

Publics, Scientists and the State: Mapping the Global Human Genome Editing Controversy

Ya-Wen Lei* 

Abstract

Literature on scientific controversies has inadequately attended to the impact of globalization and, more specifically, the emergence of China as a leader in scientific research. To bridge this gap in the literature, this article develops a theoretical framework to analyse global scientific controversies surrounding research in China. The framework highlights the existence of four overlapping discursive arenas: China's national public sphere and national expert sphere, the transnational public sphere and the transnational expert sphere. It then examines the struggles over inclusion/exclusion and publicity within these spheres as well as the within- and across-sphere effects of such struggles. Empirically, the article analyses the human genome editing controversy surrounding research conducted by scientists in China between 2015 and 2019. It shows how elite scientists negotiated expert–public relationships within and across the national and transnational expert spheres, how unexpected disruption at the nexus of the four spheres disrupted expert–public relationships as envisioned by elite experts, and how the Chinese state intervened to redraw the boundary between openness and secrecy at both national and transnational levels.

Keywords: public sphere; expert sphere; transnational public sphere; transnational expert sphere; scientific controversy; human genome editing

Controversies involving science have long existed and been studied, but scholars have yet to attend adequately to the impact of globalization on the dynamics and outcomes of such controversies. Despite widespread recognition of the limits of methodological nationalism in existing literature, most studies continue to analyse scientific controversies within single countries only and, most often, within Western countries.¹ Even in the few studies that compare scientific controversies across countries, the nation-state remains the sole unit of analysis and comparison is restricted to liberal democracies.²

* Department of Sociology, Harvard University, Cambridge, MA, USA. Email: yawenlei@fas.harvard.edu.

1 Martin 2008.

2 See, e.g., Jasanoff 2007.

The literature on scientific controversy has paid little attention to the Chinese case in a globalized context, an omission made all the more glaring given China's current ranking as the second-strongest country in terms of natural science research.³ China's rise in this arena has been fuelled in large part by the growing number of researchers from China who, since 2000, have been returning home after living and working in the United States, Europe and other parts of the world. In 2017, researchers in China published 14 per cent of the world's most cited papers, 5 per cent of which were authored by researchers with experience of working abroad.⁴ China's rise in the science rankings has not been without controversy, however, with the human genome editing controversy (HGEC hereafter) arguably being the most notable example.

Genome editing, also known as gene editing, is a group of technologies that enables scientists to change an organism's DNA. The application of gene-editing technologies is controversial as it can allow scientists to "play god" and influence the entire human gene pool.⁵ The HGEC was first triggered by research on gene editing in human embryos conducted by scientists in China in 2015.⁶ Several scientists and media outlets in the United States and Europe declared that such research had crossed an ethical "red line."⁷ The controversy was rekindled and intensified in 2018 by experiments in China that led to the birth of two babies who had been genetically edited (hereafter, the "gene-edited baby scandal"). News of the births sparked outcries from publics and scientists across national borders.⁸

Both China's rise as a scientific power and the global controversies that have emerged around research conducted there amplify the inadequacy of the existing literature. Studies of scientific controversies generally examine how various actors within a democratic polity – from bioethicists to scientists, state actors and the public – draw together to reason about morally and technically complex problems.⁹ What such studies have yet to address, however, is the reality that not all actors consider deliberation in the public sphere to be an unproblematic good. We know little about scientific controversy in contexts where actors have conflicting views about public communication and the proper relationship between science, society and politics. In the case of China, scientists there are connected to global scientific networks to be sure, but they are also deeply embedded in the local political culture and institutions.¹⁰ Furthermore, it is well known that the public sphere in China is subject to state censorship.¹¹

3 "The ten leading countries in natural-sciences research." *Nature*, 29 April 2020, <https://www.nature.com/articles/d41586-020-01231-w>. Accessed 4 July 2020.

4 Chawla 2018; Phillips 2017.

5 National Academies of Sciences, Engineering and Medicine 2015.

6 Liang et al. 2015.

7 Kolata 2015.

8 Lovell-Badge 2019.

9 Evans 2002; Hurlbut 2017.

10 Kennedy 2014.

11 Lei 2016; 2018; Roberts 2018.

To bridge this gap in the literature, this article develops a theoretical framework that highlights the existence of four overlapping discursive arenas – China’s national public sphere, China’s national expert sphere, the transnational public sphere and the transnational expert sphere – as well as the struggles over inclusion/exclusion and publicity, and the within- and across-sphere effects of such struggles. Empirically, the article analyses the human genome editing controversy that originated in China. It shows how elite scientists negotiated expert–public relationships within and across the national and transnational expert spheres, how unexpected disruption at the nexus of the four spheres threw the expert–public relationships envisioned by elite experts into disarray, and how the Chinese state weighed in and redrew the boundaries between openness and secrecy and between the four spheres.

Public Spheres and Expert Spheres in a Globalized World

Drawing on public sphere literature and science and technology studies (STS), this article proposes a theoretical framework for examining scientific controversies regarding research in China. Jürgen Habermas famously defines the public sphere as “a network for communicating information and points of view; the streams of communication are, in the process, filtered and synthesized in such a way that they coalesce into bundles of topically specified public opinions.”¹² In other words, a public sphere is a space for the communicative generation of public opinion.¹³ Crucially, this conceptualization of the public sphere does not presume that it is constituted only by rational-critical arguments or that everyone has the same capacity to access it or be heard within it.

Notwithstanding debate among historians of China about applying the concept of a public sphere in the Chinese context,¹⁴ social scientists do use the concept to study discursive space and practices in post-reform China. Tracing the development of marketized media and the internet, scholars have analysed the growth of a Chinese public sphere within the country’s authoritarian regime. They argue that public opinion generated in China’s public sphere now constitutes a social force in its own right that under certain circumstances can mobilize collective action and even impact state actions.¹⁵ Indeed, researchers point precisely to the Chinese state’s intensified efforts to control this sphere as evidence of its emergence and growing influence.¹⁶

Whereas most studies of the public sphere in China focus on the interaction between the Chinese state, media, netizens, public opinion leaders and activists in China’s national public sphere, this article broadens the conventional analytical lens by considering the interlocking relationship between the public sphere

12 Habermas 1996, 360.

13 Fraser 2007.

14 Wakeman 1993.

15 Yang 2009; Gang and Bandurski 2011; Lei and Zhou 2015; Lei 2018.

16 Lei 2018.

and the expert sphere at both national and transnational levels. As such, it analyses the interaction between experts, publics, media and the state *within* and *across* the national public sphere, the national expert sphere, the transnational public sphere and the transnational expert sphere. Leaving one of the four spheres or the relationship between them unexamined could lead to an incomplete analysis of scientific controversies surrounding research in China.

The public–expert dimension

The first dimension of the theoretical framework concerns the distinction between the public sphere and the expert sphere. Experts and non-experts differ in their possession of authoritative knowledge in a particular area.¹⁷ Historians of science and STS scholars document the relations that exist between these groups as a result. Tensions often arise when the public mistrusts experts, when experts monopolize speech in scientific controversies, or when experts and the public rely on different logics or information to make evaluations.¹⁸ Research on Western Europe and the United States finds public opinion and scientific expertise influence and shape one another. In the 1980s, public scepticism of science grew, as did the need for public funding for scientific research, prompting scientists in the United States and United Kingdom to seek to enhance the public’s understanding of science and, later, increase scientists’ public engagement. Such efforts aim to improve citizens’ scientific literacy and their perception of science, influence policymaking and justify public funding.¹⁹ As a result, science communication between experts and non-experts has become important practice.

William Leiss and Christina Chociolko argue that scientific communication occurs *in* and *between* the public sphere and the expert sphere, where participants speak different “languages.” The public sphere is a discursive arena where participants speak the language that the general public can understand, whereas the expert sphere is a discursive space where participants speak the language of scientific or technological knowledge. Certain actors can speak two “languages,” thus straddling the two spheres and contributing to communication flows across them.²⁰

The boundaries separating the public sphere and the expert sphere, and the uneven distribution of scientific or technological knowledge between experts and non-experts, often result in the exclusion of the public from the expert sphere and restricted information flows between the two spheres.²¹ Theoretically, various parties, from experts to media, government agencies, interest groups, the public and business actors, can speak in both spheres. However, as Leiss and Chociolko point out, these actors can do so only by using the specific

17 Leiss and Chociolko 1994; Callon 1999.

18 Callon 1999; Fischer 2000.

19 Kurath and Gisler 2009; Besley and Nisbet 2011; Agustí 2016.

20 Leiss and Chociolko 1994.

21 Callon 1999.

language of each sphere.²² As a result, participation in the expert sphere often includes only those who possess scientific or technological knowledge. Indeed, research in Western societies finds that scientists often consider the public ignorant and tend to discard lay opinions.²³ Critically, participants in the expert sphere not only decide what qualifies as “science” but also play a significant role in determining how much the public knows about it.²⁴ In this way, interaction within the expert sphere can influence interaction in the public sphere.

