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Introduction

Mark Brake and Emma Weitkamp

In 1929, the legendary British theoretical physicist Paul Dirac hit Wisconsin. ‘The purest soul in physics’, as he was described by Niels Bohr, Dirac was in the north central United States to deliver a series of lectures at a local university.

Dirac was an unsung genius of physics, and had made a stunning breakthrough in 1928. Combining the theories of quantum mechanics and Einstein’s special relativity, Dirac had predicted the existence of antimatter, which makes up, at least in principle, half the universe.

Local reporters gathered to interview the great man. Though they lived during an era in which the cult of personality was far less pronounced than it is today, they’d all heard of Einstein. Besides, competition in journalism was keener than ever. Broadcast radio was in its infancy. Only earlier that decade, radio emerged as a novel means of communication, a fitting medium to report the new and exhilarating science of quantum mechanics.

Had the local reporters done their research, they may have found cause for concern. Dirac was achingly shy. Later, he even wanted to refuse the Nobel Prize in order to shun the publicity. But the scoop of journalists gathered around the esteemed professor knew little of his reticence.

Finally, a reporter from the *Wisconsin State Journal* broke the silence,

‘Now doctor will you give me in a few words the low-down on all your investigations?’

We can imagine the scene: the question posed, the reporters waiting, with baited-breath in anticipation of the professor’s profound reply.

‘No’, replied Dirac.

The story of Paul Dirac’s near-silent skirmish with the press is an amusing one, especially so in today’s world of the more media-savvy scientist.

Communicating science to the public – whether through the media, museums, or outreach – is now a burgeoning global industry, a rapidly growing field of multidisciplinary practice, education and research, throughout the world.

For in the last two or three decades, it seems as though scientists have been issued with an edict: *communicate, or else!* Gone are the days when indulging in the popular communication of science seemed like professional suicide. Nowadays, each and every aspiring young researcher is also expected to be a

practitioner, someone who is prepared to take science out of the laboratory, and into the culture.

Stemming from an initial concern amongst scientists and politicians that the wider public lacked an understanding and appreciation of science, the field has grown and developed rapidly. Grounded originally in a philosophy that saw the ‘public’ as lacking an understanding and appreciation of science, the field has now moved away from didactic, top-down approaches to communication to consider more inclusive approaches to communication that emphasize the need to engage a wider range of so-called ‘publics’ in decisions about science (see for example, Miller 2001).

In fact, Public Engagement in Science and Technology (PEST) continues to be a key priority as governments around the globe seek to encourage citizens to participate in debates about new and emerging science, such as nanotechnology and stem cells. Tackling global problems, such as climate change, whether on a personal or societal level also requires citizens to engage with science and technology. As stated in the House of Lords report, Science and Society,

direct dialogue with the public should move from being an optional add-on to science based policy making and to the activities of research organisations and learned institutions, and should become a normal and integral part of the process. (House of Lords 2000)

This priority to engage the public with science and technology underpins the theories and strategies that are explored in the following chapters, which discuss both practical techniques and the historical developments which underpin the philosophy of science communication and public engagement. Science communication focuses on dialogue between scientists, policy makers and laypeople. The one-way deficit philosophy of science communication, which was predicated on the idea that the lay person was somehow deficient in his knowledge of science, is now largely out of fashion.

This doesn’t mean that all science communication activities need to involve dialogue. Strategies that inform the public of new scientific research or excite the public about scientific discoveries are still important. The point is that the public are seen as having a role to play in decisions about science, such as funding and regulation.

The implementation of [Public Engagement with Science] in the science policy arena has helped to develop and articulate new understanding of and expectations for the relationship between science and publics in policy making and other contexts. (The Centre for Advancement of Informal Science Education – CAISE 2009)

New developments, new media

In exploring the opportunities and challenges faced by science communicators, this book delves into such wide ranging approaches to science communication

as fiction, film and festivals. Using such cultural forms may offer opportunities to reach out to new audiences or those who have traditionally been hard to reach. Music festivals, such as Glastonbury, may offer novel ways to reach young people, often one of the hardest groups to engage.

Other cultural institutions, such as museums, print and broadcast media have their own strengths and weaknesses. Museums and hands-on science centres, for example, reach family audiences and school groups offering the potential for in-depth engagement. However, these venues do not reach all socioeconomic groups equally and the depth of engagement varies depending on the event and activity. Broadcast and print media are traditionally seen as fairly passive ways of informing or educating people, but may reach large audiences.

New opportunities to reach out to and engage a wide range of people with science are developing at a rapid pace. The potential of social networking sites, podcasts and blogs for science communication remains under-researched. These new media may offer exciting and interactive ways of reaching both new and traditional audiences. The ‘anytime, anywhere’ nature of these media may appeal to the 24/7 society we now live in. Certainly they provide varied and as yet under-explored opportunities for creative approaches to PEST.

