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The 6th International Undergraduate Conference on Science, Technology, Medicine, and Society: The Interaction of Science, Technology, Medicine, and Politics

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Abstract
The Sixth International Undergraduate Research Conference on Science, Technology, Medicine, and Society (STMS): The Interaction of Science, Technology, Medicine, and Politics was held March 24-25, 2022. It was hosted by the University of Toronto's History and Philosophy of Science Undergraduate Society (HPSUS) and the Institute for History & Philosophy of Science (IHPST). Student submissions examining the interaction between politics and science, including science policy, science funding, politicization of science and scientization of politics, political influences on science, as well as other topics regarding the mutual influence between science and politics were invited. These issues have been at the forefront of our lives recently with the COVID-19 pandemic, climate change, and constant technological advances including artificial intelligence. The virtual conference included slideshows accompanied by oral presentations from presenters with diverse disciplinary backgrounds from fourteen universities across four countries. Presentations were divided into five sessions: Technology & Epistemology; Politics & Science; Medicine, Mental Health, & Society; Technology & Data; and Education & Healthcare. In addition to undergraduate presentations, a keynote on "Public Trust in Science" was presented by Dr. Maya Goldenberg and a panel on "Science Policy & Funding" was held. The full program can be found at: http://tiny.cc/stms2022program

Keywords: science and technology studies; history and philosophy of science; science policy; artificial intelligence ethics; technology and medicine; education and healthcare; science and politics; healthcare policy; epistemology

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Conference Abstracts
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Technology & Epistemology

The clinical encounter: Implications of assistance by artificial intelligence
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The introduction of artificial intelligence (AI) within clinical decision making inherits unresolved issues from the evidence-based medicine (EBM) movement. While some clinical tasks benefit from being outsourced to statistical reasoning of AI, the epistemological problem of "evidence" and its logical positivist underpinnings remain. In this paper, I will provide an overview of the evolution of clinical decision making from paternalism to EBM, and extend the feminist critique of logical positivism within medicine. By responding to the concerns of EBM with the solution of combining human and artificial intelligence into hybrid intelligence, the problem of underdetermination is not sufficiently addressed. I point out a set of parallels between EBM and AI to explore how critical attitudes towards value-laden science are harmful and paint not only an impractical view of medicine, but an undesirable one. I investigate how the involvement of AI can reduce patient autonomy, highlight the limits of imperfect data sets, and introduce its own set of unique biases.

Smelling the Covfefe: Mapping discursive ecologies and user responses to maximalist moderation approaches in alt-right Reddit communities
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In recent years, social news aggregation site Reddit has gained increasing notoriety as an originator-incubator of digital hate and misinformation; importantly, however, so too has it been at the vanguard of experimentation in content moderation techniques. Following a period of imposed 'quarantine', for example, on 29th June 2020 platform administrators took the unprecedented decision to permanently bar all access to the r/The_Donald subforum, in response to its userbase's consistent violation of the platform's code of conduct. Taking r/The_Donald as a case-study, this research, which was funded by the Laidlaw Foundation, poses two novel contributions to the literature on technologically-mediated political discourse. Firstly, using large-n methods of computational analysis, it provides quantitative confirmation of ethnographically-derived observations regarding alt-right internet communities' linguistic mores. r/The_Donald users, for example, are found overwhelmingly to eschew traditional racial slurs in favour of a novel vocabulary derived from the mockery of minority vernaculars. It also finds that these pejoratives spread rapidly across subreddits, but often fall into obscurity with similar speed. This has clear implications for automated methods of abuse-detection. By charting normalized user base overlap, this research also identifies a nexus of interlinked racist, misogynistic and conspiratorial subreddits, and considers how Reddit's affordances contribute to the development of these. Secondly, this paper presents a methodology for assessing the efficacy of maximalist content moderation strategies, taking the r/The_Donald ban as a natural experiment. As such, it contributes a way through which Chandrasekharan et al. (2017)'s question of whether bans stifle or merely displace problematic speech can be addressed.