To be sure, experts themselves can also be excluded from discussion in the expert sphere. Just as scholars of the public sphere critique unequal participation within the public sphere, so too has research found the expert sphere to be anything but a level playing field.²⁵ Studies in the United States and China suggest that elite scientists affiliated with prestigious institutions constitute powerful groups that influence policymaking.²⁶ As such, an analysis of discussion within the expert sphere and the public–expert sphere relationship should consider varying degrees of inclusion among experts as well.

The national–transnational dimension

The second dimension of my theoretical framework concerns the distinction between a national and a transnational discursive space. Here, the difference lies in whether a discursive arena overflows the bounds of nations and states.²⁷ Such a distinction associates with the state’s sovereign power within a bounded political community. As Nancy Fraser has noted, Habermas’s own theory as well as critiques of his work are based on a Westphalian frame that assumes the coexistence of discursive arenas with a bounded political community and a sovereign territorial state. Public opinion generated in a national public sphere addresses a Westphalian state capable of regulating its inhabitants’ affairs and solving their problems.²⁸ Participants in a national public sphere are fellow members of a bounded political community. They conduct political debates in national languages mediated by national media. Furthermore, the mobilization of public opinion aims to hold state officials accountable.²⁹ Similarly, research on the distinction between the public and expert spheres and science communication, such as Leiss and Chociolko’s model, dwells on the assumption that the expert sphere and scientific risk are regulated by the nation-state and that participants are inhabitants of the same Westphalian state, using the same national language(s).³⁰

22 Leiss and Chociolko 1994.

23 Besley and Nisbet 2011; Agustí 2016.

24 Agustí 2016.

25 Fraser 2007.

26 Cao 2004; McCray 2013.

27 Guidry, Kennedy and Zald 2000; Fraser 2007; Castells 2008.

28 Fraser 2007.

29 Ibid.

30 Leiss and Chociolko 1994; Callon 1999.

Scholars working with varied concepts of the transnational public sphere argue that theories assuming a Westphalian public sphere have become unwieldy, as current mobilization of public opinion seldom stops at the borders of territorial states.³¹ Many issues, including those that generate scientific controversies, are inherently trans-territorial. Interlocutors who participate in forming public opinion do not necessarily share the same citizenship, national language or social imaginaries rooted in the same national political culture; nor are they mediated by the same national media.³² Scholars thus advocate examining the formation of the transnational public sphere, who is included and who is excluded from participation, to whom or what does transnational public opinion address itself, and how influential it is.³³

Similarly, just as the national public sphere can be argued to have a transnational counterpart, so too does the national expert sphere.³⁴ Science today is characterized by the transnational mobility of experts and global exchange of ideas. Transnational institutions and networks, particularly international scientific conferences and international scientific associations, provide venues for experts to exchange viewpoints and diffuse knowledge across national borders.³⁵ Expert discussions in such venues are often conducted by participants who do not share the same citizenship or who migrate internationally.³⁶ On the one hand, experts across borders share certain professional norms and collaborate with one another. On the other hand, transnational scientific exchange is also characterized by colonial histories, geopolitical concerns and competitions.³⁷ Michael Kennedy's work shows how local contexts shape knowledge production and dissemination as well as experts' professional and public engagement in the process of globalizing knowledge.³⁸ Indeed, when experts participate in a transnational sphere, they bring to it their own interests and understandings and values about public communication, which can be influenced by their national contexts. Experts' simultaneous embeddedness in national and transnational networks can lead to the overlap and interplay of national and transnational expert spheres.

Despite its many contributions, literature on the transnational public sphere tends to downplay the importance of the national public sphere and the state. Fraser writes that the place of communication has shifted from the Westphalian national-territory to de-territorialized cyberspace, and the addressee of public opinion has shifted from a sovereign territorial state to a mix of public and private transnational powers.³⁹ In a similar vein, Manuel Castells theorizes that the public sphere has "shifted from the national to the global."⁴⁰

31 Guidry, Kennedy and Zald 2000; Fraser 2007; Castells 2008.

32 Fraser 2007; Kennedy 2014.

33 Fraser 2007.

34 Fraser 2007; Kennedy 2014.

35 Heilbron, Guilhot and Jeanpierre 2008; Kennedy 2014.

36 Heilbron, Guilhot and Jeanpierre 2008.

37 Kennedy 2014.

38 Ibid.

39 Fraser 2007, 19.

40 Castells 2008, 78.

Castells further contends that state power has been “undermined by the counter-power strategies of the global civil society that seek redefinition of the global system.”⁴¹

Nonetheless, research on China’s public sphere shows that the global public sphere has not undermined the Chinese state’s power in regulating its national public sphere. Far from seeing cyberspace as a de-territorialized space, the Chinese state has insisted on its cyber sovereignty.⁴² Moreover, the Chinese state’s action has extraterritorial influence on the transnational public sphere and other national public spheres through direct and indirect mechanisms.⁴³ Leveraging the economic dependence of foreign individuals and entities on China and Chinese actors, the Chinese state directly influences media and other actors outside of China to shape public discourse beyond its national borders in its favour.⁴⁴ China’s domestic censorship can block information flows between China’s national public sphere and the transnational public sphere, indirectly influencing opinion formation outside China.⁴⁵ Therefore, although this article proposes to incorporate an analysis of the public and expert spheres at the transnational level, it argues against casting aside the national-level analysis. Instead, the article focuses on analysing the complicated nexus between the national public sphere, the national expert sphere, the transnational public sphere and the transnational expert sphere.

Inclusion/exclusion and publicity

An analysis of the four spheres and their interlocking relationships requires examining the struggles over inclusion/exclusion and over publicity in and across these spheres. To be sure, the distinction between the two types of struggle is purely analytical; empirically speaking, these struggles are often simultaneous. The struggle over inclusion/exclusion concerns who is included or excluded from a social and discursive space. It is part of what is at stake in debates, in addition to the substantive content of a given scientific controversy. The expert and non-expert distinction is an important axis of such politics. It is critical to understand to what extent specific actors seek to include or exclude certain groups and why. The struggle over publicity is activated by various actors who seek to increase or decrease the level of public attention accorded something or someone.⁴⁶ Although information and points of view in the public sphere are, by definition, public, not every piece of information or point of view receives equal attention. To bring specific issues to the centre of the public sphere, actors often adopt disruptive publicity strategies that deviate from ordinary practices

41 *Ibid.*, 82.

42 Lei 2018.

43 Lei 2020.

44 Huang 2019.

45 Lei 2020.

46 Adut 2012.

in the sphere such as leaking.⁴⁷ When something attracts undesirable public attention, the state can employ censorship to decrease or divert that attention, and in doing so, redraw the boundaries of who and what are included or excluded from a sphere of discussion.⁴⁸ As information and points of views move across the boundaries of different spheres of discussion, the struggle over inclusion/exclusion and the struggle over publicity in one sphere can have consequences in other spheres.

Data and Methods

This study is based on analyses of in-depth interviews and digital texts. Interviewees, as listed in the Appendix, include 25 biologists in China; 11 biologists, two bioethicists and one social scientist who work on science and technology policy outside of China; six media professionals in China; and three media professionals outside of China. The interviewees, including both experts and media professionals, were selected owing to their knowledge about or experience with the HGEC. The experts participated in the discussion in the expert spheres at the national or/and transnational levels. Some of them also engaged with the public through media interviews. Although only a few of the biologists interviewed in this study actually conduct human genome editing in their research, most of them use or develop gene-editing technologies in their research. As such, they are well versed in the technical and ethical issues involved in the HGEC. The media professionals who were interviewed participated in news reporting on the HGEC. To protect interviewees' anonymity, this article does not provide detailed information about each interviewee.

Snowball sampling was used to recruit biologists in the study. The recruitment began in the Boston area in the United States, specifically at the Broad Institute, in January 2016.⁴⁹ The Boston area is an excellent hub for recruitment since numerous labs that use or develop gene-editing technologies are located there. Many biologists from China work in these labs and have extensive social networks in China. Biologists not originating from China also have networks in China as some of their students and postdoctoral fellows have returned to China. Biologists in the Boston area introduced me to their contacts in China. In 2017, I attended the annual meeting of the International Society for Stem Cell Research in Boston, where I met and interviewed biologists from China. After making these initial connections, I visited and interviewed biologists in China who are affiliated with the Chinese Academy of Sciences (CAS), Fudan University, National Institute of Biological Sciences, Peking University, ShanghaiTech University, Shanghai Jiao Tong University, Tsinghua University and Sun Yat-sen University.

