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Communicating Discovery Science

PRACTICE INSIGHTS

The Hopes and Fears Lab: enabling dialogue on discovery science

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Abstract

In this Practice Insight, we consider challenges associated with dialogue-based public engagement with discovery science, related to a focus on application, the need for short-term policy impact, and the lack of conceptual attention to dialogue. We consider potential responses to these through our initial evaluation of The Hopes and Fears Lab engagement project. We suggest the potential value of foregrounding emotional connections with science for both researchers and members of the public, and the need for as much attention to be paid to the preparatory work and settings for dialogue as to the dialogue itself.

Keywords

Bridging research, practice and teaching; Public engagement with science and technology; Science communication: theory and models

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1 ▪ Introduction

The move in science engagement from 'deficit to dialogue' acknowledges that the best way to engage people with science is not necessarily to focus on transmitting information and that people bring a range of knowledge, experience and expertise to their engagement with science [Davies & Horst, 2016; Stilgoe, Lock & Wilsdon, 2014]. In this Practice Insight, we consider the challenges associated with dialogue-based engagement with discovery science, and potential responses. We introduce The Hopes and Fears Lab (THFL), an ongoing public engagement platform that brings scientists and members of the public together in conversations around discovery science across scientific domains.

THFL is a response to three challenges in conducting two-way dialogic engagement in the context of basic or discovery science. First, public engagement with discovery research can be hampered by a desire to focus on relevance and translational application. Central questions at the heart of public engagement around science include why should either members of the public or scientists engage; and what is it about engagement that enables a connection between science and the public to be formed and sustained? The answer is often that the connection that underpins engagement is one of immediate relevance; a focus on what developments in science and technology mean for people now. Newman and colleagues [2021] describe how, in the cases of biotechnology and nanotechnology, engagement around discovery science often switches rapidly to focus on applications.

An application focus has the potential to alienate both members of the public and researchers in discovery science. For the former, conversations about applications that may be decades away may feel insubstantial and irrelevant. For the latter, an application focus conflicts with how discovery science, or 'basic research' is conceived within research contexts, as research that "is directed solely toward acquiring new knowledge rather than any more practical objective" and where distance from application is used strategically by scientists to position their work [Calvert, 2006]. This tension restricts opportunities for shared understanding, and risks misrepresenting the goals, nature, and motivations of both discovery scientists and publics [c.f. Evia & Peterman, 2020; Jensen & Buckley, 2014].

A related challenge is that 'public dialogue' on science is primarily justified by and focused on policy impact [Stilgoe et al., 2014]. While the extent of this impact is unclear in any event [Smallman, Lock & Miller, 2020], this emphasis presents a problem for the timelines on which discovery science operates and the open-endedness of research, which make any policy impact necessarily a long-term endeavour. In the pursuit of such longer-term changes, it may be that dialogue appears not to be "doing anything visibly useful" [Bohm, 2004, p. 22], even as it plays an important role in enhancing capacities (including skills, knowledge and disposition) for both members of the public and scientists [Selin et al., 2017].

Finally, the nature of discovery science accentuates general barriers associated with engagement and the delivery of 'good' dialogue. Despite the centrality of dialogic approaches to contemporary public engagement, it is not always clear what dialogue means, whether 'dialogue' occurs, or how we would recognise it if it did [de Roo, Metze & Leeuwis, 2024; van der Sanden & Meijman, 2008; Zorn, Roper, Weaver & Rigby, 2010]. Research suggests that scientists rarely focus on two-way communication in engagement [Yuan et al., 2017], while apparent dialogues are often more suited for, and enabling of, information transmission [de Roo et al., 2024]. In attempting to build dialogue, therefore, we need to ensure that we are not simply establishing focussed and small-scale deficit-model encounters.

We introduce an approach to dialogic engagement that attempts to address these challenges, The Hopes and Fears Lab, reflect on what we have learnt from our experience and preliminary evaluation of this project, and identify outstanding questions and next steps.

