

Introduction

Science communication as the social conversation around science

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Introduction: what is a textbook of science communication?

Science communication studies have attracted continuously growing attention since the first edition of this handbook was published in 2008. The output of and outlets for journal papers on science communication topics are increasing steadily. Training courses, educational programmes and research clusters are generating demand for practice manuals and study resources. While this is a benign setting for publications like this volume, the shifting sands of science communication practice and policy create significant challenges in offering a settled view of the field. For some, this is one of the principal attractions of science communication – that it is a developing field with moving and porous boundaries and intellectually stimulating challenges. New and potentially fruitful perspectives, often very different from each other, are being offered periodically. At the same time, some offerings appear ‘new’ only because they have paid inadequate attention to the history of the field.

This handbook has aimed in each edition to summarise the state-of-the-art of science communication studies at the given time, but also in historical contexts, and acknowledging the complexities and contingencies of professional, volunteer and institutional practices in the field. Realising this aim in the situations we have faced raises an awkward question: What is a textbook or handbook of science communication? The notion of handbook is, at least semantically, related to that of a manual: the book is a guide for the work of the hand. This is at the origin of an understanding of a handbook as a set of tools and tips or a portfolio of strategies to communicate science (cf. Wilson 1998). This handbook tackles a series of critical questions that every science communicator and student in this field should consider: why, for whom, in which contexts and with which consequences is science communication shared and performed? Answering these questions implies an understanding of the actors, institutions, media, and contexts involved.

So, our imagined reader is studying the field, though not necessarily as a classroom student. The classroom is the context in which the *textbook* is situated more specifically, at

least in English. In German, the textbook is *Handbuch* and ‘textbook science’ (*Handbuchwissenschaft*) is the term coined by German scholar Ludwik Fleck in his classic *Genesis and Development of a Scientific Fact* (1935). For Fleck, textbooks are where you should look for the petrified, solid-rock, state of knowledge in a given scientific domain. In papers, conferences and discussions among specialists of each field, knowledge is moving, uncertain, complex and controversial. In school and university textbooks and popular contexts, it is simplified, black-boxed, taken for granted. For Thomas Kuhn (1962), who drew great inspiration from Fleck’s work, this is the static, frozen picture of a paradigm. Traditionally, textbooks were in the same relation to the dynamic of contemporary research as astronomical images to stars – their light taking so long to reach us that what we see may be million years old. The situation of the textbook has changed dramatically during recent decades. Changes in communication technology as well as in research and communication practices have made multiple levels of science content and discussion potentially and actually available to students and lay people. The student that Fleck or Kuhn conceived was fixed in place, with a textbook and a teacher as their guiding star, plus maybe some stardust from popularisation as complementary source of information – or more likely, inspiration and fascination. In our age, the textbook is just one, and often marginal, piece of an extraordinary armoury of sources available at the touch of a fingertip. Thus, a student of physics, for example, can easily be exposed (not just in the web, but also in science festivals) to harsh controversial contemporary discussions about quantum theory that are omitted from textbooks; a student of virology may consider her/his textbook obsolete since it does not deal with the coronavirus pandemic, and so on. In this communicative landscape, the very notion of textbooks and handbooks should be addressed in a new and different way.

If this poses a challenge to any research domain, it is even more challenging in a domain like science communication. Even in Fleck’s and Kuhn’s terms, it was never fully clear what a handbook of science communication should look like, posing difficult questions to authors and teachers: what is the state of the art of science communication? Does such a thing exist? Are we going to present yesterday’s frozen picture or today’s blurred, moving picture? In recent years, some scholars in the field have adopted the handle of ‘science of science communication’. Would this lead, in textbooks or coursework, to teaching the ‘history of the science of science communication’, or even ‘the science of the science of science communication’?