"Data does not lie": Chicago's ShotSpotter contract
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The ShotSpotter company claims that its audio-based gunshot detection technology is "100% reliable and based entirely on the facts and science." And yet, independent audits highlight ShotSpotter systems' tendency to misclassify fireworks as gunfire. Still, Chicago continues to pay the company more than 8.5 million dollars a year for its services. The city's contract with the company reflects beliefs that data is truth and algorithms are objective. These assumptions obscure ShotSpotter's financial motivation to overstate its system's capabilities, as well as the capacity for the police's implementation of the technology to perpetuate patterns of structural racism. A trust in ShotSpotter's misleading statistics is shown through the contract's failure to place requirements on the system's classification accuracy. Further, the absence of independent testing

and data verification mechanisms have reinforced beliefs in the AI-driven system's effectiveness. The contract's incomplete requirements have enabled it to be quietly renewed without City Council approval. As a result, Chicago's unwarranted trust in ShotSpotter's systems and statistics have funneled police into surveilled Black and Brown communities.

Non-propositional knowledge in scientific theories
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This paper attempts to provide a clear and rigorous comparison and analysis of the different types of knowledge inherent in scientific theories, before determining the relative utility of each in describing the process of scientific change. I begin with a survey of the existing philosophical literature including Gilbert Ryle's knowledge-how/knowledge-that dichotomy and the distinction popularized by Michael Polanyi between tacit knowledge and explicit knowledge. In all, the six main terms I discuss are: knowledge-how, knowledge-that, tacit knowledge, explicit knowledge, non-propositional knowledge, and propositional knowledge. In comparing and contrasting these concepts, I attempt to clarify definitions and remove ambiguity. After clarifying the differences and similarities between the terms and addressing the ambiguities that result, I investigate the role each concept plays in the acceptance and rejection of scientific theories. Finally, I discuss the necessity and importance of each when working to trace the process of scientific change.

Politics and Science

Science against domination: A normative frame for political philosophy of science
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Political philosophy of science answers to what Kitcher (2011) called "the central question for the general philosophy of science", namely, how to understand the relation between science and society. Approaches under this label vary, but they include general normative accounts, such as Kitcher's own well-ordered science (2001). Adding to this last set of positions, I will propose, inspired by the political scientist and theorist Ian Shapiro (2017), a minimalist account of what should be expected of science's relation to society. I will defend that science ought to keep itself to the requirement of battling and preventing domination (resembling Shapiro's minimal account of the role of democracy). I will first start by arguing the heuristic desirability of general normative accounts from the point of view of policy, where this kind of conceptual tool might help deliberation. Then, I will posit two arguments that make such a minimal account desirable. First, illustrating how the wicked nature of the issue invites a simplification of the problem to take hold of common ground that might promote widespread (if reluctant) agreement, agreement that more substantive accounts might not achieve. The second argument will be from the issue of outcomes versus processes. This corresponds to the problem concerning whether the relation between science and society should focus on the integrity of the processes or on attaining desired outcomes. I will propose that the 'reactive' nature of the against domination ideal marries the inclusion of both desired ends and democratic processes.

Sloppy science's impact on the COVID-19 pandemic
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The ability to properly mitigate COVID-19 cases is undermined when science is "sloppy". Sloppy science is a form of carelessness, characterized by using scientific shortcuts and a lack of questioning assumptions. When scientism (the belief that all that is labeled as "science" is good) combines with sloppy science, these shortcuts can carry over into policy and decision making. COVID-19 demonstrated that good science seldom comes from taking shortcuts. Politicians, scientists, and media were often misled by many instances of sloppy science and scientism encountered as the world dealt with the unfolding of the COVID-19 pandemic. The result of these poor decisions was bad decisions concerning transmission mitigations with huge costs of rising caseloads and hospital admissions. By contrast good science demands that we continually ask how we got to an answer, and what we can do to replicate that process. We should base further inquiry on the assumptions, contexts, and constraints of that process to yield usable data and avoid misleading others. This paper uses the

COVID-19 pandemic to describe the relationship between sloppy science and the actions that result from such negligence – as well as what can be done to prevent such mistakes from happening in the future.