Each interview lasted around one to two hours. Experts were asked about their observations of the HGEC and experience of participating in discussions in the

47 Ku 1998; Bail 2015.

48 Roberts 2018.

49 Broad Institute of MIT and Harvard is a biomedical and genomic research centre.

expert and public spheres. Media professionals were asked about their experience of reporting on the HGEC. I conducted phone interviews and face-to-face interviews in Beijing, Guangzhou, Shanghai and Boston.

This study also collected digital texts from Weibo and Twitter as a way to understand discussion in China's public sphere and the transnational public sphere. Weibo posts were collected using WiseNews and Octoparse. WiseNews is an electronic database updated with daily news articles published in Greater China and social media content on Weibo in real time. It is widely used by social scientists to collect media content.⁵⁰ Octoparse is a "crawling" and "scraping"⁵¹ software that helps users extract content from websites or social media reliably.⁵² Twitter Archiver was used to collect and save Tweets automatically.⁵³ "He Jiankui" 贺建奎 and "gene-edited baby" (*jiyin bianji yinger* 基因编辑婴儿) were used as keywords to collect Tweets and Weibo posts because, as the following sections will elaborate, these keywords accurately identify content related to the gene-edited baby scandal. My research assistants skimmed through Weibo posts and Tweets to make sure of their relevance. They also compiled statistics of Weibo posts and Tweets, including the number of likes, retweets and comments to measure the influence of Weibo and Twitter users and specific Weibo posts or Tweets. I read and analysed digital texts qualitatively to map out public discourse, paying particular attention to posts and comments with a higher degree of influence.

Finally, this study estimated the prevalence of censorship regarding the gene-edited baby scandal on Weibo. WiseNews collects Weibo posts as soon as they are published online, and so once a post is published, the database collects the title and the link of the post immediately. I compared datasets collected using WiseNews and Octoparse in March 2019. Both datasets compiled posts for the same period, 25 November 2018 to 2 February 2019, using the same keywords. Since the Octoparse dataset did not collect data in real time, and because Weibo blocked/censored some of the posts and disabled some keyword searches, the number of posts collected in the Octoparse dataset is smaller than the number in the WiseNews dataset. Comparing the two datasets reveals the extent of ex-post censorship, meaning censorship that is conducted after the publication of a post. In addition, this study analysed the content of censored and uncensored posts in the WiseNews dataset. As mentioned, WiseNews collects the title and the link of a post. When the link of a post does not work owing to subsequent censorship, the title of the post remains in the database. By then searching for the titles of censored posts through Google, I was able to find their content on other websites, especially those outside of the Great Firewall of China.⁵⁴

50 Studies using WiseNews are published in journals such as the *American Journal of Sociology* and *Social Movement Studies*.

51 Web crawling involves looking at a page in its entirety and indexing it; web scraping is extracting data from websites in an automated manner.

52 Thirafi and Rahutomo 2018.

53 Twitter Archiver is an extension available for Google Spreadsheets. The application saves Twitter content to a Google spreadsheet automatically.

54 The Great Firewall blocks access to selected websites.

The Human Genome Editing Controversy (HGEC)

Negotiating inclusion/exclusion within and across the national and transnational expert spheres

In April 2015, the journal *Protein & Cell* published the results of an experiment, conducted by Dr Huang Junjiu 黄军就 and his colleagues, that used the gene-editing tool CRISPR/Cas9 to modify genes in human tripronuclear zygotes.⁵⁵ *Protein & Cell* is an international academic journal published by Springer, with its editorial office located in the Institute of Biophysics of the Chinese Academy of Sciences (CAS). The research published by Dr Huang and his colleagues was immediately discussed and criticized by scientists and bioethicists in North America and Europe for its ethical and regulatory considerations, and media outlets outside and inside of China were quick to pick up on the story.⁵⁶ Scientists and bioethicists around the world had different views on whether human germline gene editing was ethical, as the change produced by such gene editing would be heritable. Experts also had divergent views on how close CRISPR/Cas9 was to becoming a viable option for treating disease. Some critics worried that allowing human germline gene editing in basic research could open a window for scientists to use the technology for reproduction purposes before a rigorous regulatory framework was in place.⁵⁷ Media and public discourse within and outside China raised the spectre of scientists helping the rich to create “designer babies.”

As literature on the interplay between public opinion and scientific expertise suggests,⁵⁸ the controversy in the transnational public sphere led to discussion in the expert spheres, both at the transnational level and in China, regarding the appropriate relationship between scientists and the public. Once aware of the global controversy, Dr Huang declined most media requests for an interview, but this decision sparked further criticism in the transnational expert sphere. For example, Tetsuya Ishii, a bioethicist at Hokkaido University in Japan, told the internationally renowned science-focused magazine *Nature*, “It’s like he’s [Dr Huang’s] hiding,” when instead he should recognize his “responsibility to address his critics.”⁵⁹ Such comments made clear the fact that experts in different contexts have different understandings about whether an individual scientist has a responsibility to address the public, including a transnational public.

Unlike Dr Ishii, most interlocutors in China’s expert sphere did not criticize Dr Huang for declining to address the public; rather, many of them criticized the Chinese government instead. They argued that the Chinese government – and more specifically, the Ministry of Technology – should have responded to

55 Liang et al. 2015.

56 Kolata 2015.

57 National Academies of Sciences, Engineering and Medicine 2015.

58 Agusti 2016.

59 Cyranoski 2015.

the global public criticism. Simply not responding, they argued, was irresponsible because it damaged the global reputation of all biologists in China; the fact that Dr Huang's experiment was controversial did not necessarily mean he had done anything illegal or unethical.⁶⁰ As one interviewee said, "for Chinese government officials, the less trouble, the better. They don't care about biologists' reputation or the future of humans; they only care about their own posts."⁶¹ Several interviewees explained that the global reputation of Chinese scientists is important because it influences how international scientific journals review their manuscripts.⁶² Some of my interviewees reported being rejected by top international journals owing to ethical reasons.⁶³ Being able to publish in top international scientific journals, especially *Cell*, *Nature* and *Science*, is a top goal shared by my interviewees in China. Indeed, as research on the transnational mobility of scientists shows, scientists in China are deeply embedded in global networks.⁶⁴ The foremost goal of publishing in top international scientific journals makes biologists in China deeply concerned about their global reputation. Interestingly, however, my interviewees' argument that the Ministry of Technology should address the public applied only to the *global* public, not the Chinese national public.

Some senior Chinese biologists took the lead in addressing the crisis in the national expert sphere. They organized meetings under the aegis of CAS, the top academic institution in natural sciences and the highest scientific and technological advisory body in China.⁶⁵ CAS is above universities in China's bureaucratic structure. It is a ministry-level organization under the supervision of the State Council, whereas many top universities in China are sub-ministry level and mostly come under the supervision of the Ministry of Education. CAS organized panel discussions that brought together the Ministry of Technology, professional associations, bioethicists, several biologists who work on stem cell and reproductive medicine, and the executive editor of *Protein & Cell*. Together, these actors surveyed the relevant regulations and laws in China and concluded that Huang had not committed any violation. Their reasoning pointed to two key issues: first, China bans only human germline gene editing for reproduction purposes and Dr Huang used spare embryos from fertility clinics that could not progress to a live birth; and second, the experiment was approved by an ethical review committee in line with Chinese regulations.⁶⁶

Collaborations and exchanges between national academies then began, connecting expert spheres at the national and transnational level. Members of the United States' National Academy of Sciences (NAS) visited CAS in Beijing in May 2018 in order to learn about the practices and governance of gene editing

60 EC2; EC3; EC4.

61 EC14.

62 EC3; EC6; EC15; EC16; EC19.

63 EC3; EC6.

64 Heilbron, Guillhot and Jeanpierre 2008.

65 Cao 2004.

66 EC2; EC3.

in China. CAS then accepted an invitation from NAS to co-host an international summit with the United Kingdom’s Royal Society in December 2015 in Washington, DC. The summit aimed to present and deliberate on the scientific, ethical, legal and governance issues associated with human gene editing. Scientists at CAS accepted the invitation because they felt they had an obligation to address the criticism by foreign media and international scientist communities regarding practices in China.⁶⁷ One of my interviewees in the United States participated in the initiative from the very beginning. According to him, NAS decided to collaborate with the Royal Society and CAS because NAS and its experts saw the HGEC as a *global* issue. Since the three national academies are among the most prestigious academic institutes in the world, it would be reasonable for them to lead the global initiative. NAS wanted to produce a guideline with CAS and the Royal Society that could serve as a template for other countries.⁶⁸ Asked why an initiative was not launched through the United Nations, my interviewee replied that it would be “too political,” as demonstrated by the divided views on stem cell research among member states.⁶⁹ Multiple biologists in the United States expressed the view that seeking a consensus among scientists through national academies would be easier than seeking one among nation states.⁷⁰ These responses reveal experts’ preference that the discussion be led by elite experts at the transnational level.