While we are aware of those challenges, we do not have a straightforward solution. Our vision of a twenty-first century textbook in science communication is certainly not Kuhnian. Yet, we do not take the opposite – and often widespread – position that we should get rid of textbooks altogether. The first two editions of this handbook, together with other texts in the field, have been widely used and referenced. There is, we believe, still a place for handbooks in twenty-first century science and twenty-first century science communication. And, actually, based on our experience, we could go so far as arguing that handbooks in science communication have never been more needed than today, perhaps not any more as a guiding star but more as a compass and map to navigate in an ever vaster and more open ocean of resources.

Since the publication of the first edition of this handbook, comparable and related volumes have been produced by other publishers, e.g., *Oxford Handbook of the Science of*

Science Communication (Jamieson et al. 2017) and *Science Communication* (Leßmöllmann et al. 2020), which was published in a series of handbooks on communication science. From our present publisher have also come the *Routledge Handbook of Environment and Communication* (Hansen and Cox 2015) and, co-edited by two contributors to this volume, the *Routledge Handbook of Art, Science and Technology Studies* (Rogers et al. 2021). The multiplicity and variety of such publications should contribute to contemporary debates in a continuous and dynamic conversation between what research and scholarly reflection can teach us and what we can learn by relating them to present and future challenges. Some classic themes – the roles of science journalism, of scientific experts, and of museums, also the challenges of citizen engagement, the meaning of scientific culture – are still, and perhaps even more, central and our approach to these themes can now benefit from the knowledge of decades of research and reflection.

Divergences and debates

Over the past two decades, institutionalisation, professionalisation and diversification have become increasingly evident in both the study and practice of science communication. These trends help solidify the infrastructure and strengthen the culture of science communication, but they also can create tensions, and these have the potential to be constructive or disruptive. For example, the formats and actors of science communication can be seen to diversify, in part at least as a consequence of media innovations, while the professionalisation of science communication through training and qualifications and its institutionalisation in research centres, higher education institutions and state agencies tends to support more or less standardised strategies. The practices of volunteer science communicators may not always sit comfortably with those of the newly emerging cadre of science communication professionals. How these tensions are negotiated in the coming years will have a critical influence on the development of the field of science communication. These tensions relate also to the challenges to science communication research that we identified in the introduction to the second edition of this handbook, including those we named as *New mediations*, *Collapsing communication contexts*, *Plural science and plural publics* and *Quality and evaluation*. All of these have been taken up in research and commentary of recent years, from various angles and with various outcomes.

As testified by our previous and present contributors, also by an anthology of ‘major works’ in the field (Bucchi and Trench 2016), history of science, anthropology, media studies, social psychology and other fields have all enriched our understanding of science communication and strengthened the quality of theoretical reflection and empirical research. Science communication studies include philosophically distinct tendencies to emphasise audience analysis through social research methods, or to emphasise understanding changing institutional contexts through sociological analysis or yet to emphasise interpretation of media and other social representations of science through discourse analysis and other cultural studies approaches. We might hope to see divergent tendencies in science communication research as signs of maturation of our field, but much depends too on how these divergences are articulated. This relates to a discussion of a decade ago of science communication as a discipline. In a contribution to that discussion, we referred to science communication as ‘an emerging discipline’ (Trench and Bucchi 2010). We now consider

that this view of science communication as a discipline-in-the-making should give way to one of science communication as an inherently, even joyously, interdisciplinary field.

From the early 2010s, the case has been made, mainly in the US, that there is or can be a ‘science of science communication’. This proposition has been put forward by leading scholars in the field, has attracted others from neighbouring fields, notably political communication and social psychology, and gathered support from major funders. In considering the feasibility of a ‘science of science communication’ we need to address the larger question, particularly pertinent in the English language, Is there a science of communication? In French and German, for example, this is hardly a question: *les sciences* and *Wissenschaft* cover almost the full range of formal knowledge production. These designations of science include what is in English generally bracketed out as social sciences and humanities, to distinguish them from *hard* or *exact* science, namely the physical, material and life sciences. Philosophically, that distinction resides in the separation of the subject-researcher from the object-nature; this does not apply in the study of society, language and culture, for example, in which the researcher is themselves thoroughly enmeshed (for more on this, see also Cassidy in this volume). For there to be a communication science, this distinction needs at least to be acknowledged. But some enthusiasts for the science of science communication (e.g., Kahan 2015) argue just to get on with the work, and not to dwell on the definitions. A more recent collected volume, published in a German series on communication science, refers to science of science communication and science communication research as interchangeable, drawing on decades-long disciplines in the humanities, notably linguistics (Leßmöllmann et al. 2020).