In sum, the tools, techniques and strategies available to science communicators continue to grow. As scientific issues clash with societal concerns the need for PEST will surely grow. Global social issues such as sustainability, distribution of natural resources and healthcare require citizen involvement in science policy both on local, national and international levels. These indicators point to a continuing need for the public to engage with science and technology.

This book about the communication of science is designed to help science communicators work through all of these demands. It provides an introduction to the main methods and issues of the field, in simple, clear and direct language. It is structured, presented and packaged in such a way as to provide an attractive and affordable introductory pocket guide to science communication, providing a must-have basic text for anyone involved in the field.

This book includes practical advice and exercises, grounded in those aspects of communication and learning theory likely to be of most immediate and practical use to teachers, trainers and students alike. The presented material is also accompanied by a sufficient historical and social context to make for an easier and more informative read.

The text also provides the student of science communication with a brief history of the field, together with practical advice on communicating science. Areas of science communication covered in subsequent chapters, fall into several broad areas: science communication between scientists, between scientists and the public, and between scientists and policy makers; communication on science and technology issues carried out within and between

governments, businesses and other organizations, and between governments, businesses, etc. and the general public and the role of the traditional and new media in science communication. The emphasis of the book is on providing practical guidance, a so-called ‘how to’ approach, but within the context of the main theoretical movements both underpinning the field and driving it forward today.

Structure of the book

Introducing Science Communication is presented in two distinct sections. Part I, Science Communication: In Context, comprises those chapters that are more theoretically informed and provide the background material to the practical guide presented in Part II, Science Communication: In Practice.

Part I opens with The History and Development of Science and its Communication, the subject of Chapter 1, which focuses on the nature of science and the place of science within society. Given that this book is a guide to science communication, it would not be complete without an in-depth introduction to the nature of science itself. The field has often neglected such an articulation of science. And yet an understanding of the nature of science cannot be taken for granted. Especially as fields such as history, philosophy and sociology reveal the challenges in the public’s engagement with science and also that controversies in the scientific sphere are often a reflection of deeper political struggles in society itself. This chapter, therefore, provides a context and rationale for the communication of science by locating science firmly in a historical and social context. It highlights the role of science in economic development, as well as in social progress. The chapter considers the history of the practical nature of science and its relationship to technique, in order to develop an appreciation of some of the major ways in which these relations inform the communication of science.

The link between science and culture is explored in Chapter 2. Science in Popular Culture considers how science informs and contributes to popular cultural forms, including literature, cinema and theatre. The chapter focuses specifically on science in fictional contexts, considering how science is used and portrayed in these media and the potential of various cultural forms to contribute to the science communication agenda. The role of science advisors to cinema and theatre is considered and the role of scientists as ‘mass media’ personalities is also scrutinized.

The final chapter of Part I is on the subject of Science and the Citizen, presented in Chapter 3. This chapter discusses recent movements in science communication. A range of ideas is considered, from the now largely outdated ‘Scientific Literacy’ approach, to the more inclusive public engagement approach. The chapter considers the role of science communication in formal education from the policy drivers in the United States and Europe, which emphasize the need to encourage more young people into scientific careers,

through to the role of learning theory and science education in the field of science communication. The importance of interactions between science and society is also considered in relation to its impact on science communication, along with strategies for developing science communication initiatives based on dialogue, such as Citizens' Juries.

The practical aspects of science communication are presented in Part II. Chapter 4, *Writing Science*, provides an introduction to science journalism, considering the needs of both readers and editors. The chapter outlines the key principles of good writing and gives practical advice on finding interesting science stories, whilst exploring the tools and techniques needed to write for a variety of print and online media outlets.

A brief history of broadcast media from radio to early TV is provided in Chapter 5, *Broadcasting Science*. Readers are introduced to the world of broadcast media, exploring the roles and professions involved in creating both radio and TV programmes. Radio and TV genre are placed in the context of presenting ideas to potential producers and programme makers, either for entire programmes or simply to convey a specific scientific development. The chapter provides guidance for the aspiring broadcast science communicator, including interview techniques and an exploration of the up and coming related media, such as podcasting and videocasting (e.g., YouTube), which may be more readily accessed by aspiring producers.

Practical demonstrations of scientific developments and ideas have a long history and provide an exciting opportunity to communicate science. Chapter 6, *Presenting Science*, explores the principles and pitfalls of presenting science in public. A facet of successful science communication, whether through a live demonstration or broadcast documentary, is a thorough understanding of the audience. In this chapter, readers will explore the nature of different audiences and how to cater for them. Practical advice on planning, preparing, presenting and evaluating 'SciComm' events, such as talks, lectures and so on, is provided, as well as tips on organizing events along with the dos and don'ts of live experiments and demonstrations.

Science museums from the early Ashmolean in Oxford to the present day have played a key role in communicating science. Chapter 7, *Communicating Science in Museums and Science Centres*, considers styles and trends in public exhibitions of science and the origins and rise of the hands-on science centre and exploratorium. The pros and cons of artefact-based communication are considered, as is museum visitor behaviour, along with practical advice on creating and evaluating traditional and hands-on science exhibits.

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