The summit attracted the online and offline participation of over 3,500 people, mostly experts and journalists. Although opinions varied over whether scientists should be allowed to edit early human embryos or germline cells for basic and preclinical research, the organizing committee concluded that such research is needed and should proceed according to appropriate legal and ethical rules and oversight. The committee also agreed that it would be irresponsible to proceed with any clinical use of germline editing given outstanding safety and efficacy issues and the absence of a broad societal consensus.⁷¹ The committee’s conclusion was consistent with China’s domestic regulatory framework. One biologist in China emphasized to me that Alta Charo, one of the organizers of the summit and a professor of law and bioethics at the University of Wisconsin at Madison, made it clear at the summit’s press conference that Dr Huang had not violated any Chinese law.⁷² Scientists in China were largely relieved by the discussion in the transnational expert sphere as well as the news about that discussion in the transnational public sphere.

After the 2015 summit, organizers from CAS, NAS, the National Academy of Medicine of the United States (NAM) and the Royal Society began considering where to have the second summit. The organizing committee of the first summit

67 EC1; EC2; EC5.

68 EA1.

69 Ibid.

70 EA1; EA3; EA6.

71 National Academies of Sciences, Engineering and Medicine 2015.

72 EC2.

called upon the four national academies to take the lead in creating an ongoing international forum. As envisioned by the committee, the forum would be inclusive across nations and engage a wide range of perspectives and expertise, including not only scientists, social scientists, bioethicists, patients and families but also policymakers, regulators, public interest advocates and, importantly, members of the general public.⁷³

Contention soon emerged, however, over location and participation. At first, the plan was for CAS to host the second summit in Beijing, but in 2017, CAS reversed this decision.⁷⁴ The first sticking point was disagreement over who constituted “the general public” and whether they should be included. Some scientists at CAS were against opening the discussion of the issues surrounding human gene editing to the public in China. The Chinese public, they argued, had a poor understanding of science, citing as an example the “nonsensical” public debate in China about genetically modified (GM) food. If CAS co-hosted the second summit in Beijing, they feared that the media, social media celebrities and netizens would link gene-editing issues to GM food. One scientist explained:

If we open the discussion to the public, scientific problems will evolve into social problems. Then we could lose control over the issues ... We might not be able to conduct important research in the future because of absurd public opinion and illogical social media celebrities like Cui Yongyuan 崔永元. That would be a disaster for science.⁷⁵

In fact, most of my interviewees in China supported the CAS decision in this regard. One common argument pointed to the source of funding, as one interviewee explained:

I don't think such discussions should be open to the public because our research funding totally comes from the government instead of the public. Therefore, we don't have to talk to the public. China has a centralized political regime, whereas the United States has a democratic regime. This makes things very different.⁷⁶

Similarly, another interviewee said, “In China, scientists only need to convince the government and experts in order to receive research funding. The public is not relevant.”⁷⁷ Indeed, as political battles over human embryonic stem cell regulations in the United States and Europe show, public scepticism in liberal democracies can lead to institutional restrictions on research, public funding and intellectual property rights.⁷⁸ In comparison, China's political regime to a large extent isolates government funding organizations and scientists from the influence of public opinion.⁷⁹ As research on the public sphere in China shows, although public opinion can lead to the removal of individual officials, it has led to limited institutional changes.⁸⁰

73 National Academies of Sciences, Engineering and Medicine 2015.

74 EC2; EC5.

75 EC2. Cui Yongyuan is a social media celebrity famous for his opposition to GM food.

76 EC6.

77 EC19.

78 Jiang 2016.

79 Ibid.

80 Lei 2018.

My interviews with biologists in China reveal tensions with the public similar to those found between experts and the public in Europe and the United States.⁸¹ But they also reveal distinctive power relations between the public and scientists, specifically the limited ability of the public in China to influence policy, legislation, regulation and funding for scientific research. Such national institutional difference accounts for the varying ways in which scientists in China (via CAS) and in liberal democracies (via NAS and the Royal Society) deal with public–expert tensions.

Chinese scientists are not the only ones to express doubts about the general public’s capacity to understand and debate scientific issues. Research based on survey data shows that the majority of scientists in the US and the UK think that the public does not know much about science.⁸² During my research, many of my interviewees in the United States raised similar concerns about the level of scientific understanding among the general public there – some noted, for example, that a proportion of Americans hold very hostile and distorted views on biological research owing to their religious beliefs.⁸³ Nevertheless, despite such views, the scientists I interviewed in the United States did not argue that the public should be excluded from participating in scientific debates.

There was also disagreement among CAS scientists and their counterparts over whether a second summit was even necessary. Some scientists at CAS felt that their participation at the first summit had already completed its “historic mission,” meaning that they had restored the reputation of Chinese scientists. In addition, they thought experts had reached a consensus at the first summit regarding the use of gene-editing technology in basic and preclinical research as well as in clinical applications. Therefore, there was no need for a second summit. They also challenged the very idea of any “East versus West” ethical divide circulated by Western media, arguing that, in fact, the ethical and regulatory standards in China were transplanted by hospitals and the government from the West in the 1990s and thus were identical.⁸⁴ The difference between the two contexts, they argued, did not concern ethical standards per se but rather the implementation of regulations, which are rightly under domestic jurisdiction.⁸⁵

Scientists at CAS decided against hosting the second summit in Beijing. They told NAS, NAM and the Royal Society that they would be amenable to a closed-door international meeting among scientists in Beijing to discuss scientific and ethical issues but not an international summit open to the general public in China. The other national academies, however, insisted that the discussion be

81 Callon 1999; Fischer 2000.

82 Besley and Nisbet 2011.

83 EA1; EA6; EA8.

84 Chinese scholars went to the US and Japan to learn about ethical review institutions in the 1980s. The term “ethical committee” first appeared in China in 1987. Hospitals in China began to establish ethical review committees in the 1990s. In 1998, the Ministry of Health enacted its “Measures for the ethical review of biomedical research” (*Sheji renti de shengwu yixue yanjiu lunli shencha banfa*). See Tian and Zhang 2006.

85 EC2; EC3.

open to the general public and media.⁸⁶ My interviews thus reveal divergent understandings about who should be included in the transnational discussion of human genome editing. After CAS declined to host the second summit in Beijing, NAS, NAM and the Royal Society invited the Hong Kong Academy of Sciences (ASHK) to co-host the second summit in Hong Kong. According to one member of the organizing committee of the second summit, the committee considered ASHK's involvement to be critical because it made the summit less Western-centric.⁸⁷

My interviews with biologists in China also reveal exclusion in the national and transnational expert spheres. Scientists at CAS were uneasy about being perceived as representing or speaking for the entire country or for all Chinese scientists.⁸⁸ Indeed, several of my interviewees who work in universities were critical of the role played by CAS and the hierarchical structure of the national expert sphere. They complained that the Chinese scientists who spoke at the first summit did not represent them.⁸⁹ For example, one biologist explained, “the expert circle in China is controlled by a few scientists. They are part of the bureaucracy, so they can influence policymaking. Those scientists exclude not only the general public but also other scientists.” He was also critical of the fact that NAS had only contacted CAS and not the universities.⁹⁰ Another scientist used the term “political scientists” (*zhengzhi kexuejia* 政治科学家) to refer to influential scientists in the national expert sphere.⁹¹ Several interviewees who work in China also mentioned that Western scientists and national academies have the power to decide what kind of people and discourse can be included in transnational discussion.⁹² This shows that in addition to issues about including/excluding the public in China, there are issues about the inclusion/exclusion of experts in China's national expert sphere and the transnational expert sphere, both of which tend to be dominated by elite scientists associated with CAS and elite scientists in the United States and United Kingdom, respectively.