A longer-running, though related, argument has been collecting strength through the decade, that there is a harmful gap between research and practice that needs to be closed, principally by reorienting research. A commissioned report (National Academies of Sciences, Engineering and Medicine 2017) set out an agenda for research in the field that could support more effective science communication practice. In this agenda, achieving effectiveness is strongly linked with applying notions of strategic communication to science communication, that is, targeting closely defined publics with tailored messages. The science communication research underlying this approach— as reflected in the NASEM report’s bibliography — presents the field as recently emerging and largely US-based; the strategic pitch for political effectiveness reduces the history, geography and complexity of the field.

Some protagonists in this debate seek to ascribe to research a role in service of practice or in provision of evidence to guide practice, while others insist on the relative autonomy of research as a practice in itself. There are echoes here of a debate in communication studies over 60 years ago between ‘administrative’ and ‘critical’ research, the former dedicated to solving ‘real-world’ problems, the latter more focused on generating new theories and concepts. In science communication, there is, at the very least, a widespread awareness of the pertinence of this relationship. However, some forms of the argument for closing the gap appear as a case for a full instrumentalisation of research serving practice.

Much science communication research is properly directed to working out conceptual relationships that may, sometimes remotely, underpin approaches to policy and practice. Understanding how science communication *really* works means bringing the tools *and*

theories of social research in general to bear, and the resulting analyses may often not translate to practical recommendations. Leßmöllmann (2020: 679) observes that the perceived gap between research and practice in science communication is the

the same gap between science and its transfer to laypeople or practitioners that other fields grapple with ... Not every practical problem is examinable with scientific methods, and not every scientific outcome from science of science communication research can be translated into practical advice.

More recently, advocacy has emerged for ‘evidence-based science communication’, as a way of addressing the research–practice ‘double disconnect’ (Jensen and Gerber 2020). This argument has clearly some relevance since it would be unreasonable to practice science communication today as if the rich body of knowledge and results produced by research in this area did not exist. This is, indeed, also what this volume is about: to lay out a common repertoire and repository of empirical study and theoretical reflection. This has obvious value for readers who will engage themselves in research on science communication but also for readers who are, in different ways, professionally involved in science communication activities: as scientists, communicators, staff working in research organisations, public institutions, policy makers, companies, media outlets. Being exposed to existing research on science communication may help them better understand their roles and practices and their prospective audiences, drawing upon examples and evaluating continuously their communication activities.

The implications of advocating ‘evidence-based science communication’, however, seem stronger than this, verging on the prescriptive. Should all science communication be evidence-based? And if so, on which evidence? As with all rich research fields, science communication has produced different theorisations and different – sometimes even potentially contradictory – evidence. The stock of knowledge that most scholars would potentially recognise as common ground is expressed more in terms of concepts than specific results; also, it is constantly moving, expanding and revising itself. Should the latest evidence be the guiding light of science communication practice or rather should that be an awareness of the field as a whole, from its classic pioneering theorising to contemporary debates and doubts? Proposing ‘evidence’ as a prescriptive resource underscores that science communication involves a high number of variables (in terms of actors, contexts, aims, etc.) that make it difficult for any actor, however knowledgeable, to anchor or even judge the process compared to available evidence. We should not be naive to the fact that evidence in our field, as in other fields (think about the coronavirus pandemic), can be selectively invoked depending on the aims of actors or organisations.

