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Need Public Policy for Human Gene Editing, Heatwaves, or Asteroids? Try Thinking Like a Citizen

In a ballroom at the Arizona Science Center one afternoon in 2017, more than 70 Phoenix residents—students, teachers, nurses, and retirees—gathered around tables to participate in a public forum about how cities can respond to extreme weather such as heat waves. Each table was covered in colorful printouts with a large laminated poster resembling a board game. Milling between the tables were decisionmakers from local government and the state. All were taking part in a deliberative process called participatory technology assessment, or pTA, designed to break down the walls between "experts" and citizens to gain insights into public policy dilemmas involving science, technology, and uncertainty.

Foreshadowing their varied viewpoints and experiences, participants prepared differently for the "extreme weather" of the heavily air conditioned ballroom, with some gripping cardigans around their shoulders while others were comfortable in tank tops. Extreme heat is something all the participants were familiar with—Phoenix is one of the hottest cities in the country—but not everyone understood the unequal way that heat and related deaths affect different parts of the Valley of the Sun. Though a handful of the participants might have called themselves environmentalists, most were not regular town-hall goers or political activists. Instead, they represented a diverse cross section of people in Phoenix. All had applied to attend—motivated by a small stipend, the opportunity to have their voice heard, or a bit of both.

Unlike typical town hall setups, where a few bold participants tend to dominate questioning and decisionmakers often respond by being defensive or vague, pTA gatherings are deliberately organized to encourage broad participation and conversation. To help people engage with the topic, the meeting was divided into subgroups to examine the story of Heattown, a fictionalized name for a real but anonymized community contending with the health, environmental, and economic impacts of heat waves. Then each group began a guided discussion of the different characters living in Heattown, vulnerabilities of the emergency-response and infrastructure systems, and strategies for dealing with those vulnerabilities.

Participants often refocused the conversation on the things they found important. At one table, a resident joined a discussion about strategies to lower heat by saying, "While it's nice [these strategies] lowered the temperature outside from 110 to 105, making sure the power grid is up.… That's gotta be the forefront I think." Another shared a personal memory of when their power went out. The conversation led to disagreements about what constitutes "long-term" resilience. Some felt that meant protecting the electrical grid, while others felt it meant making changes to the urban landscape, such as planting trees to provide shade. Some changed their minds during discussions—others did not. Importantly, participants had the opportunity to see other views from the standpoint of differing values rather than as "right" or "wrong." At the end of the exercise, opinions still varied and

the group exchanged good-humored teasing and laughter.

After taking a vote about their preferred heat-mitigation plan, the people at each table used laptops to explore plausible outcomes through maps and short newspaper articles about unintended consequences. A facilitator asked participants about their decision to plant trees to help combat higher temperatures associated with lots of concrete and asphalt. One participant remarked that the group needed to consider that some poorer communities might be left out of grant programs designed to incentivize tree planting. The participants at other tables expressed new worries, such as whether community plans for short-term heatwaves were capable of protecting people's lives and well-being through longer-term ones.

We have been conducting these pTA forums for the past 10 years, and many times diverse members of the public have brought up values and alternative options that were different from those prioritized by experts. As with the 30 forums we've previously conducted, this one was not aimed at creating a laundry list of actions for policymakers, nor was it aimed at achieving consensus among participants. Instead, it was designed to help participants express what they cared about and where their values aligned and diverged.

For decisionmakers, the process is valuable because it gives them a detailed map of citizen concerns and values. One official at a forum in Portland, Oregon, observed that it "created a situation where the focus was on the issues and the problems and not me and my work.… It shifted the focus of that engagement in a way that made it much more accessible for me, where I could listen, and ponder things without having to be in a reactionary mode." Another realized that she needed to do a better job of communicating water laws and regulations. And a third found it gratifying to see participants grapple with the same challenges and constraints he faced every day.

The forums in Phoenix and Portland resembled other pTA forums in that afterward experts and officials said they had revised their view of public engagement—from an obligatory formality to a dynamic process that can inform strategic decisions and planning. For example, in 2014 the National Aeronautics and Space Administration conducted a pTA forum about a proposed asteroid mission, where federal officials were surprised to find that the public independently desired a federal role in protecting Earth from asteroid collisions. These detailed citizen concerns fed into NASA's decision to create an office for coordinating planetary defense.