Disruption at the public–expert and national–transnational nexus

Although CAS scientists and the experts associated with NAS and the Royal Society attempted to structure the public–expert relationship according to their respective visions, their efforts were unexpectedly impeded by Dr He Jiankui 贺建奎, a scientist who strategically endeavoured to gain global publicity. Trained in both China and the United States, Dr He was a professor at the Southern University of Science and Technology in Shenzhen. His use of

86 EC2; EA9.

87 EA10.

88 EC2; EC5.

89 EC12; EC14; EC18; EC19.

90 EC14.

91 EC16.

92 EC3; EC4.

CRISPR/Cas9 to edit human embryos culminated in the birth of two gene-edited babies in 2018. He was a relative newcomer to gene editing, having previously worked on gene sequencing. In 2018, he accepted an invitation to present his non-human gene-editing research at the second summit.⁹³ Dr He spoke two “languages,” to use Leiss and Chociolko’s terminology, straddling both the expert and public spheres.⁹⁴ In sharp contrast with most of my interviewees in China, Dr He was eager to connect with the public, but the way he communicated with the public diverged from the dominant norm in the transnational expert sphere: he used the media to create a theatre for himself based on the logics of marketing. His media record since 2013 shows numerous instances of him seeking public attention in and beyond China for commercial interests.⁹⁵

Before even subjecting his human gene-editing research to a peer-review process, He hired a US public relations advisor to arrange an exclusive interview with the Associated Press and to produce YouTube videos about this experiment. The day before the second summit, where He was scheduled to present his non-human gene-editing research, he uploaded five videos to YouTube. He spoke in English in four of the videos, while a technician in his lab spoke in Chinese in the fifth. Through these videos, He announced the birth of two gene-edited, HIV-resistant babies. Already anticipating criticism of his experiment, He used the videos to explicitly communicate his ethical views on therapeutic-assisted reproductive technologies.⁹⁶ His key message was that he wanted to help patients with HIV to have healthy children. The videos and resulting news triggered a global outcry and prompted heated discussion in China’s national public sphere and expert sphere and the transnational public sphere and expert sphere.

Many biologists in and beyond China considered Dr He’s publicity strategy to be disruptive as it deviated from their understanding of the appropriate relationship between the expert sphere and the public sphere at both national and transnational levels. Scientists in and outside of China commented in interviews that He should have gone through a peer-review process to get the science right before announcing his experiment to the public.⁹⁷ As one biologist in China commented:

He Jiankui kept so many secrets from other scientists. What he did shouldn’t have been secret but should have been discussed and reviewed by other scientists and regulatory agencies. And yet he suddenly exposed some of those secrets to the entire world to gain personal fame at the expense of both science and the reputation of scientists.⁹⁸

Many interviewees were of the opinion that the adjudication of scientific work should occur in the expert sphere first, otherwise science cannot be adequately discussed in

93 Lovell-Badge 2019.

94 Leiss and Chociolko 1994.

95 “Fang hanhai jiyin chuangshiren He Jiankui boshi” (Interview with GenoCare’s founder, Dr He Jiankui). *360zhyyx.com*, 23 October 2018, <https://www.360zhyyx.com/home-research-index-rid-69625.shtml>. Accessed 28 June 2020.

96 The videos can be found at https://www.youtube.com/channel/UCn_Elifynj3LrubPKHXccwQ. Accessed 4 July 2020.

97 EC22; EC23; EC24; EC25; EA9; EA10; EA11; EA13.

98 EC23.

the public sphere. In their view, Dr He's refusal to follow this process threatened to undermine the legitimacy of all scientists in the public sphere. Literature on the public sphere theorizes on the boundary politics of openness/secretcy, and particularly the leaking of secrets from the state to the public sphere in a domestic context.⁹⁹ Dr He, on the other hand, was engaging in another type of boundary politics – one situated at the public–expert and national–transnational nexuses.

Dr He's disruptive publicity strategies prompted discussions about how scientific communities should respond to the unexpected crisis. In China, biologists quickly established a consensus opinion. A group of Chinese biologists, including scientists in the Genetics Society of China and the Chinese Society for Stem Cell Research (CSSCR), released a statement in both Chinese and English to condemn He's behaviour. Many Chinese biologists, including two of my interviewees, agreed to be interviewed by the media in and beyond China.¹⁰⁰ They swiftly disseminated their opinions to the national and transnational public spheres and the transnational expert sphere. Meanwhile, in the transnational public sphere, the members of the second summit organizing committee debated whether they should include He in the summit. The committee members initially disagreed as some argued that the summit should not be utilized as a personal platform. After deliberation, however, the committee unanimously agreed to let He talk and, even more importantly, answer questions from the audience.¹⁰¹

At the session that included He, scientists, ethicists and journalists questioned him about the experiment's lack of oversight and transparency, the inadequate informed consent from the parents, the existence of alternatives for preventing HIV infection, the enormous health risks, the project's unclear sources of funding and the accuracy and efficacy of his gene editing. Dr He, however, addressed just a few of these questions. After He's presentation, Dr David Baltimore, Nobel laureate and chair of the summit organizing committee, described He's work as irresponsible and evidence of “a failure of self-regulation by the scientific community.”¹⁰² All of the summit participants interviewed in this study expressed frustration at He's evasive responses to the questions and believed that he had withheld important information. Scientists outside of China complained that he had not clarified what exactly CRISPR/Cas9 did in terms of editing, how he had obtained approval from ethical review panels, why the relevant regulatory agency in China had failed to enforce its law and regulations, and why there were no whistle blowers.¹⁰³ Biologists in China also had questions about He's funding. They speculated, for example, about the involvement of business and government actors in China as well as certain scientists in the US with whom He was close and who had served as his mentors.¹⁰⁴ All agreed that many questions, including

99 Ku 1998; Bail 2015.

100 EC21; EC23.

101 EA9; EA14.

102 National Academies of Sciences, Engineering and Medicine 2019.

103 EA9; EA10; EA11; EA14.

104 EC20; EC21; EC23; EC24.

those related to the secrecy of the Chinese state, remained and that further investigation and discussion were required.

Despite the disruption wreaked by Dr He, my interviewees outside of China did point out a silver lining – namely, the enthusiastic discussion of science globally.¹⁰⁵ Reflecting upon her experience of attending the summit, one summit organizer said that she had never seen so many media outlets and cameras at a science conference.¹⁰⁶ On the last day of the second summit, a journalist at *Guokr* (*Guoke* 果壳), a new media company specializing in science and technology reporting in China, asked Dr Baltimore what he thought of all the media attention accorded to Dr He. Baltimore responded, “You said it’s a shame that his [He Jiankui’s] activities dominate the media, but I think that we’ve been able to talk about these technologies freely in the media. That’s already good enough.”¹⁰⁷ He Jiankui’s boundary-crossing publicity strategy seemed to have opened up discussions about the HGEC in China’s national public sphere and the transnational public sphere.

The sovereign state and the national and transnational public spheres

Although the literature on the transnational public sphere tends to downplay the power of the sovereign state and emphasizes the de-territorialization of cyberspace, the Chinese state contained the global public outcry swiftly and effectively.¹⁰⁸ On the second day of the summit, when Dr He made his presentation, news organizations in China received three consecutive prohibitive instructions from the propaganda system. The state’s instructions not only restricted news organizations from producing their own news about the scandal but also requested that news organizations delete “harmful” comments from their websites and social media. Meanwhile, major online news portals and social media platforms also received instructions to block inappropriate information on their sites and to downplay the scandal.¹⁰⁹ The instructions soon reached Chinese mainland journalists at the summit in Hong Kong.¹¹⁰

A virtual black hole of information subsequently appeared in China’s national public sphere. One biologist reported that he was interviewed by a newspaper about the science and ethics related to the HGEC, but his interview was never published owing to censorship. As he related, “The journalist apologized to me that my interview got censored ... Those censors adopted a one-size-fits-all approach to censor things without understanding what they were doing.”¹¹¹ The content of many webpages related to the scandal was similarly blocked.

105 EA11; EA14.

106 EA14.

107 The videos can be found at http://k.sina.com.cn/article_1850988623_m6e53d84f03300dzh.html?from=science. Accessed 5 July 2020.

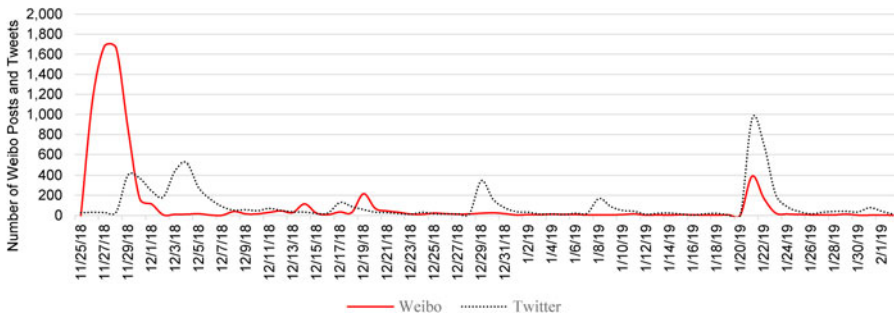
108 Fraser 2007; Castells 2008.