The evidence agenda belies the increasing variety and cultural diversity of science communication practices on a global scale; standard recipes or gold standards can hardly be universally agreed and applied. Much of the evidence produced in our field so far refers to Europe, North America and Oceania contexts of research and practice, but also with a significant and increasing representation of Latin America. Should such evidence guide science communication practice in Africa or Asia? Even within the geographical and cultural areas that have become the primary sources, we have witnessed substantial changes in the guiding political contexts of science communication. Think, for example,

of the multiple shifts of European policy in this area during the last three decades from ‘raising public awareness’ to ‘science and society’ and ‘science in society’, to ‘responsible research and innovation’. Science communication practice has had to adapt to these shifts; science communication research likewise had to adapt, sometimes to respond, on some occasions to reflect critically on them. But some of the evidence produced within one of the past frameworks has little but historical value today; and the same fate can be expected for some of the research produced today. In three editions of this handbook and in the ‘major works’ anthology, we have tried to document those shifts, always with an inquiring, critical perspective. Our priority has been – and still is – to offer the reader an overview of concepts and ideas that can be valuable also in the face of diverse and changing practices, evidence and policies.

As seen clearly in the coronavirus crisis, science communication, in all its articulations and at different levels, is relevant to every single citizen. However, the tendencies outlined above have the effect of limiting the scope of science communication research and advice very largely to scientific institutions’ and agencies’ strategies. ‘Evidence’ is a valuable but narrow term that speaks mostly to professionals. ‘Quality’, ‘trust’, ‘expert’, ‘engagement’, ‘disengagement’ are keywords that matter to society, politics and research as a whole. We believe science communication research and theories should contribute to a more informed, yet open, discussion of science in society at all levels, and relating to all concerned actors.

Redefining the field

Views of the role of research relate closely to different definitions of science communication. Many contemporary definitions focus on manifest or latent *purposes* of science communication practice, such as the transfer of information or provision of learning or even stronger political expectations – paternalistic in their mild form, disciplining the audience in their strong version. For reasons of continuity and homogeneity, the title of the previous two editions of this handbook, referring to ‘public communication of science and technology’, has been maintained. It represents part of a long tradition of research and practice in the field, also identifying the leading community and international network (‘PCST – the global network for science communication’). However, we recognise the recent advances in locating public communication of science as part of a continuous process, rather than as a terminal, residual stage. There are different levels, media, contexts and audiences, but we believe no sharp distinction (even more so in the age of digital media and open science challenges) can be drawn between public and non-public communication of science. So, we use the term ‘science communication’ most often, recognising its rich variety and diversity, encompassing informal, non-purposive communication as well as that which is targeted and strategic. Our view emphasises the relevance of cultural, historical, societal and other contexts of science communication, considering such contexts to be inextricably entwined with the content and actors of communication.

The cultural context has been given priority in the present edition of the handbook, influencing both the revisions of existing chapters and the addition of new chapters. In taking this direction we were responding to a ‘cultural turn’, as we might call it, in

science communication practice. We perceive an increasing variety of formats being deployed in presenting science in public, and an increasing proportion of those formats drawing on performance, musical and visual arts. For some, this shift is expressed in the adoption of the acronym, STEAM, to replace the longer-established STEM: arts are inserted – perhaps instrumentally, as Halpern and Rogers consider in their new chapter in this volume – into the combination of science technology, engineering and mathematics. At the same time, and in a rather different spirit, a new model of science centre is being applied across the world based on ‘colliding’ science and art. The Science Gallery International network has grown out of the experience of a small centre established in Trinity College Dublin in 2008. As of 2020, there are sister galleries recently opened, or due to open soon, in Australia, Britain, India, Italy and United States. In these and other venues, art-science appears as a distinct model of science communication. This and other significant experiences represent a broader, non-prescriptive, non-strategic view of science communication, encompassing a variety of languages and forms of expressions that get visitors to think about, respond to and discuss science and its role in society. In this view, science communication is not about displaying stabilised knowledge (the Science Gallery does not have any permanent collection of objects to display, and explanation panels are minimal) but something that occurs in the encounter itself of different forms of expertise, communication, creation and visitors’ engagement.