2 ▪ The Hopes and Fears Lab

The Hopes and Fears Lab is an effort to open two-way dialogues around the ethics of discovery science by providing a space and framework that seeks to promote good dialogue about the purpose and value of research

THFL is a talk-based dialogue activity that brings together members of the public and discovery scientists in small-scale, short (15-minute) conversations about their shared 'hopes' and 'fears' for science. The project aims to affect public awareness of ethical questions associated with discovery science, and how scientists view the public and their own research, creating opportunities and building capacity for future, deeper engagement. This involves change across a range of dimensions, including in conversational skills related to discovery science and dispositions towards partners in dialogue. This impact will be demonstrated in the experience of members of the public and researchers at THFL and their feedback (presented here) and, in further work, by the effect of engagement on dimensions including attitudes towards the field of dialogue, the value of dialogic relationships and dialogue partners, including levels of mutual trust. This, we propose, forms part of building a wider system for dialogue around discovery science through initiating symmetrical ripples of dialogic activity through science and society [c.f. Davies, McCallie, Simonsson, Lehr & Duensing, 2009].

To date, we have applied THFL to topics including genomics and gene editing, neurotechnology, and uses of artificial intelligence in science. It has been held with mixed public audiences, specific community groups, and used as an input into deliberative processes. Here, we draw particularly on the evaluation from two iterations. The first took place in November 2023, and focused on artificial intelligence. Over three days, two in Cambridge and one in London, 22 researchers working with machine learning techniques across scientific disciplines from theoretical physics and astronomy to computer science, psychology, law, neuroscience, pathology, medicine, and design took part in short conversations as part of THFL. The researchers came from a wide range of demographics, and most had not participated in public dialogue work before. At both sites, THFL was open to a drop-in public. However, in London, we also collaborated with organisers of the U.K. People's Panel on AI to bring participants in this citizen's assembly to THFL to allow them to have open and exploratory conversations with researchers as part of their deliberations [Connected by Data, Hopkins van Mil, 2023]. In all, around 200 members of the public attended THFL: AI over the course of the three days.

The second iteration we draw on here was aimed towards a specific community rather than an area of discovery science. The Hopes and Fears Lab: Iftar was held during Ramadan 2024 and focussed on engaging Cambridge's Muslim community. The aim of this event was to engage with participants who are more likely to be excluded from engagement activities, including those from minoritised ethnic groups [Dawson, 2018] and faith-based communities [O'Malley, Slattery, Baxter & Hinman, 2021]. This iteration of THFL took place over Iftar, the meal eaten at sunset to open the fast during Ramadan. Building on the core THFL set-up,

this iteration included the opportunity for a smaller number of members of the public to sit down for a meal with scientists from across the University of Cambridge, four of whom were Muslim, and whose research covered areas of science from plant biology to chemistry and AI in medicine.

In the following sections, we describe the core elements of the design and process of THFL and the ways in which they aim to address the challenges described above. We focus on three elements: a focus on emotional connections, supporting conversational dialogue, and fostering mutual regard. We draw on evaluations from THFL sessions to date to illustrate these and to consider what we have learned from our experience with the project.

2.1 ▪ *Emotional connections*

Engagement around discovery science often rapidly moves to conversation about the applications of science, in part because of the need to create a connection with participants, to hook them with the knowledge of what this development might mean for them. However, this application focus has the potential to alienate both scientists and the public. In The Hopes and Fears Lab, participants inevitably discuss the potential applications of discovery science. However, the goal is to engage with the nature and tone of discovery science and build connections by foregrounding and starting from emotional connections with science ('how do you feel about it'), rather than the products of that science.

Emotions are integral to scientific practice itself [White, 2009], and scientists' accounts of discovery are replete with expressions of varying emotions that do not feature in formal scientific accounts, but come across in individual conversations. These include emotions of curiosity, surprise, joy, and wonder — what the neuroscientist and artist Ramon y Cajal described as the "sublime wonder" associated with the act of discovery [2008, p. 32]. They also, though, include experiences of discomfort, fatigue, and anticlimax associated with the process of discovery and its aftermath [Sampson & Atkinson, 2013].