Politicization of science during the pandemic
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The politicization of science during the COVID-19 pandemic has sowed much discord among people worldwide. When the Emergency Act was enacted to fast-track trials for the COVID-19 vaccine in Canada, many recall the infamous 1976 swine flu outbreak where US President Gerald Ford's fast-tracked approval for a vaccine that was later associated with increased reports of the Guillain-Barré Syndrome which caused paralysis and possible death. Most recently, after the Johnson & Johnson and AstraZeneca vaccinations were granted emergency authorization use, they were soon pulled due to rare clotting cases, which increased government mistrust around mass vaccination policies that skip clinical trials. Many protestors labeled as fanatical anti-vaxxers do not actually oppose vaccination or science but rather, the authoritarian government vaccine mandates and restrictions that are unscientific and ineffectual. This past January, thousands of people around the world protested the decision of the Australian government to revoke the visa of unvaccinated tennis player Novak Djokovic which, according to the Immigration Minister, was to quell anti-vaccine sentiments, not about the concern of COVID transmission. Further, the Ontario provincial government failed to inspire confidence among vaccine-hesitant individuals when Deputy Premier, Christine Elliot urged the College of Physicians to investigate licenses of doctors expressing concern about myocarditis and COVID vaccination in young children. This statement threatens to silence discourse and discussion in the medical community over medical treatment which is essential in the development of science.

Modern Western medicine and traditional Chinese medicine: Values underlying their incompatibility
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The purported feasibility of the coexistence of modern Western medicine and traditional Chinese medicine (TCM) has been the topic of heated debate. I argue that, in fact, this coexistence is unattainable due to the conflicting values shaping the two medical systems. The existing arguments of both proponents and challengers of integrative healthcare are presented, as well as the discussion on randomized controlled trials as the chosen standard of evidence in Western medicine. I construct three premises that support the separation of modern Western medicine and TCM. The premises are summarized as follows: each medical framework is profoundly governed by its unique values, these values affect the type of evidence used to generate scientific explanations, and these explanations lead to conflicting treatments. This discussion on the feasibility of integration of modern Western medicine and TCM is pertinent, as it powerfully informs state budgets and policies on where to spend resources allocated to healthcare. Moreover, this topic contributes to a larger debate on the said superiority of Western scientific protocols and whether this status is merited within the context of medicine. This paper questions the ideal for equal contributions to the discovery of medical truth by practitioners of alternative modes of medicine and by the nominally deemed medical "experts" of the modern Western world.

Medicine, Mental Health & Society

Self-diagnosing sadness: On the over-medicalization of depression in the pandemic
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According to sources such as the CDC, we've seen a rise in mental illness during the pandemic. Should we take these reports at face value? There is reason to worry that techniques used in research are invalid since they require self-reporting. A worrisome consequence is that normal emotional responses to the pandemic like sadness are being medicalized. I argue that people cannot accurately conduct psychological self-examinations because they often don't have access to unconscious emotions. This means they cannot precisely answer survey questions used in mental health research. Moreover, the language used on surveys, whether exceedingly complex or simplistic, can mislead subjects and generate inaccurate results. A potential response is that some survey questions are simple enough and don't require deep self-knowledge. If true, this raises other

issues. Overly simplistic questions aren't enough to hone in on the unified phenomenon in the mind behind a diagnosis. Perhaps one could hold that mental illnesses aren't diagnosed by finding unified phenomena, rather by using clusters of symptoms. However, such nosologies have poor construct validity. Importantly, they tend to allow clusters of largely heterogeneous symptoms to fall under the same diagnosis. It is crucial to consider the reliability of survey-based techniques because governments need more accurate ways to track societal psychological well-being. Better strategies could strengthen policies for tackling post-pandemic mental illness.