Such developments encourage the consideration of science communication as culture, requiring analysis with the tools and concepts of cultural studies; this theme is taken up here in a new chapter by Davies and Horst, extending the work done in *Science Communication – culture, identity and citizenship* (Davies and Horst 2016). These authors also contributed to a more recent analysis of the same issue in a context of storytelling (Davies et al. 2019, 3), where it is observed

rather than public communication [of science] being about the transfer of certain facts—the nature of DNA, the scientific method, whether vaccines cause autism—it is instead about how particular societies or groups explain the world. Understanding science communication as meaning-making therefore draws our attention to its functions at the level of shared identities and imaginations, alongside its undoubted role in disseminating particular scientific notions.

Over 20 years ago Jean-Marc Lévy-Leblond, as mentioned in our Introduction to the second edition, proposed that science communication was about the *mise-en-culture* of science (Lévy-Leblond 1996). He deliberately suggested a connection with the putting-on-stage (*mise-en-scène*) of a piece of theatre. He may also have been hinting at the application in science of *mise-en-culture*, which refers to the cultivation of organisms *in-vitro*. There is no corresponding phrase in English for the theatrical version, hence the use of *mise-en-scène* in English too, but we have that notion in mind when we refer to the infusion of science into general culture and the percolation of science through culture. Writing on science in popular culture Bucchi (2008: 140) described the interchanges of ‘ideas circulating in the public arena and in the specialist discourse’ as ‘cross-talk’; this was proposed as ‘a different understanding of science communication’ – different from the dominant model of information

transfer. In the same collection of essays, Trench (2008: 131) named as conversation the ‘base communication model’ underlying the science communication model of participation, situated in a triad with deficit and dialogue models. In a further contribution to that collection Bauer (2008: 23) outlined a possible ‘paradigm change for science communication’ proposing that ‘cultivating public conversations that are highly scientifically literate, but also sceptical of the hyperbolic claims of professional knowledge marketers’ could be a mark of ‘universally desirable’ science and technology in society. Bauer later (2009: 235) referred to the challenge of mapping ‘the societal conversation of science’ as equivalent to showing ‘the presence of science in public conversations’. These approaches to science communication as part of social cross-talk and conversation were not developed much further at that time (but see Bauer and Falade in this volume). However, in the second edition of this handbook, we suggested that the object of science communication research might be expressed as ‘how society talks about science’ (Bucchi and Trench 2014: 10) and Trench (2018) spoke of science communication as ‘society telling stories about science ... [including] everyday stories about science on radio programmes, in social networks, in artists’ studios, in cafés and bars’. Add to that the novels, pop and rock songs, theatre and comedy performances that give presence to science in public and popular culture and in the everyday, and we come to a definition: *Science communication is the social conversation around science.*

Two related usages of *conversation* are in play here: a mode of interactive communication that is set in contrast with dissemination or other hierarchical modes; a concept that embraces all that is being said on a certain matter in society. Our inclusive definition of science communication not only validates activities such as science cafés and science comedy that are oriented to pleasure, but also recognises as part of the wider practice of science communication the ‘spontaneous’ use and widespread percolation in popular culture of images and ideas from and related to science. Hozier, an Irish singer-songwriter with an international audience, picked up from a TED Talk by astrophysicist Katie Mack the notion that the expansion of the universe could be reversed. He named Mack in his song, No Plan: ‘As Mack said, there will be darkness again’. This naming found its way into the Wikipedia entry for Mack¹, the pair met in 2019 after one of his concerts and tweeted excitedly about the encounter, and so the ‘conversation’ has continued on Twitter and by other means, continually amplifying Mack’s thesis. In her book, *The End of Everything (Astrophysically Speaking)* (2020), she returned the compliment to Hozier, by quoting him. Thus, science communication may be found where there are no science communicators, self-designated or not.

