVID-19 vaccine rollout, ownership language again proved the most effective at increasing vaccine uptake. Today, nearly every pharmacy and many health systems are using "reserved for you" or "waiting for you" language when messaging patients.

Milkman discussed a more recent study examining how free rides and text reminders affected COVID-19 vaccination decisions. The good news was that simple reminders increased vaccination rates. However, there was no benefit of providing free rides even though her team, other experts, and laypeople predicted “A free ride to and from the pharmacy has been reserved for your booster appointment” would be the top performer. Prompting people to make a plan and suggesting a date and time were the most effective messaging strategies.

**ZUBER MODERATED THE Q&A AND DISCUSSION BETWEEN PCAST MEMBERS AND CHETTY, TUCKER, AND MILKMAN.**

#### **Public Comment**

No public comments were presented.

#### **CLOSING COMMENTS**

The co-chairs expressed appreciation to the speakers for their presentations.

**PUBLIC MEETING ADJOURNED: FRIDAY, SEPTEMBER 8, 2023, 12:46 P.M. EASTERN TIME**

#### **SUMMARY OF PREPARATORY MEETING**

During the preparatory (closed) sessions, PCAST heard brief updates from its sub-committees and discussed the next steps for those efforts.

#### **SUMMARY OF CLOSED MEETING**

On Wednesday, September 27, 2023, PCAST participated in a closed meeting with President Biden. The introductory remarks of that meeting were open to the press and can be viewed via the [PCAST meetings webpage](#) and [here](#). Subsequently, PCAST members discussed with President Biden the recently released Patient Safety report, and then focused on several areas in which AI is opening new frontiers for scientific research. They discussed how AI can be used to predict the probability of extreme weather events, how AI can be used to design new materials with transformative properties, and how AI can help us understand the origins of the universe.

I hereby certify that, to the best of my knowledge, the foregoing minutes are accurate and complete.

Frances Arnold, Ph.D.  
Co-Chair  
President's Council of Advisors on Science and Technology

Arati Prabhakar, Ph.D.  
Co-Chair  
President's Council of Advisors on Science and Technology

Maria Zuber, Ph.D.  
Co-Chair  
President's Council of Advisors on Science and Technology