A small nation in the big world of science: Singapore's attempt to draw the line between the modernization and westernization of science and technological development

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As nations rush to successfully compete in the global economic market, specifically through scientific and technological development, the lines between modernization and westernization become harder to distinguish. Singapore, an emerging technological hub, has shown rapid developmental growth since the 1970s, investing in medical, engineering and technology industries while attempting to maintain its Singaporean cultural and moral values. However, criticisms that it has become "too western" or that it will never reach the status of a western nation have arisen. Oftentimes, the struggle to become a viable competitor on the world stage can lead to an identity dilemma, and while some Asian nations such as Japan pride themselves in their eastern approach to science and technological progress, Singapore works to invest in education that will allow its scientists and engineers to competitively make their mark in western science (the dominant model and approach today) while maintaining Asian cultural values and morals, and priding themselves in multiculturalism. Can a nation truly maintain its cultural and national identity while modernizing, and is Singapore's model effective? How do science and technology become a part of Asian identity and a matter of heart? A look into how education is used to enhance nation building and identity and how orientalism and occidentalism are recursively used in political rhetoric will allow us to further analyze these questions.

Headspace and health for whom?: A story of mindfulness

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The COVID-19 pandemic not only brought viral threats to our physical health but also posed unprecedented challenges to our mental health. Often having to stay at home or 6 feet away from others, people were scrambling to find new means of maintaining their mental well-being amid all the unique challenges brought by the pandemic. At a time when coming in close contact with other human beings signified possible exposure to a deadly virus, many aspects of our previous lives quickly underwent a digital transformation, and mindfulness was no exception. Smartphone applications that supposedly help people learn various coping techniques for anxiety and depression, talk to therapists, relieve stress, keep mood journals, and meditate have flourished in the past two years. For my undergraduate senior thesis project, I am writing a story of mindfulness comprising of two parts: a Foucaldian genealogy of mindfulness (Part I) and a case study of Headspace, a popular mobile application for guided meditation and mindfulness (Part II). In Part I, I am investigating how discourses around mindfulness emerged and shaped the practice, leading to the arrival of this originally Buddhist tradition in Silicon Valley. In Part II, I am conducting a case study of Headspace using a Science and Technology Studies (STS) methodology called the Walkthrough Method, to analyze how the Headspace app reflects and further reinforces our present conception of mindfulness. Through telling a story of mindfulness at this particular moment, I attempt to unravel who digitized mindfulness is for.

COVID-19 and the generation of novel scientific knowledge: Research questions, study designs, evidence-based decisions and data sharing

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Rationale, aims and objectives: One of the sectors challenged by the COVID-19 pandemic is medical research. COVID-19 originates from a novel coronavirus (SARS- CoV-2) and the scientific community is faced with the daunting task of creating a novel model for this pandemic or, in other words, creating novel science. This series of articles explore the intricate

relationship between the different challenges that have hindered biomedical research and the generation of novel scientific knowledge during the COVID-19 pandemic. Methods: During the early stages of the pandemic, research conducted on hydroxychloroquine (HCQ) sparked several heated debates with respect to the scientific methods used and the quality of knowledge generated. Research on HCQ is used as a case study in the papers. The authors explored biomedical databases, peer-reviewed journals, preprint servers and media articles to identify relevant literature on HCQ and COVID-19, and examined philosophical perspectives on medical research in the context of this pandemic and previous global health challenges. Results: These papers demonstrate that a lack of research prioritization and methodological rigour resulted in the generation of fleeting and inconsistent evidence that complicated the development of public health guidelines. The reporting of scientific findings to the scientific community and general public highlighted the difficulty of finding a balance between accuracy and speed. Conclusions: The COVID-19 pandemic presented challenges in terms of (1) finding and prioritizing relevant research questions, (2) choosing study designs that are appropriate for a time of emergency, (3) evaluating evidence for the purpose of making evidence-based decisions and (4) sharing scientific findings with the rest of the scientific community. These four challenges have often compounded each other and have contributed to slowing down the creation of novel scientific knowledge during the COVID-19 pandemic.