109 MC2; MC3; MC4.

110 MC1.

111 EC23.

Figure 1: Number of Tweets and Weibo Posts on the Gene-edited Baby Scandal, 25 November 2018–2 February 2019



Note:

The number of Tweets between 25 and 28 November 2018 is under-estimated as I only began to collect Tweets on 29 November 2018 using Tweeter Archiver.

To the surprise of many biologists in China, even the statement issued by the CSSCR described above was blocked by WeChat.¹¹² Other media outlets also removed reports from their websites and social media.

Compared with conventional news organizations, science-focused new media companies in China are less subject to direct monitoring by the propaganda system.¹¹³ The Chinese state has turned a relatively blind eye to the activities of such companies because they are not as influential as conventional news organizations in terms of reaching the general public, and science-related news is generally considered to be less politically sensitive.¹¹⁴ My analysis of Weibo data finds that science-focused new media companies, and specifically *The Intellectual* (*Zhishifenzi* 知识分子), *Guokr* and *Dingxiangyuan* 丁香园, are among the top 20 most influential Weibo accounts when it comes to the gene-edited baby scandal, based on the number of original articles, retweets, likes and comments. However, an interviewee who works in one such company still complained that articles were blocked or subjected to traffic control on the company's website and social media accounts, and that certain keyword searches were no longer possible.¹¹⁵

With information from conventional news organizations effectively censored, the number of social media posts on the scandal immediately declined. A comparison of Twitter and Weibo reveals the effect of the government's action. Figure 1 shows a sharp decline on Weibo after 28 November 2018. In the two weeks after the state-imposed censorship, there were still hundreds of original

112 EC23; EC25.

113 Science-focused new media in China have become increasingly popular. Platforms such as *Guokr* and *The Intellectual* have gained considerable readership and investment. Both provide science- and technology-focused news and discussion, with more than 9 million and 1.8 million followers on Weibo, respectively.

114 MC5; MC6.

115 MC6.

Tweets on the scandal, but the number of Weibo posts decreased sharply and did not increase significantly even when updates emerged about the scandal. Following the government-imposed censorship, news organizations in China published follow-up news about the scandal only when the government disclosed information about the investigation. Outside of China, journalists who covered the scandal reported that they were heavily influenced by the censorship as Chinese news is an important source for their news production.¹¹⁶ This highlights some of the extraterritorial impacts of censorship.¹¹⁷

The power of the Chinese state in containing the public outcry can be understood by looking at the prevalence of censorship. Comparing the two datasets described in the method section provides an estimation of the prevalence of scandal-related censorship on Weibo. Between 25 November 2018 and 2 February 2019, there were 13,469 Weibo posts in the real-time (or first) dataset, but only 7,407 posts from the February 2019 (or second) dataset. This suggests that around 45 per cent of posts were censored after publication. In fact, according to a study conducted by researchers at the University of Hong Kong, the gene-edited baby scandal was among the top-ten most censored topics on WeChat in 2018.¹¹⁸ Since the censorship began on 28 November 2019, this study further examined censorship of Weibo posts published on 29 November. First, examining the difference between the two datasets finds 1,177 posts from the real-time (the first) dataset, but only 863 posts from the February 2019 (the second) dataset, a difference of 314 posts. Second, among the 1,177 posts in the real-time dataset, only 907 posts were still accessible online in March 2019, whereas 270 were not. Analyses using the above two methods yields similar results, suggesting that around 23 to 27 per cent of the posts published on 29 November disappeared. The censorship rate on 29 November 2018 was lower on average than that between 25 November 2018 and 2 February 2019, because censorship had just been imposed on 28 November and the number of posts that had to be reviewed by censors was higher when the scandal first broke.¹¹⁹

This study further compared the content of the 270 censored posts with that of the 907 uncensored posts produced on 29 November 2018 in the real-time dataset to uncover the logic of the censorship. The analysis reveals that censorship was far from uniform. Interview data suggest that since different enforcers of censorship applied different standards, it was not unusual for some posts to be blocked in WeChat or Weibo but others with the same content to remain untouched.¹²⁰ Despite the uneven nature of the censorship, the analysis finds five salient patterns. First, during the scandal, several prominent market-oriented media outlets, such as *Life Week* (*Sanlian shenghuo zhouban* 三联生活周刊) and *Caixin* 财新, produced informative investigative reports that shed light on how regulatory,

116 MA2; MA3.

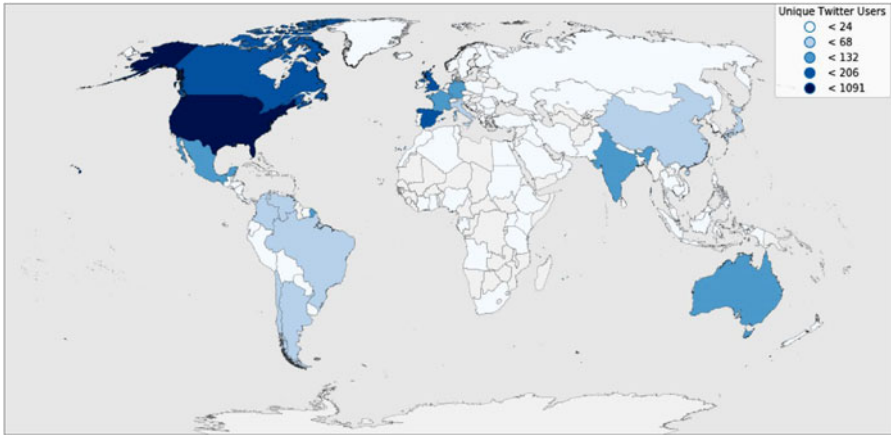
117 Lei 2020.

118 Gan 2019.

119 MC4; MC6.

120 MC2; MC4

Figure 2: Geocoded Twitter-user Location in the Gene-edited Baby Scandal, 25 November 2018–2 February 2019



informed consent and ethical review processes went wrong. Since these reports often leaked state secrets,¹²¹ Weibo posts that referenced such reports tended to be censored.¹²² Second, *Guokr* produced one of the most censored Weibo posts. The post, frequently sought and forwarded by users but repeatedly censored by Weibo, explained the science behind Dr He’s experiment, documented his presentation and interaction with the audience at the summit, and included experts’ commentary. Third, Weibo posts that directly criticized the central government, central leaders or China’s regulatory system as a whole were also frequently censored. Fourth, Weibo posts that featured the scandal in their headline tended to be censored for having made the scandal too visible, contradicting the censorship instruction to “cool down” public opinion. Fifth, Weibo posts that mentioned foreign news outlets or foreign government agencies were more likely to be censored, often because such posts translated foreign news or statements on the scandal. This demonstrates the degree of effort to block flows of information from the transnational public sphere to the national public sphere.

Finally, the study compared how the Chinese national public and the transnational public reacted to the gene-edited baby scandal and how they were influenced by the Chinese state’s censorship by analysing articles and comments on Weibo and Twitter, respectively. As Figure 2 shows, Twitter users in Asia, Australia/Oceania, Europe, North America and South America engaged in the discussion of the gene-edited baby scandal. The most prevalent language on Twitter is English, thus this study only analysed Tweets written in English. Of the

121 Ku 1998; Bail 2015.

122 MC2; MC5.

top 40 most influential accounts that discuss the scandal, 88 per cent and 80 per cent are the official accounts of news media, while 12 per cent and 20 per cent are individual accounts on Weibo and Twitter, respectively.

Although the idea of a scientific ethical divide between China and the West had already begun to circulate among the media after Dr Huang's controversy in 2015, when it came to the 2018 gene-edited baby scandal, public discourse was mostly uniform across China's public sphere and the transnational public sphere in terms of who was to blame and why. In both spheres, most commentators criticized Dr He for overstepping ethical and legal boundaries, failing to conduct science properly and for keeping his experiment a secret. Commentators across the public spheres were critical of those scientists who knew about Dr He's experiment but failed to disclose the information before the news broke. In addition, commentators in both spheres were suspicious that the Chinese government might have been complicit in Dr He's research by providing funding.

Nonetheless, public discourse in China's national public sphere and in the transnational public sphere also differed in several ways. Chinese netizens supportive of He often mentioned China's national interests; in comparison, commentators supportive of He in the transnational public sphere emphasized patients' interests. In addition, although the Chinese public and the transnational public were both critical of American scientists who knew about He's experiment before the scandal broke, or who served as advisors for He's company, the Chinese public was more critical of those American scientists. Chinese netizens drew on the pre-existing cultural discourse of "evil foreign forces" (*xie'e de wai-guo shili* 邪恶的外国势力) to condemn such scientists. Furthermore, the Chinese public was much more critical than the transnational public of the Chinese government and Chinese institutions. Many Chinese netizens condemned ethical review boards for being little more than "rubber stamps" (*xiangpi tuzhang* 橡皮图章). They also accused the Chinese government of funding research without knowing how to evaluate its scientific, ethical and legal implications. The Chinese public was more sceptical of the government's investigation and saw state censorship as an effort to cover up larger problems and absolve the state of responsibility. In comparison, only a few commentators on Twitter mentioned the censorship of the scandal.