It is increasingly recognised that emotions are central to the conduct of dialogue, and to how we engage with and imagine science and the futures associated with it [Hughes, 2024; Tutton, 2021]. In the context of science engagement, emotions impact how individuals interact with scientific content, whether through feelings of inclusion, interest, and personal relevance, exclusion and fear, boredom and ennui, or complex configurations of these [Davies, 2019; Middleton et al., 2023]. Engagement with science is profoundly influenced by experiences that ignite curiosity and interest, or exclude and repel [Dawson, Hughes, Lock & Wahome, 2022; Staus & Falk, 2017], by affective dimensions such as confidence in ability to engage in discussion of scientific concepts [cf. Lin, Lawrenz, Lin & Hong, 2013], and by the emotions that researchers themselves bring to the event — as one public attendee put it, part of the experience of attending was to "[learn] more about the hopes + fears of others across the different fields (physics/computer science/biology)".

The Hopes and Fears Lab aims to foreground these emotional aspects of science and engagement for both scientists and members of the public to establish grounds for dialogue and to build the confidence of both groups to discuss complex or potentially fraught areas of work. This is achieved by the foregrounding of emotions in the title of the event (albeit in a binarized form), through the instructions given to researchers to lead with their commitments, aspirations, concerns, and emotional connection, and through efforts to flatten power

relations in discussion, described below. In our evaluation, we aim to capture both the impact of conversations on the participants' sentiments towards the field and the confidence of both attendees and researchers in discussing diverse fields of discovery science.

With regards to the first of these, participants are asked before and after THFL about whether they feel 'hopeful' or 'fearful' about the future of science. This gives a broad sense of the feelings in the room during the event. It also helps prompt conversations within the Lab — all participants are given a sticker (red for hopeful, blue for fearful, black for neutral) that is used to start discussion from the point of feelings. In the AI event described above, from which the largest number of evaluation forms were returned, we saw a movement in this affective judgement (Figure 1). 30% of respondents said they had changed their perception of AI as a