A tool for talking across and about S&T divides

Because pTA engages both citizens and policymakers in new ways that inform policy, we believe the Biden administration should embrace this process. The new administration has outlined ambitious initiatives for public action on the pandemic, climate change, and the stagnating connection between innovation and economic outcomes in communities around the country, issues that will require new levels of informed public guidance of policy. Further, pTA could provide a much-needed public platform for addressing complex questions about technologies' potential effects on people, livelihoods, and society's shared environments and institutions.

Echoing prior administrations, President Biden says he wants to leverage science and technology (S&T) to "benefit the nation's health, economic prosperity and national security." He is elevating the White House Office of Science and Technology Policy (OSTP) to a cabinet position, and nominating Eric Lander (MIT professor and founding director of the Broad Institute) as director and Alondra Nelson (president of the Social Science Research Council) as deputy director. In a January 2021 letter, he reaffirmed the close relationship between S&T and social and moral goals by saying that it was now time to "refresh and reinvigorate our national science and technology strategy…so that our children and grandchildren may inhabit a healthier, safer, more just, peaceful and prosperous world."

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This expansion in the OSTP's status—and the new administration's refreshing recognition that S&T questions are also public value questions—demands new ways to engage with the inescapable entanglement of S&T and society. While the nation has political institutions, such as Congress, designed to deliberate and decide in the context of conflicting public values, there are fewer developed mechanisms for contemplating and incorporating public values into decisions about science and society. It is here that pTA can provide a process for integrating the public's values with policy approaches on matters of public importance.

We propose the Biden administration create a government entity (or something similar) tasked with supporting federal government deliberations through pTA. This entity can be a laboratory for bringing inclusivity, deliberation, and transparency into decisionmaking.

A year into COVID, the nation cannot afford to ignore the dicey decisions inherent in managing pandemics—

not to mention climate change—as well as the history of injustices committed under the banner of science. Reinvigorating the relationship between citizens, science, and government won't be easy. The Biden administration can take a good first step by adopting strategies and processes that invite and take seriously the input of citizens usually left out of S&T decisionmaking and excluded from the prosperity of technological advances.

The deliberation before the deliberation

In contrast with other ways to gauge public feeling, such as open town halls, public opinion surveys, or the existing federal public comment process, pTA is designed to elicit good-faith discussion, shared understandings, and new ideas. This work is accomplished through a rigorous structure, requiring organizers to spend considerable energy engaging stakeholders before a forum, creating space for discussion during the forum, and allowing for reflection by decisionmakers afterward.

Over the past decade, pTA has evolved to meet the needs of numerous communities and institutions in the United States. Pioneered by the Danish Board of Technology as a tool for involving the public in decisionmaking, it was adopted throughout Europe and Britain in the late 1980s. In 2010, a group of US researchers, educators, and policy practitioners, including one of us (Farooque), began a systematic effort to integrate public dialogue with expert assessment on a variety of topics.

Long before participants gather, forum organizers work with stakeholders, subject-matter experts, and policymakers to define the issue, recognize nuances, and identify questions where public input could help sort through uncertainty or competing goals. Mapping questions, values, and perspectives in this way determines which materials and activities will be used at the forum. Forum organizers and stakeholders also work to identify communities that are not typically involved in public commentary or interest group politics as potential participants.

For topics unfamiliar to most of the public, or where stakeholders hold deeply entrenched views, organizers use small focus groups to explore how to approach the topic. For example, before a recent forum on solar geoengineering, organizers convened citizen focus groups and expert-stakeholder meetings to consider which options for research, funding, and governance would be incorporated into the larger forum. While experts framed the problem as one of choosing among different governance alternatives, some citizens expressed deep concerns about whether humans should "mess with mother nature" at all. From there, organizers put together an outline of potential uncertainties, questions, and trade-offs that avoided discounting some viewpoints expressed by the focus group attendees, including the "no geoengineering" option.

Working from these conversations, organizers proceed to develop educational content. Like the story about Heattown, used in Phoenix, these materials convey relevant information while also creating the space for discussion, disagreement, and value judgments. Maps and videos highlight scientific or technical knowledge that participants may want to consider. Some elements of the materials humanize trade-offs and uncertainties to help attendees work through complex issues without the use of reductive tools such as cost-benefit analysis.

Another aspect of pTA's deliberate process is recruitment. While anyone can apply, recruiters actively engage with communities that are often left out of policymaking. Forum organizers lower barriers to participation by compensating participants for their time with a small stipend and serving lunch. By the time they arrive at the forum, everyone has received an issue briefing so that they feel prepared to speak on both expert assessments and their own experiences.