Perhaps the clearest impact of censorship was the sentiment expressed both within China's national public sphere and the transnational public sphere that far too many important questions remained unanswered. For some Chinese netizens, the gene-editing baby scandal represents just one more incident about which the truth will never be revealed. Similarly, commentators on Twitter asked how to ensure better oversight of research with such global human relevance in the future, especially when China, a major player when it comes to this research, seems to have little interest or the capacity to enforce its own laws regulating scientific research. Although several elite experts both inside and outside of China who were interviewed in this study were critical of state censorship and

dissatisfied with the state's investigation, their prevailing sentiment was also that they were powerless to wield any influence in these matters.¹²³

Conclusion

This article contributes to the literature on scientific controversies by developing a theoretical framework to analyse a specific global scientific controversy surrounding research in China, namely, the human gene-editing controversy. Although most research on scientific controversies and science communication focuses on the interactions and tensions between experts and the public in a national context,¹²⁴ this article analyses efforts to shape the public–expert relationship at both national and transnational levels. On the one hand, elite scientists across national borders were similar in that they preferred the discussion and deliberation to be led by experts.¹²⁵ They considered certain kinds of politics undesirable – for some experts in the US that was politics under the United Nations, while for scientists in China it was politics that engaged the general public in China – since such politics might undermine experts' influence over the controversy. On the other hand, elite experts involved in transnational discussions had different views about who should be included in discussion owing, in part, to differences in their respective local contexts, especially in terms of political regime.¹²⁶ Nonetheless, the results of negotiations conducted in the transnational expert sphere still impacted China's public sphere. Although the second summit was not ultimately hosted in Beijing, the decision to host a summit that included the public and media, instead of a closed-door international meeting among scientists, still opened up the HGEC to public discussion in China.

This study also incorporates an analysis of inclusion/exclusion and struggles over publicity among experts. Although the literature on science communication tends to focus on the uneven distribution of scientific knowledge between experts and non-experts and its exclusionary effects,¹²⁷ this study reveals heterogeneity among experts. Transnational elite experts decided how the HGEC would be discussed by experts, stake holders and the public. Meanwhile, some scientists not belonging to the elite groups in China felt excluded, expressing discontent with the uneven distribution of organizational and discursive power domestically and globally. Furthermore, as a challenger of the existing order, Dr He employed publicity strategies that disrupted the hierarchies observed by transnational elite experts, and ignited discussion in the public and expert spheres at the national and transnational levels. The analysis thus shows that the power dynamics among experts also shaped the unfolding of the HGEC.

123 EC23; EC24; EC25; EA10; EA14.

124 Leiss and Chociolko 1994; Evans 2002; Hurlbut 2017.

125 STS scholars have criticized the ways in which NAS led the international initiative. See Jasanoff, Hurlbut and Saha 2015.

126 Kennedy 2014.

127 Callon 1999.

Furthermore, whereas literature on the transnational public sphere tends to downplay the importance of the state and the national public sphere,¹²⁸ this study shows the power of the sovereign state in the globalized context, especially the extraterritorial influence of the sovereign state. The Chinese state was one of the addressees of domestic and transnational public opinion regarding the HGEC. Rather than responding to public opinion in and beyond China, the Chinese state chose to contain news reporting, expert opinion and public opinion in China, while blocking information flows between the transnational and national public spheres. Such efforts obstructed the initially heated discussions and inquiries on the HGEC both inside and outside of China. As a result, elite scientists, publics and the media at national and transnational levels were rendered relatively silent by the sovereign state.

To address global scientific controversies, scholars have called for inclusive deliberation and democracy.¹²⁹ The lesson gleaned from the HGEC is that China's recent ascendance as a global scientific power should serve as a reminder that differences among transnational and national actors in terms of how they envisage public–expert relationships must be taken into account. Researchers should never underestimate the will and power of the sovereign state in shaping the boundary between openness and secrecy, and the boundaries between the expert sphere and public sphere at both national and transnational levels.

Acknowledgements

I thank Kim Greenwell, Adam Mestyan, Sebastian Veg, two anonymous reviewers and participants of my talks at Harvard's Society of Fellows, the Harvard sociology department's "Culture, History, and Society" workshop, and Stanford sociology department's colloquium, all of whom provided excellent comments and suggestions. I am also grateful to my biologist friends, interviewees and research assistants for their generous help. My thanks also go to the Chiang Ching-kuo Foundation, D. Kim Foundation, Dean's Competitive Fund at Harvard University and Harvard's Weatherhead Center for International Affairs for funding support. Finally, a special thank you goes to members of Harvard's Society of Fellows for providing me with a stimulating interdisciplinary intellectual environment.

Conflicts of interest

None.

Biographical note

Ya-Wen LEI is an associate professor in the department of sociology at Harvard University, and is affiliated with the Fairbank Center for Chinese Studies and the

128 Fraser 2007; Castells 2008.

129 See, e.g., Jasanoff, Hurlbut and Saha 2015.

Weatherhead Center for International Affairs at Harvard. She holds a JSD from Yale Law School and a PhD in sociology from the University of Michigan. She is the author of *The Contentious Public Sphere: Law, Media and Authoritarian Rule in China* (Princeton University Press, 2018). Her articles have appeared in *American Journal of Sociology*, *American Sociological Review*, *Law & Society Review*, *Political Communication*, *Socius* and *Work, Employment and Society*.

摘要: 鉴于研究科学争议的文献尚未将全球化以及中国在全球科研的领导地位纳入分析, 本文提出一个理论框架以分析与中国有关之跨国科学争议。此框架指出四个重叠的话语领域: 中国的公共领域、中国的专家领域、跨国的公共领域与跨国的专家领域。本文建议检视行动者如何在这些领域凸显自己的能见度、排除或接纳其他行动者参与讨论, 以及探讨这些行为在这四个话语领域的影响。本文进一步分析中国科学家在2015至2019年间涉及的人类基因编辑争议, 经由实证分析, 本文检视中国及国外的菁英科学家如何在中国及跨国的专家领域协商专家与公众间的关系, 以及菁英科学家未预见的行为如何在四个话语领域交界处出现, 并扰乱菁英科学家对于专家与公众关系的安排; 本文亦分析中国政府如何介入科学争论而重塑在中国及跨国的话语领域中公开信息与秘密的界线。

关键词: 公共领域; 专家领域; 跨国公共领域; 跨国专家领域; 科学争议; 人类基因编辑

References

- Adut, Ari. 2012. "A theory of the public sphere." *Sociological Theory* 30(4), 238–262.
- Agustí, Nieto-Galan. 2016. *Science in the Public Sphere: A History of Lay Knowledge and Expertise*. London: Routledge.
- Bail, Christopher A. 2015. "The public life of secrets: deception, disclosure, and discursive framing in the policy process." *Sociological Theory* 33(2), 97–124.
- Besley, John C., and Matthew Nisbet. 2011. "How scientists view the public, the media and the political process." *Public Understanding of Science* 22(6), 644–659.
- Callon, Michel. 1999. "The role of lay people in the production and dissemination of scientific knowledge." *Science, Technology and Society* 4(1), 81–94.
- Cao, Cong. 2004. *China's Scientific Elite*. London: Routledge.
- Castells, Manuel. 2008. "The new public sphere: global civil society, communication networks, and global governance." *The ANNALS of the American Academy of Political and Social Science* 616 (1), 78–93.
- Chawla, Dalmeeth Singh. 2018. "Research returnees boost China's scientific impact." *Nature Index*, 18 September, <https://www.natureindex.com/news-blog/research-returnees-united-states-boost-chinas-scientific-impact>. Accessed 20 June 2020.
- Cyranoski, David. 2015. "Embryo editor." *Nature*, 14 July, <https://www.nature.com/articles/528459a.pdf?platform=oscar&draft=collection>. Accessed 20 June 2020.
- Evans, John H. 2002. *Playing God?: Human Genetic Engineering and the Rationalization of Public Bioethical Debate*. Chicago, IL: University of Chicago Press.
- Fischer, Frank. 2000. *Citizens, Experts, and the Environment: The Politics of Local Knowledge*. Durham, NC: Duke University Press.