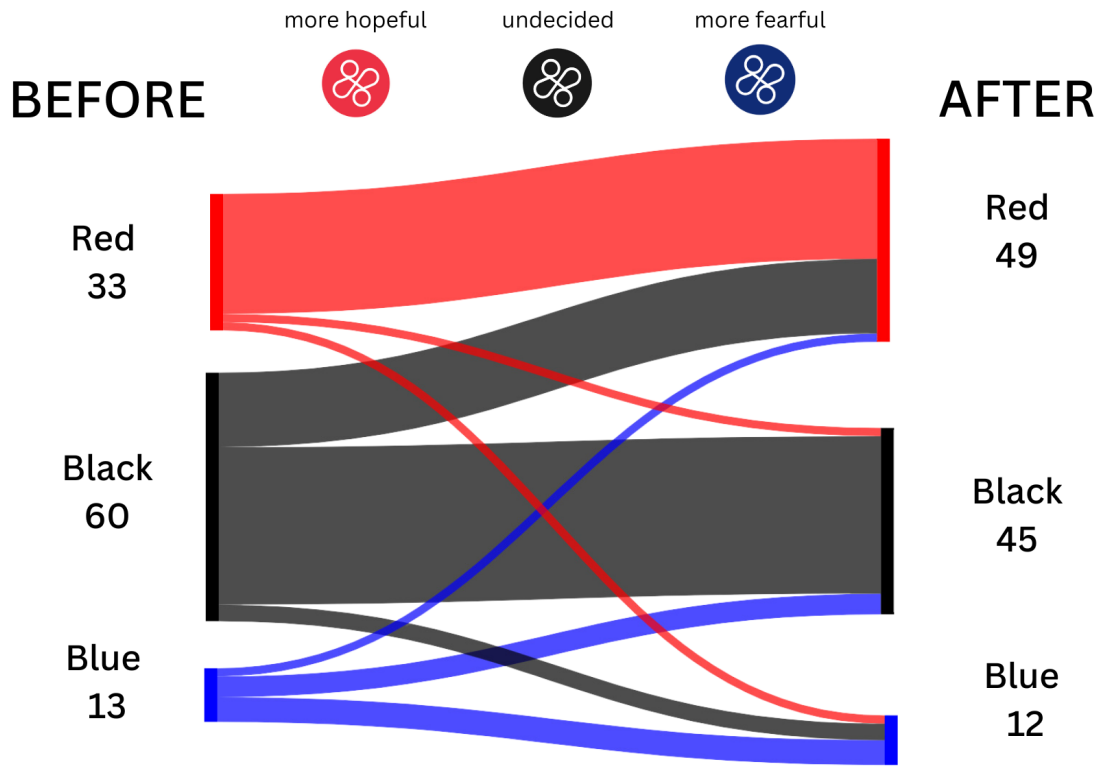

Figure 1. Changes in emotional connection with AI in The Hopes and Fears Lab: AI edition. Participants were asked before and after whether they felt hopeful, fearful or undecided.

direct consequence of participating in the event. The biggest shift was from starting the event undecided about AI to feeling hopeful about it, as would be expected from conversations with researchers passionate (but also honest) about their field. We also saw participants report an increase in their confidence in discussing the future of AI, with 65% of 111 feedback respondents selecting 8/10 or higher (mean 7.6, median 8). Among 26 researchers who returned feedback forms across THFL events, 22 (85%) selected 8/10 or higher when asked whether the event would help them engage around their work (mean 8.8, median 9). In future events, we plan to augment this evaluation through the use of snapshot interviews with attendees [Bultitude & Sardo, 2012], reflective interviews with researchers and the inclusion of brief measures of key outcomes of dialogue, including dialogic

open-mindedness [Doney & Wegerif, 2017] and communicative self-efficacy for researchers [Robertson Evia, Peterman, Cloyd & Besley, 2018].

2.2 ▪ *Supporting dialogue*

As Zorn and colleagues argued over a decade ago, to understand the value of dialogue, "researchers need to identify the particular model, assumptions and goals of what they mean by dialogue" [2010, p. 848]. Dialogue represents one form of conversational interaction, but can be distinguished from the adversarial mode of debate or output-focussed deliberation [Bohm, 2004]. Central features of dialogue are exploration and learning, the creation of common meanings and understandings through sharing facts, concepts, notions, feelings, emotions, and fears [van der Sanden & Meijman, 2008]; and regard for the other party, with the conversational partner recognized to be more important than the topic, argument, or conclusions [Noddings, 1994]. As Wegerif and colleagues describe in the context of educational dialogue, "dialogicity is 'to partially inhabit the positions of others,' understanding not only what is said, but more importantly the reasons and the cultural context underlying it, and the possible attitude of the speaker" [Wegerif et al., 2019, p. 82]. This process can contribute to an "expanded repertoire" [Wegerif et al., 2019, p. 81] of perspectives.

2.2.1 ▪ *Spaces for dialogue*

The design and conduct of THFL aims to foster dialogue through careful attention to the spaces in which dialogue occurs and how conversations are established and structured [c.f. Marks & Russell, 2015]. The importance of space and place to engagement has been acknowledged in work on informal science learning [Bultitude & Sardo, 2012], including within the science café movement [c.f. Saunders & Moles, 2013]. The 'science café' (or café scientifique) format highlights that open, informal conversations about science may be encouraged by moving these conversations outside traditional academic settings and into cafes, bars, restaurants and theatres [Dijkstra, 2017]. However, it retains a format based around expert presentations followed by discussion, which risks a continued reliance on information transfer, 'deficit' or banking models of science engagement. While also recognising the importance of moving science into public spaces, THFL starts with conversations from the outset and the public's perspective. As such it builds on work such as that of Stofer and colleague [2019], who successfully used casual conversations between pairs of scientists and public patrons in everyday and leisure spaces to create higher levels of science engagement in bars, coffeehouses, libraries, and laundromats.