Conversation also emphasises long-term continuity in science communication; the cover illustration on this volume depicts a ‘scientific conversazione’, a widely practised form of public science in the 19th century. Going back further, one of the very first best-sellers in science communication, Robert Hooke’s *Micrographia* (1665), a book consisting of sixty illustrations, mostly drawn from observations at the microscope, was originally designed to *include in the conversation* King Charles II, who was expected to pay a visit to the Royal Society; his Majesty could obviously not be asked to sit together with the fellows and look into the microscope (Nicolson 1956). Also in the 17th century, Flemish painters Roelant and Jan Savery painted pictures of the dodo bird, of which the last living exemplar was seen in 1662 in Mauritius. Two centuries later, mathematician and writer

Charles Dodgson introduced the bird as a character in *Alice's Adventures in Wonderland*, authored under the pseudonym of Lewis Carroll (1865). He was likely inspired by a Savery image of a dodo that he had seen in Oxford in guiding his illustrator, John Tenniel. In the same period naturalist Richard Owen (1866) was figuring out how to reconstruct fossil remains of a dodo sent to him at the British Museum and used Roelant Savery's paintings as a source. Three years later Owen acknowledged he had been misled by such paintings to represent the dodo as 'squat and overly obese' (Cheke and McOran-Campbell 2009: 45; see also Parish 2013; Pender Hume et al. 2004), but by then the image of the clumsy and funny dodo had stuck. We see here an interesting conversation loop from images in art influencing science and literature and settling in popular culture (Bucchi and Canadelli 2015).

A characteristic of conversation articulated in communication studies and philosophy is that it is unpredictable and open-ended; we have deliberately adopted this characteristic in our view. Franco-Moroccan philosopher Ali Benmakhlouf (2016) stresses the unknowable trajectory of conversation but also its difficulties; for this, he derives insights from *Alice's Adventures in Wonderland*, which features many false starts and misunderstandings in conversations. Ideas, information or images from and about science can spread widely, as one conversation opens another: in the process, the ideas, information and ideas inevitably acquire new meanings. This process does not always or only depart from and return to science, its actors and its institutions; it swirls in society, somewhat independently and with interruptions, and that is what we intend to capture with the preposition, *around*.

For key thinkers on the public like Dewey and Habermas talk and conversation were basic ingredients of civil, democratic and public life. Dewey (1927) declared the decline of conversation '*the problem of the public*'. Communications theorist James Carey advocated strongly from the 1970s for conversation as fundamental to democracy and for journalism as facilitating that conversation. Carey liked to quote a philosopher-critic of an earlier generation, Kenneth Burke: 'Life is a conversation. When we enter it, it is already going on'. By the 1990s communications scholar Michael Schudson was writing of the 'obsession' with, and 'romance' of, conversation, drawing attention to differences between rules-bound problem-solving conversation, which can be difficult and even boring, and sociable conversation that is 'an end-in-itself, an aesthetic pleasure' (Schudson 1997: 300). In turn, Finnish scholar Risto Kunelius (2001: 45) questioned Schudson's hard distinctions:

If we deem only certain kinds of conversations democratically virtuous, we run the risk of uprooting democratic interaction from its cultural settings, and glorifying something that is at the same time in great danger of becoming irrelevant and hollow ... the 'public pleasure' of the participants is an important (preliminary) piece of evidence against the categorical idea of the uncomfortable and dangerous nature of public conversations.

There may well be useful analogies to be drawn here with conversations on and around science, and a common tendency to prioritise those virtuous ones that (aim to) provide learning over those pleasurable ones that (merely) entertain. Also

relevant to science communication, with its frequently asymmetrical relations, is the observation of US communications scholar John Durham Peters that ‘conversation is no more free of history, power, and control than any other form of communication’ (2000). In other words, conversation can be manipulated and is not *necessarily* open and equitable. Many attributes can be a handicap to participation, including gender, educational level, ethnicity and language. It takes conscious action to address these imbalances and exclusions. Mexican cultural theorist Gabriel Zaid declared boldly (2003): culture is conversation; to publish a book is to insert it into public conversation. But that conversation does not have infinite capacity, as we still have to deal with the multiplicity of languages and the diversity of conversations.