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Throughout the forum, participants explore the materials and the issues in an effort to uncover new ideas. At the end of the forum, they vote as tables—revealing common ground and majority views—but they also write their private views, preserving diverse minority perspectives.

Unlike methods of consensus-finding that operate by aggregating or drowning out minority opinions and values, pTA's process elevates these perspectives in the decisionmaking process. Furthermore, pTA avoids the trap of treating policy questions as technical ones, which tends to elevate the voices of experts. Instead, pTA openly recognizes citizens, their lived experiences, and other forms of knowledge.

The pTA technique is particularly relevant for questions that require not only expert knowledge but also contain social, cultural, physical, and economic concerns. This is the type of question that the philosophers of science Silvio Funtowicz and Jerome Ravetz called "post-normal science,"

where "facts are uncertain, values in dispute, stakes high and decisions urgent." These cases require an extension of who counts as expert, because purely technical analysis will yield incomplete answers to what are inherently political questions. This in turn could lead to inequitable or undemocratic outcomes and frayed relations between scientific, public, and policy communities.

The nation faces an increasing number of postnormal science questions. Consider the pressing question that Phoenix residents were contemplating in their forum: what investments in energy, infrastructure, or social programs should be adopted to combat extreme heat? Such postnormal questions demand an appropriately thoughtful approach to the real values and competing concerns of society—one that pTA is uniquely positioned to provide.

PTA for a postnormal presidency

To integrate public input into federal science and technology policymaking, the Biden administration has several options. The president could issue an executive order asking science-based agencies to utilize pTA for policy decisions that occur in this postnormal zone. The administration could establish a federally funded research and development center to conduct pTA in concert with federal agencies. Or the OSTP could expand the function of an existing R&D center, the Science and Technology Policy Institute.

Another model of what might be possible can be found in the US Digital Service, formed in 2014 to provide the expertise and capacity to help agencies across the federal government provide digital services. A similar new office for pTA services could quickly collaborate with other agencies to design, conduct, and evaluate pTA activities in service of policymaking.

Lastly, pTA could be implemented as one-off pilot projects by individual agencies. Something similar can be found in today's Expert and Citizen Assessment of Science and Technology (ECAST) network. ECAST is a distributed network of universities, science museums, and nonpartisan think tanks that has worked on pTA projects sponsored by NASA, the National Oceanic and Atmospheric Administration, the Department of Energy, and the National Institutes of Health. However, this approach would not facilitate standardization or the sharing of best practices with agencies and across the government, and would be slowed by the process of navigating the legal and cultural structures of each agency.

Time to stand Asilomar on its head?

For too long, policymakers have simply relied on expertise and conceptions of scientific authority to make complex decisions. "Science," whatever that is taken to mean, does not advance action or achieve desirable public outcomes on its own. Citizens must be involved, offering their own expertise and understanding of public values to navigate pressing postnormal questions. Whether contemplating the new CRISPR gene-editing technology or the complications of climate change, the days when a team of scientists alone could retreat to an isolated spot to discuss complex sociotechnical issues—as some 150 scientists famously did at the Asilomar conference center in 1975 to review recombinant DNA research—should be long behind us.

Through pTA, the Biden administration can learn how to restore the public's trust and faith in government and policymaking by engaging with a critical group of experts—American citizens themselves. By elevating lived experiences alongside technical expertise, pTA creates the ground for trust between people who are experts in science and those who are experts in their own lives. It communicates an important message in the historical context of experts who have decided for themselves how to steer the future of technologies: Asilomar is over. As society moves toward making important public decisions on technologies new and old alike, establishing a commitment to real public input will be important to ensure that innovations serve the broader good.

Decisions at the intersection of science, technology, and society belong to topically diverse experts, decisionmakers, *and the public*, and pTA is one of the few tools that equitably recognizes and integrates each of those perspectives. At a time when decisionmakers are trying to balance scientific opinions with public ones, pTA can allow them to focus on the longer game of listening to the people who will be impacted by S&T, who will in turn shape S&T, and who can help better steer S&T toward equitable outcomes and broader public benefit. Integrating the pTA process at the federal level now can provide infrastructure for decades of complex policy choices to come.

President Biden, in his inaugural address, called on Americans to meet the nation's current moment of crisis through unity, humility, respect, and a sense of civic duty to strive toward the nation's ideals. If the administration is to deliver on this call to action, it will mean empowering citizens to boldly work through the challenges we face and uphold our democratic ideals.

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