With THFL, we aimed to not only move dialogue but construct a space for it, one that references and plays with these traditional sites of science. Space is an important feature of dialogue — not least through the creation of safe spaces that establish conditions for listening [de Roo et al., 2024]. In addition, space is an important feature of scientific activity and the societal distribution of expertise; specific sites and locations have been integral to the conduct of scientific research and to restricting or admitting specific individuals or groups to these conversations [Henke & Gieryn, 2008]. Moving engagement out of these sites is thus an essential part of ensuring a balance in conversations about scientific matters, particularly in fields that may be esoteric or abstract from everyday applications.

The core space of THFL is that of the cardboard laboratory, imagery and artefacts, designed in collaboration with artist Tom McLean. The aim of the space is to enable people to step outside their expected roles, while holding the 'scientific' nature of the space. In addition, for the AI edition of THFL, we moved conversations onto two vintage red London buses (deliberately chosen because of their familiarity with broad public audiences in the U.K. and their representation of 'everyday' rather than 'elite'), playing with the idea of 'where are we going with AI'. We accompanied the short conversations with opportunities for alternative ways of connecting, including through facilitated discussions using artistic creation.

2.2.2 ▪ *Fostering conversation*

Interactions in THFL are structured around guidance on how conversations should be established and conducted. At the heart of these principles is an effort to flatten power relationships within the engagement experience, and to provide opportunities for genuine two-way communication and change in which conversation moves beyond narrow concerns, fixed lay/scientist identities, and the power of authoritative knowledge [de Roo et al., 2024; c.f. Hennessy, 2011]. They are designed to enable participants to share judgement, assumptions and listen to each other's assumptions [Bohm, 2004] and build conversation on a level that is quickly and widely accessible. As described above, this means focussing not on the content of the science, but on the aspirations of both members of the public and researchers for the future of a scientific field, or their concerns or hesitations about where the field may head. Practically, this includes limiting props available to scientists (particularly excluding the use of slides), encouraging them to lead with feelings and commitments, as discussed above, and emphasising the importance of listening and turn-taking. This helps create conditions for all parties to become open to conversation.

Through attention to the practical and spatial structuring of dialogue, THFL aims to steer engagement away from pre-defined issues and 'information transfer' and towards emotional and empathetic connection and the creation of a common dialogic ground in which the relationship between researchers and members of the public is one of collaboratively identifying and exploring interconnected scientific and societal futures. In their work that adopted a similar conversational approach, Stofer et al. [2019] suggest that engagement may be promoted by the motivation and preparation of the scientists to involve members of the public's own experiences more — 'high engagement' in their study always involved the 'expert' asking questions of the members of the public. This questioning must always be partnered with listening and responsiveness and foregrounds public views, concerns and attachments to discovery science in conversation so that they can be discussed openly [de Roo et al., 2024; Reincke, Pieterman-Bos, Bredenoord & van Mil, 2024]. As one public attendee at THFL described, the event was:

> *"an opportunity to think afresh — blue sky thinking so we can take a bit of control, rather than feeling 'done to"'*

The consequence, we hope, of flattening power relations within THFL is to support symmetrical impact, neither simply influencing science policy (in the short term) nor fostering a scientifically literate or more supportive public, but enabling new configurations of 'socially robust' science by fostering mutual regard. Thus, for example, Davies et al. [2009] suggest

that dialogue events can function as sites of learning that form the basis for a gradual change in relationships between science and society as dialogue around controversial issues initiates a ripple effect of activity. This understanding of impact is supported both by an idea of dialogue as enabling the creation of new and shared understandings and positions, but also as an activity that affects a change in how participants regard one another. As a result of dialogue, participants may experience attitudinal changes in their thinking and feelings [Hennessy, 2011; Wegerif et al., 2019] — but not only towards the subject or field of discussion but also toward themselves and their co-participants [c.f. van Baalen et al., 2021]. High-quality, reciprocal dialogue can serve as an indicator to members of the public of the trustworthiness of scientists, demonstrating care for communities, shared values, and openness to external views [Peterman, Robertson Evia, Cloyd & Besley, 2017]. For scientists, conversations repeatedly led to comments on the quality of questions and the strength of commitments that they encounter, fostering respect and, potentially, greater scientific trust in the public as competent and motivated interlocutors.