Many meanings of conversation can be accommodated in this discussion, the structured engagement across society, the sponsored consultation, the spontaneous, even unruly café chat, the strongly centred national conversation carried by a desire to shift public opinion in a certain direction and the Internet-mediated flow of information between experts and publics.² The conversation is both singular – *the* social conversation – and plural – the dispersed conversations of communities and colleagues, including the behind-the-scenes conversations of scientists that are increasingly coming into public view through social networks. Scientists’ cafeteria and corridor conversations resonate with public chat and feed into expert presentations for lay audiences, touching both ends of a spectrum that we represent graphically (Figure 1.1), illustrating various kinds of conversation that bear on science in society in diverse ways. This is an arrangement that is itself adjustable: the spectrum may be partially or fully extended at a given time. New formats of science communication, notably art-science projects, may well facilitate conversations around science, and with scientists, of kinds not yet envisaged (see Halpern and Rogers in this volume for discussion of conversations embodied in and stimulated by art-science works). The range of communication modes is continually expanding, but not just in the direction of more participation, or co-creation, as a ‘progressivist’ point of view might suggest. In the context of the Covid-19 crisis, science was invoked by politicians, or scientific legitimacy was claimed by advisers to governments, to support measures that sought total compliance and thus limited conversation.

This perspective on science communication as social conversation/s has implications for science communication research, both applied and fundamental. It gives higher priority to questions of ethics, equity, inclusion, quality and history in the analysis of science communication. It suggests that evaluation of practice might be done in terms of how, and how much, a given practice or set of practices stimulate wider conversation. It also points to a bigger context for analysis and reflection on science communication’s social role and responsibility. Long-standing issues of impact and effectiveness of science communication are put into a new context, in which questions are raised about the values and social purposes guiding science communication and about the largely tacit political and economic connotations of keywords like ‘responsible innovation’ or of fashionable formats for presenting science to young audiences, as well as their long-term consequences for the public perception and social role of science. A narrow definition of science communication has often carried with it a narrow definition of quality: impact, effectiveness, expectations of quick fixes and solutions. Viewing science communication as social conversation expands and deepens also the quality challenge,

Frameworks of the social conversation around science

Base model	Dissemination					Dialogue					Participation			
	Deficit	Defence	Promotion	Popularisation	Outreach	Engagement	Consultation	Interactivity	Deliberation	Chat	Play	Co-creation	Film & fiction	Art-science
Sci-comm applications														
Aspects of science	Findings: finished knowledge					Issues: applications and implications of knowledge					Processes: interpreting and (re-) constructing knowledge			
Public uses	Information, awareness, learning					Questioning, opinion, discussion					Sharing, creating, enjoyment, critique			
Social perspectives	Science literacy: scientism, technocracy					Science in society: Mode-2, post-normal, post-academic					Society in science: civic science, citizen science			
Orientation	<div style="text-align: center;"> </div>					<div style="text-align: center;"> </div>								

Figure 1.1 Frameworks of the social conversation around science
Source: adapted from Trench (2008).

increasing the range of relevant points of views and stakeholders: the quality of a conversation can never be judged just by one of the parties to that conversation.

Conclusions

In this introductory chapter, we have reviewed some key trends and issues in science communication studies and advocated for variety and diversity in the field, resisting some tendencies with the potential (intended or unintended) to restrict its scope. We have revised some of our own views and revisited notions of communication as conversation to propose an inclusive definition of science communication as the social conversation around science. With this proposal, we intend to encourage those studying and practising science communication to see everywhere, and in the everyday, actual and possible communication of scientific information and ideas. We aim to stimulate science communication practitioners, students, educators and researchers to engage generously with the ever-broadening conversations around science.

Notes

- 1 [https://en.wikipedia.org/wiki/Katie_Mack_\(astrophysicist\)](https://en.wikipedia.org/wiki/Katie_Mack_(astrophysicist)).
- 2 This is represented in the online initiative, *The Conversation*, ‘working with more than 105,000 specialist scholars and researchers’; <https://theconversation.com/uk/10-ways-we-are-different>.

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