- Fraser, Nancy. 2007. "Transnationalizing the public sphere: on the legitimacy and efficacy of public opinion in a post-Westphalian world." *Theory, Culture and Society* 24(4), 7–30.
- Gan, Nectar. 2019. "US–China trade war among most censored topics of 2018 on WeChat." *South China Morning Post*, 13 February.
- Gang, Qian, and David Bandurski. 2011. "China's emerging public sphere: the impact of media commercialization, professionalism, and the internet in an era of transition." In Susan L. Shirk (ed.), *Changing Media, Changing China*. New York: Oxford University Press, 38–76.
- Guidry, John A., Michael D. Kennedy and Mayer N. Zald. 2000. "Globalizations and social movements." In John A. Guidry, Michael D. Kennedy and Mayer N. Zald (eds.), *Globalizations and Social Movements: Culture, Power, and the Transnational Public Sphere*. Ann Arbor, MI: University of Michigan Press, 1–34.
- Habermas, Jürgen. 1996. *Between Facts and Norms: Contributions to a Discourse Theory of Law and Democracy*. Cambridge, MA: MIT Press.
- Heilbron, Johan, Nicolas Guilhot and Laurent Jeanpierre. 2008. "Toward a transnational history of the social sciences." *Journal of the History of the Behavioral Sciences* 44(2), 146–160.
- Huang, Jaw-Nian. 2019. *The Political Economy of Press Freedom: The Paradox of Taiwan versus China*. Milton, MA: Routledge.
- Hurlbut, J. Benjamin. 2017. *Experiments in Democracy: Human Embryo Research and the Politics of Bioethics*. New York: Columbia University Press.
- Jasanoff, Sheila. 2007. *Designs on Nature: Science and Democracy in Europe and the United States*. Princeton, NJ: Princeton University Press.
- Jasanoff, Sheila, J. Benjamin Hurlbut and Krishanu Saha. 2015. "CRISPR democracy: gene editing and the need for inclusive deliberation." *Issues in Science and Technology* 32(1), 25–32.
- Jiang, Li. 2016. *Regulating Human Embryonic Stem Cell in China: A Comparative Study on Human Embryonic Stem Cell's Patentability and Morality in US and EU*. Singapore: Springer.
- Kennedy, Michael D. 2014. *Globalizing Knowledge: Intellectuals, Universities, and Publics in Transformation*. Palo Alto, CA: Stanford University Press.
- Kolata, Gina. 2015. "Chinese scientists edit genes of human embryos, raising concerns." *The New York Times*, 23 April.
- Ku, Agnes S. 1998. "Boundary politics in the public sphere: openness, secrecy, and leak." *Sociological Theory* 16(2), 172–192.
- Kurath, Monika, and Priska Gisler. 2009. "Informing, involving or engaging? Science communication, in the ages of atom-, bio- and nanotechnology." *Public Understanding of Science* 18(5), 559–573.
- Lei, Ya-Wen. 2016. "Freeing the press: how field environment explains critical news reporting in China." *American Journal of Sociology* 122(1), 1–49.
- Lei, Ya-Wen. 2018. *The Contentious Public Sphere: Law, Media, and Authoritarian Rule in China*. Princeton, NJ: Princeton University Press.
- Lei, Ya-Wen. 2020. "China's transnational impact," https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3626173. Accessed 15 March 2021.
- Lei, Ya-Wen, and Daniel X. Zhou. 2015. "Contesting legality in authoritarian contexts: food safety, rule of law and China's networked public sphere." *Law and Society Review* 49(3), 557–593.
- Leiss, William, and Christina Chociolko. 1994. *Risk and Responsibility*. Montreal: McGill-Queen's University Press.
- Liang, Puping, Yanwen Xu, Xiya Zhang, Chenhui Ding, Rui Huang, Zhen Zhang, Jie Lü, et al. 2015. "CRISPR/Cas9-mediated gene editing in human triploid zygotes." *Protein & Cell* 6(5), 363–372.
- Lovell-Badge, Robin. 2019. "CRISPR babies: a view from the centre of the storm." *Development* 146(3), 1–5.
- Martin, Brian. 2008. "The globalisation of scientific controversy." *Globalization* 7(1), <http://globalization.icaap.org/content/v7.1/Martin.html>.

- McCray, W. Patrick. 2013. *The Visioneers: How a Group of Elite Scientists Pursued Space Colonies, Nanotechnologies, and a Limitless Future*. Princeton, NJ: Princeton University Press.
- National Academies of Sciences, Engineering and Medicine. 2015. *International Summit on Human Gene Editing: A Global Discussion*. Washington, DC: The National Academies Press.
- National Academies of Sciences, Engineering and Medicine. 2019. *Second International Summit on Human Genome Editing: Continuing the Global Discussion: Proceedings of a Workshop – in Brief* (S. Olson (ed.)). Washington, DC: The National Academies Press.
- Phillips, Nicky. 2017. “Charting China’s rising dominance in science.” *Nature Index*, 21 July, <https://www.natureindex.com/news-blog/charting-chinas-rising-dominance-in-science>. Accessed 20 June 2020.
- Roberts, Margaret E. 2018. *Censored: Distraction and Diversion Inside China’s Great Firewall*. Princeton, NJ: Princeton University Press.
- Thirafi, M.F. Shadiqin, and F. Rahutomo. 2018. “Implementation of naïve bayes classifier algorithm to categorize Indonesian song lyrics based on age.” Paper presented at the international conference on “Sustainable information engineering and technology,” Malang, Indonesia, 2018.
- Tian, Dongxia, and Jinzhong Zhang. 2006. “Progress in research on Chinese medical ethical committee.” *Chinese Medical Ethics* 19(1), 78–81.
- Wakeman, Frederic. 1993. “The civil society and public sphere debate: Western reflections on Chinese political culture.” *Modern China* 19(2), 108–138.
- Yang, Guobin. 2009. *The Power of the Internet in China: Citizen Activism Online*. New York: Columbia University Press.

Appendix

Table A1: List of Interviewees

ID	Category	Date	Location	ID	Category	Date	Location
EC1	biologist	Apr. 2017	Phone	EC25	biologist	Jul. 2019	Guangzhou
EC2	biologist	Jun. 2017	Boston	EA1	biologist	Jan. 2016	Phone
EC3	biologist	Jun. 2017	Boston	EA2	biologist	Jan. 2016	Phone
EC4	biologist	Jun. 2017	Boston	EA3	biologist	Feb. 2016	Boston
EC5	biologist	Jun. 2017	Boston	EA4	biologist	Feb. 2016	Boston
EC6	biologist	Jul. 2017	Shanghai	EA5	biologist	Mar. 2017	phone
EC7	biologist	Jul. 2017	Shanghai	EA6	biologist	Mar. 2017	Boston
EC8	biologist	Jul. 2017	Shanghai	EA7	biologist	May. 2017	Boston
EC9	biologist	Jul. 2017	Shanghai	EA8	biologist	May 2018	Boston
EC10	biologist	Jul. 2017	Guangzhou	EA9	biologist	Jan. 2019	phone
EC11	biologist	Jul. 2017	Guangzhou	EA10	biologist	Jan. 2019	phone
EC12	biologist	Jul. 2017	Guangzhou	EA11	biologist	Jan. 2019	phone
EC13	biologist	Jul. 2017	Guangzhou	EA12	bioethicist	Jun. 2016	Boston
EC14	biologist	Aug. 2017	Beijing	EA13	bioethicist	Feb. 2019	phone
EC15	biologist	Aug. 2017	Beijing	EA14	social scientist	Mar. 2019	phone
EC16	biologist	Aug. 2017	Beijing	MC1	media professional	Jan. 2019	phone
EC17	biologist	Aug. 2017	Beijing	MC2	media professional	Jan. 2019	phone
EC18	biologist	Aug. 2017	Beijing	MC3	media professional	Feb. 2019	phone
EC19	biologist	Aug. 2017	Beijing	MC4	media professional	Mar. 2019	phone
EC20	biologist	Dec. 2018	phone	MC5	media professional	Mar. 2019	phone
EC21	biologist	Jan. 2019	phone	MC6	media professional	Mar. 2019	phone
EC22	biologist	Jan. 2019	phone	MA1	media professional	Jan. 2019	phone
EC23	biologist	Apr. 2019	Shanghai	MA2	media professional	Feb. 2019	phone
EC24	biologist	Apr. 2019	Shanghai	MA3	media professional	Mar. 2019	phone

Notes:

EC1–EC25 are biologists in China; EA1–EA11, EA12, EA13 and EA14 are biologists, bioethicists and social scientists outside of China; MC1–MC6 are media professionals in China; and MA1–MA3 are media professionals outside of China.