The ability of dialogue to support the formation of mutual regard is seen in the comments left by scientists who took part in THFL whose feedback expressed surprise at the level of concern or unhappiness associated with applications of new technology, while acknowledging that it was "interesting that people had good reasons to worry". Researchers also commented on the quality of public conversations and the need for humility and patience in engagement. Thus, scientists commented that take-home messages for them were about the need to:

> *"be patient with people and listen to what they say. You might find yourself in interesting conversations"*

They also described the value of:

> *"talk[ing] to the public or anyone outside your usual environment! They will ask questions you've never thought about"*

It is here — through shared understandings and mutual regard — that one wider 'political' impact of dialogue lies — not in the immediate or short-term effects on policy, but in affecting dispositions and building relationships of mutual responsiveness that support a longer term 'ripple' through engaged communities. Such impact, however, requires work. As one researcher highlighted, the interactions showed the heterogeneity of the public, that "people are very varied and it's hard to say what they want". Given this, it is important to recognise that the emergence of shared understandings through dialogue will be a slow and long-term project requiring more than fifteen minutes of conversation.

3 ▪ Conclusions

In this Practice Insight, we have described The Hopes and Fears Lab, a project that aims to address some of the core challenges associated with public engagement with discovery science: the focus on application, the difficulty of establishing dialogue, and the lack of policy impact. THFL aims to create opportunities for engagement and connection with discovery science that do not immediately concentrate on applications, but start somewhere

different, with emotional connections. It does so by paying close attention to what dialogue involves, and how setting and space shape engagement interactions. We have drawn on the lessons from the project evaluation to describe how THFL works to build these emotional connections, to build spaces for dialogue, and enable relations of mutual regard between scientists and the public.

The 'mini conversations' of THFL provide researchers and members of the public with opportunities to explore new ways of interacting and can enable productive and meaningful dialogue between members of the public and scientists. In the future, we will continue to expand data collection and our understanding of how this approach works and can evolve. Nevertheless, the experience to date also shows that there is some way to go in building good dialogues around discovery science — the 'ripple' of impact created through the conversations needs supporting and reinforcing. If it is to spread and take hold, further effort is needed to enable a wider cross-section of both scientists and the public to 'get on the bus', and we need further attention to, and evidence on, what constitutes 'good dialogue' around discovery science. In this project, we explored the conditions that enable dialogue to flow — where as much attention is paid to the preparatory work before the dialogue as there is to the dialogue itself. We will use this to build the evidence base of how to design and deliver effective engagement interactions between discovery scientists and members of the public so that, ultimately, these can be delivered within any scientific discipline and any public audience.

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References

Bohm, D. (2004). *On dialogue* (2nd ed.). London, U.K.: Routledge.

Bultitude, K. & Sardo, A. M. (2012). Leisure and pleasure: science events in unusual locations. *International Journal of Science Education 34* (18), 2775–2795. doi:10.1080/09500693.2012.664293

Calvert, J. (2006). What's special about basic research? *Science, Technology, & Human Values 31* (2), 199–220. doi:10.1177/0162243905283642

Connected by Data, Hopkins van Mil (2023). *People's panel on AI summary findings*. London, U.K.: Connected by Data. Retrieved from http://connectedbydata.org/projects/2023-peoples-panel-on-ai

Davies, S. R. (2019). Science communication as emotion work: negotiating curiosity and wonder at a science festival. *Science as Culture 28* (4), 538–561. doi:10.1080/09505431.2019.1597035

Davies, S. R. & Horst, M. (2016). *Science communication: culture, identity and citizenship* (1st ed.). London, U.K.: Palgrave Macmillan. doi:10.1057/978-1-137-50366-4

Davies, S. R., McCallie, E., Simonsson, E., Lehr, J. L. & Duensing, S. (2009). Discussing dialogue: perspectives on the value of science dialogue events that do not inform policy. *Public Understanding of Science 18* (3), 338–353. doi:10.1177/0963662507079760