Technology & Data

Alexa: A product of its users and Amazon

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Millions of people use Amazon's virtual assistant, Alexa, and it is no surprise why. The device, among other capabilities, can provide cookbook recipes, set grocery reminders, and manage other smart devices. Nonetheless, with the convenience that Alexa provides also comes a host of privacy concerns regarding how Amazon handles and protects user data. Although the company claims its customers' privacy and security are one of its primary concerns, its actions have not always reflected this, eliciting the question of how much Alexa users should be trusting Amazon to protect their data. However, both Alexa and non-Alexa users alike have also contributed to the privacy crisis simply by being consumers in an increasingly digital world. Moreover, people have attributed human identities to virtual assistants since their emergence in the 20th century, and Alexa is no different, having taken on the roles of lover, Zen coach, and companion to users. Alexa also has a strong link to femininity due to its name and its voice. Not only is the device an emblem of femininity, but it also reflects stereotypical notions of women with Alexa's purpose being to assist users in any manner at any time. Ultimately, both Amazon and Alexa users have contributed to all Alexa entails, from being a source of privacy concern to being humanized to reflecting society's understanding of femininity. In addition to recognizing this, it is also important for Alexa users and non-users alike to be informed and aware of the role technology plays in their lives.

#NotAHashtagApproach: Considering data activists tracking racialized and gendered violence on social media

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There are over 150 organizations globally that track gendered violence and even more that track racialized violence. Many of these organizations are data activists, collecting details and information on specific cases, and previous research has focused on how they use information and communication technologies. But how do these data activists disseminate their information to the public? Using social media, I analyze how 12 different data activists in the United States and Canada who track racialized and gendered violence use their posts to raise awareness about the issue, spread information about specific cases, and further their mission as an organization. In a qualitative analysis of 600 social media posts across Twitter, Facebook, and Instagram, I analyze how different tracking groups use their social media as an extension of their mission and message. Instead of doing network analysis, as is common in social media research, I look at trends in the 12 different groups' posts such as usage of victim images, intersectional messaging, and audience targeting. Further, I develop how the groups' similarities and differences influence their social media presence and potential social media techniques for future data activists.

Deepfakes and the epistemic threat to scientific information
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I am presenting an in-depth look into the potential harm that the spread of deepfake content may have to the practice of science and the spread of scientific information. I argue that as deepfake content continues to spread in popularity, the relationship that exists between experts and the public will become further strained as the public no longer trusts expertise as a whole. This will spread into all forms of expertise and affect experts of all kinds but will hit the world of scientific information and its experts particularly hard. Without the trust of the public, scientific experts will begin losing funding and the recommendations that they make will no longer be executed, all of which will cause significant damage to the reputation and future of scientific practice. Over time, the power that science holds as an epistemic authority figure will weaken and wither, becoming a shell of what it once was. The best way in which we can combat this damage is to reinforce the relationship between experts and the public by enhancing the trust that exists within it. One possible solution I present is the prevention of the anonymity of scientific experts. Making experts and their ideas and beliefs more popular increases the chance that when deepfakes are inevitably made of these experts to make it seem as though they support an idea that they do not, it will be easier to detect the attempted trickery.

Education & Healthcare

Ethics in the biotechnology lab: An integrated pedagogy
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Bioethics theory and application curriculum requirements for bioscience undergraduates are irregular across the United States. Currently, bioethics taught through a liberal arts approach are generally separated from the technical biology or biotechnology curriculum. This separation can range from separate lessons within a semester to physical separation of the bioethics classrooms from bioscience laboratories. Bioethics education, as well as national and international guidance from entities such as human research ethics committees (HREGCs), have historically deferred to principle-based applied bioethics while avoiding the role of visceral emotions in bioethics decision-making. Laboratory-based curriculum that includes the bioethical impact of biotechnologies are currently utilized in many undergraduate institutions to try and address this dichotomy of material lab practice and bioethics. However, these programs differ in their methods of bioethics integration with the laboratory or science-focused material. The resulting course presented in this paper incorporates elements of previously implemented bioethics pedagogy strategies for biotechnology and biology undergraduate students. Quantitative analysis of the efficacy of the designed course is extrapolated from a short-term bioethics lab workshop composed of upper-level undergraduate biotechnology, biology, and integrated science and technology (ISAT) students at James Madison University. Potential advantages of the imagined bioethics pedagogy presented in this paper include legitimizing creative expressive encounters within the laboratory environment, acknowledging the role of researchers' visceral emotions through a combined principle-based and an emotionally reflexive approach.