Dawson, E. (2018). Reimagining publics and (non) participation: exploring exclusion from science communication through the experiences of low-income, minority ethnic groups. *Public Understanding of Science 27* (7), 772–786. doi:10.1177/0963662517750072

Dawson, E., Hughes, S., Lock, S. J. & Wahome, M. (2022). Exploring the politics of science communication research: looking at science communication from a social justice perspective. *JCOM 21* (07), C05. doi:10.22323/2.21070305

de Roo, N., Metze, T. & Leeuwis, C. (2024). University-led dialogues with society: balancing informing and listening? *JCOM 23* (01), N02. doi:10.22323/2.23010802

Dijkstra, A. (2017). Analysing Dutch science cafés to better understand the science-society relationship. *JCOM 16* (01), A03. doi:10.22323/2.16010203

Doney, D. J. & Wegerif, P. R. (2017). *Measuring open-mindedness*. London, U.K.: Tony Blair Institute for Global Change.

Evia, J. R. & Peterman, K. (2020). Understanding engagement with science festivals: who are the engaged? *Visitor Studies 23* (1), 66–81. doi:10.1080/10645578.2020.1750276

Henke, C. R. & Gieryn, T. F. (2008). Sites of scientific practice: the enduring importance of place. In *The handbook of science and technology studies* (p. 353). Cambridge, MA, U.S.A.: The MIT Press.

Hennessy, S. (2011). The role of digital artefacts on the interactive whiteboard in supporting classroom dialogue: dialogue and IWB artefacts. *Journal of Computer Assisted Learning 27* (6), 463–489. doi:10.1111/j.1365-2729.2011.00416.x

Hughes, S. (2024). Hearts and minds: the technopolitical role of affect in sociotechnical imaginaries. *Social Studies of Science*. doi:10.1177/03063127241257489

Jensen, E. & Buckley, N. (2014). Why people attend science festivals: Interests, motivations and self-reported benefits of public engagement with research. *Public Understanding of Science 23* (5), 557–573. doi:10.1177/0963662512458624

Lin, H.-s., Lawrenz, F., Lin, S.-F. & Hong, Z.-R. (2013). Relationships among affective factors and preferred engagement in science-related activities. *Public Understanding of Science 22* (8), 941–954. doi:10.1177/0963662511429412

Marks, N. J. & Russell, A. W. (2015). Public engagement in biosciences and biotechnologies: reflections on the role of sociology and STS. *Journal of Sociology 51* (1), 97–115. doi:10.1177/1440783314562503

Middleton, A., Costa, A., Milne, R., Patch, C., Robarts, L., Tomlin, B., … Parry, V. (2023). The legacy of language: what we say and what people hear, when we talk about genomics. *Human Genetics and Genomics Advances 4* (4), 100231. doi:10.1016/j.xhgg.2023.100231

Newman, T. P., Brossard, D., Scheufele, D. A., Chen, K., Qian, Y., Cate, A. & Middleton, L. (2021). *Assessing the scholarship of public engagement with basic science*. Report for The Kavli Foundation as part of the Science Public Engagement Partnership. Madison, WI, U.S.A.: University of Wisconsin-Madison.

Noddings, N. (1994). Conversation as moral education. *Journal of Moral Education 23* (2), 107–118. doi:10.1080/0305724940230201

O'Malley, R. C., Slattery, J. P., Baxter, C. L. & Hinman, K. (2021). Science engagement with faith communities: respecting identity, culture and worldview. *JCOM 20* (01), C11. doi:10.22323/2.20010311

Peterman, K., Robertson Evia, J., Cloyd, E. & Besley, J. C. (2017). Assessing public engagement outcomes by the use of an outcome expectations scale for scientists. *Science Communication 39* (6), 782–797. doi:10.1177/1075547017738018

Ramon y Cajal, S. (2008). *Reglas y consejos sobre investigación científica*. Original publication date 1899. Madrid, Spain: CSIC Press.

Reincke, C. M., Pieterman-Bos, A., Bredenoord, A. L. & van Mil, M. H. W. (2024). Learning (how) to listen: a key aspect in training future scientists for meaningful dialogue with society. *International Journal of Science Education, Part B*, 1–16. doi:10.1080/21548455.2024.2347531

Robertson Evia, J., Peterman, K., Cloyd, E. & Besley, J. (2018). Validating a scale that measures scientists' self-efficacy for public engagement with science. *International Journal of Science Education, Part B 8* (1), 40–52. doi:10.1080/21548455.2017.1377852

Sampson, C. & Atkinson, P. (2013). The golden star: an emotional repertoire of scientific discovery and legacy. *The Sociological Review 61* (3), 573–590. doi:10.1111/1467-954x.12064

Saunders, A. & Moles, K. (2013). The spatial practice of public engagement: 'doing' geography in the South Wales valleys. *Social & Cultural Geography 14* (1), 23–40. doi:10.1080/14649365.2012.733407

Selin, C., Rawlings, K. C., de Ridder-Vignone, K., Sadowski, J., Altamirano Allende, C., Gano, G., … Guston, D. H. (2017). Experiments in engagement: designing public engagement with science and technology for capacity building. *Public Understanding of Science 26* (6), 634–649. doi:10.1177/0963662515620970

Smallman, M., Lock, S. J. & Miller, S. (2020). United Kingdom: the developing relationship between science and society. In T. Gascoigne, B. Schiele, J. Leach, M. Riedlinger, B. V. Lewenstein, L. Massarani & P. Broks (Eds.), *Communicating science: a global perspective* (pp. 931–957). doi:10.22459/cs.2020.39

Staus, N. L. & Falk, J. H. (2017). The role of emotion in informal science learning: testing an exploratory model. *Mind, Brain and Education 11* (2), 45–53. doi:10.1111/mbe.12139

Stilgoe, J., Lock, S. J. & Wilsdon, J. (2014). Why should we promote public engagement with science? *Public Understanding of Science 23* (1), 4–15. doi:10.1177/0963662513518154

Stofer, K. A., Rujimora, J., Sblendorio, D., Duqueney, E., Tatineni, M. & Gaudier, G. (2019). Casual conversations in everyday spaces can promote high public engagement with science. *International Journal of Science Education, Part B 9* (4), 296–311. doi:10.1080/21548455.2019.1670882

Tutton, R. (2021). Sociotechnical imaginaries and techno-optimism: examining outer space utopias of Silicon Valley. *Science as Culture 30* (3), 416–439. doi:10.1080/09505431.2020.1841151

van Baalen, S., Gouman, J., Houtman, D., Vijlbrief, B., Riedijk, S. & Verhoef, P. (2021). The DNA-dialogue: a broad societal dialogue about human germline genome editing in the Netherlands. *The CRISPR Journal 4* (4), 616–625. doi:10.1089/crispr.2021.0057

van der Sanden, M. C. A. & Meijman, F. J. (2008). Dialogue guides awareness and understanding of science: an essay on different goals of dialogue leading to different science communication approaches. *Public Understanding of Science 17* (1), 89–103. doi:10.1177/0963662506067376

Wegerif, R., Doney, J., Richards, A., Mansour, N., Larkin, S. & Jamison, I. (2019). Exploring the ontological dimension of dialogic education through an evaluation of the impact of Internet mediated dialogue across cultural difference. *Learning, Culture and Social Interaction 20*, 80–89. doi:10.1016/j.lcsi.2017.10.003

White, P. (2009). Introduction. *Isis 100* (4), 792–797. doi:10.1086/652019

Yuan, S., Oshita, T., AbiGhannam, N., Dudo, A., Besley, J. C. & Koh, H. E. (2017). Two-way communication between scientists and the public: a view from science communication trainers in North America. *International Journal of Science Education, Part B 7* (4), 341–355. doi:10.1080/21548455.2017.1350789

Zorn, T. E., Roper, J., Weaver, C. K. & Rigby, C. (2010). Influence in science dialogue: individual attitude changes as a result of dialogue between laypersons and scientists. *Public Understanding of Science 21* (7), 848–864. doi:10.1177/0963662510386292

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