Evaluating strategies to improve navigation of the U.S. health system for limited English-proficient patients
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In the 2010 United States Census, 25.2 million individuals over the age of 5, or 9%, reported that they could speak English "less than very well." The U.S. health system is complex even for patients who are fluent in English, yet currently provides inadequate support to the growing population of limited English proficient (LEP) patients, who face challenges with both health literacy and health access, manifesting in higher rates of adverse events.
In this paper, I investigate the roles and effectiveness of several strategies that have been implemented in the United States healthcare system to serve LEP patients: ad hoc communication, translation technology, interpreters, and bilingual health navigators. Synthesizing literature case studies of the experiences of Spanish-speaking interpreters and health navigators and a self-conducted interview of a navigator, I argue that despite the perceived convenience of using ad hoc interpreting, bilingual health system navigators are more beneficial for LEP patients with low health literacy while professional interpreters should be used for LEP patients who are more comfortable with the health system. The COVID-19 pandemic has exacerbated negative health outcomes in the Spanish-speaking LEP population, as data published by the New England

Journal of Medicine in October 2020 reported that test positivity rate for Hispanic patients was 42.6%, compared to the rate of 8.8% for non-Hispanic white patients. Thus, LEP patients need more equitable and effective healthcare strategies to address the elevated rates of adverse health events, including bilingual health navigators and trained interpreters.

The unsustainability of hospital waste

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American hospitals produce over five million tons of physical waste yearly. My research project aims to explore how disposable personal protective equipment (PPE) – a large component of that waste – has become normalized in the American healthcare system despite our knowledge of its environmental damage. Disposable PPE was historically designed to appease risk averse patients and providers, but became fortified in the American healthcare system as a mechanism of consumerism. Expansive disposable PPE use is also a product of invisible infrastructures that allow waste to accumulate out of sight from the middle and upper-class consumer, therefore placing the environmental and health burden of this waste on conventionally marginalized communities. The use of disposable PPE exemplifies the power dynamics present in both the medical system and the fabric of our entire nation as people of color (POC) and nurses serve as the primary activists against this wastefulness yet often go ignored. In light of both the COVID-19 pandemic and pressing climate change concerns, this research contributes to a critical and expanding realm of literature that can be useful when exploring opportunities for improvement in both healthcare and environmentalism. Furthermore, it should be used to consider pre-existing policies that promote wastefulness and inequality in one of America's largest industries.

Brown boosts immunity: A community-centric approach to project-based service-learning in higher education

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Service-learning models serve as noteworthy curriculum paradigms that can help students engage with their communities while continuously learning. This paper recounts the implementation of a service-learning model within a student initiative aimed to help combat vaccine hesitancy and promote the uptake of vaccinations within the Rhode Island community. Through a collaborative effort between students, faculty, and the university, the student initiative was able to construct a credit-bearing course to help assess and alleviate vaccine hesitancy within Rhode Island. This article highlights the journey the organization took to develop a service-learning model within the course, the project details, and the impact that their project has had on the community. A detailed analysis of the impact the service-learning model had on students as well as key takeaways of the project is also highlighted below.

Conflicts of Interest

The authors declare no conflict of interests.

Authors' Contributions

N.M.L.: Served on a planning committee for the conference, served on abstract review committee for the conference, communicated with keynote speaker and panellists, hosted Q & A following presentations.
A.C.: Served on a planning committee for the conference, served on abstract review committee for the conference, designed the conference program, hosted Q & A following presentations.
A.H.: Served on a planning committee for the conference, served on abstract review committee for the conference, was a panellist in the "Science Policy and Funding" panel.

H.R.R.: Served on a planning committee for the conference, served as head of communications for the conference, hosted Q & A following presentations, hosted the panel, drafted the conference abstract booklet, and gave final approval of the version to be published.
F.Z.: Served on a planning committee for the conference, designed conference webpage, formatted abstracts and abstract book for publication.

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