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Journalism Education

Journalism Education is the journal of the Association for Journalism Education a body representing educators in HE in the UK and Ireland. The aim of the journal is to promote and develop analysis and understanding of journalism education and of journalism, particularly when that is related to journalism education.

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Journalism Education special edition: science journalism in education and practice

Esoteric plaint of scientific authority and scientific uncertainties makes science journalism education and practice a redoubled challenge

Journalism Education is pleased to introduce this edition's guest editors, Prof Gita Bamezai, Former Professor and Head Department of Communication Research Indian Institute of Mass Communication New Delhi and Coordinator of the First-Ever Critical Appraisal Skills programme on Health Journalism and Communication in IIMC in collaboration with Reuters Foundation, UNICEF, and Oxford University; and Communicating Science for Media Professionals under the United Nation's Capacity Building programme for Communicating Bio-safety Programme in India

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For a long time, the public's main source of information about science and technology has been the mass media. Current scientific and technological developments are becoming dominant elements of everyday politics.

Science informs public policy as well as personal decisions on environment, conservation, agriculture, health, transportation, communication and defence. Almost every aspect of modern life is impacted by scientific knowledge. Contemporary world is largely governed and run by science and scientific innovations and is shaping our social, legal and political landscapes in which we live and act. If, on one hand, technology is gaining wider social acceptance, on the other, apprehensions are voiced of potential risks associated with some of the novel techno-scientific innovations. Scientific and technological controversies are creeping into our public discourses.

The Covid-19 pandemic has also thrown up challenges for all of us, where we not only need to re-evaluate our current science journalism approaches but also innovate new ones. The pandemic has created a niche area of communication where scientific research, health, environment and risk communication intersect and interact with each other. At this juncture, need for science journalism is now more than it has been ever before. Science Journalism has the potential to engage the public on broader scientific and technological discourses and in strengthening our democratic and liberal values.

With increasing corporate control on scientific research, profit is slowly replacing the idea of larger public good in science. Contemporary scientific and technological developments such as Artificial Intelligence, CRISPR and self-driving vehicles are generating important ethical and social questions. The present-day scientific developments have the potential to change the course of human history and evolution. Artificial Intelligence technologies would have far reaching effects on our work force, transport, business, employment, transport, healthcare and basically on every aspect of human life. Similarly, Human Genome Editing technique would have even deeper impact on our life itself.

Not only is Technology redefining and reshaping the ideas of democracy and citizenship, but the current scientific developments are themselves now strong ingredients of both political communication and everyday politics. Emerging political cultures are altering the way we think about aspects of expertise and trust in policymaking. In such a scenario, science and scientific innovations not only need to be celebrated but also watched with a sense of scepticism. Critical science journalism could focus on providing a balanced assessment of the work, one that highlights specific strengths but also emphasises specific limitations or flaws. We believe that science journalism must understand the widest social and cultural consequences which scientific and technological innovations have or are capable of having in the society. At a juncture when lot of politics happens around scientific knowledge in terms of claims and counterclaims, science faces challenges at multiple fronts. Science journalism can enrich the public's understanding of science and also prevent misleading claims from going viral.

With ever evolving digital technologies, mobile devices and social media platforms, the entire media landscape is changing and so is science journalism. New media platforms are broadening access to scientific information. But with the increasing access to scientific information, there is also a tremendous regional deficit which is felt in academic and training programmes in the field of science journalism.

A vibrant science journalism would not only act as a watch-dog but would also ensure that such technological innovations are used for global development and human welfare which makes it incumbent to ensure that these operate within our ethical and moral limits. Our embrace of novel technological pathways, as Sheilla Jasanoff puts it, 'leads to a complex interplay of technology, ethics and human rights'. (Jasanoff, 2016). Hence, to explore the ethical aspects of a technological driven society should be our foremost duty.

Science journalism plays a considerable role in democratizing the institution of Science. Science journalists strive to help democratize science by not only simplifying it (Allan, 2011) but also bringing it into public sphere.

There is still a disconnect between science and the public. The disconnect is partly due to what critical theorist Habermas observed as large-scale specialization of scientific research and also increasing bureaucratization of the institution of science (Habermas, 1971). Public participation in scientific research can bridge this disconnect.

Such discourses are still limited to academia and have not captured the attention of science journalists. Scientific literacy (which includes literacy with regard to science, health and environment), in society is now more needed than ever. This can be achieved by what Global Science Report calls ethos of science journalism which include informing, translating complex material and educating the masses. (Global Science Journalism Report, 2021) Besides, our public policy is becoming more and more dependent on scientific knowledge and technological interventions. Science is becoming an inalienable part of our daily lives, at a pace, seen never before in the history of mankind. Journalism has a vital role to play in ensuring that the scientific knowledge is used for human welfare while keeping a watch on the latest developments in the world of science and technology, and concomitantly raise questions of how and in what ways they are going to impact our lives.

Mass media discourses on scientific and technological developments could ensure that they follow our ethical and moral values while also taking into consideration environmental sustainability. Credible science journalism would also help inform science about societal needs, and thus contribute towards its public welfare goal. In the wake of scientific & technological developments, which have far-reaching consequences, it is now becoming absolutely necessary that we have a proactive science journalism ecosystem in the world.

The spread of Covid-19 pandemic brought with it risks and vulnerabilities unknown to many of us. It became another instance when we felt an incredible need for a vibrant and quality science journalism. The problem of misinformation and disinformation has been rife and in tandem with the phenomenal rise of 'infodemic' which has made it incumbent to establish quality science journalism practice at the local and regional level as well as national. Pandemic is a tangible proof of how unmindful and wilful human interference of nature can have catastrophic results. Covid-19 pandemic gave rise to an urgent and inevitable need to **push the boundaries** of science journalism, beyond and envisioning a holistic approach involving environment, health and science taken together in reporting an issue. It also nudged us about how as humans we need to govern and manage our scientific research efficiently. Healthcare became a prime focus in every country in the past one and half years and we slowly realized that we will never affect a truly meaningful health care reform if we don't improve the public dialogue about it. A meaningful science journalism can play a considerable role in facilitating such a healthy public dialogue. Covid-19 pandemic also reminded us of the inevitability of an effective health risk communication strategy. In fact, the consequences of any influenza pandemic for a vulnerable population depend partly on the effectiveness of health risk communication. (Vaughan and Tinker, 2009)

Year 2021 also saw the release of Global Science Journalism Report, which put a spotlight on the present and future of science journalism. While majority of the respondents who were surveyed as part of the report on one-hand, believe that science journalism was becoming more interesting in line with scientific advances but on the other agree that too few people are reporting on the process of science as opposed to reporting on the results of scientific research. Contrary to the common perception, majority of science journalists who were surveyed are happy with their jobs, the vast majority of them see themselves staying in their occupations for the foreseeable future also. The respondents see science journalism performing multiple roles which include promoting science literacy, exposing complexity, motivating change, rebuilding trust in science, verifying information, making science the key element of public debate and engaging the public on scientific issues. The report also found that like science, science journalism is also acquiring a global character (p. 22). Science and Technology is progressing at a very fast pace. New technologies are emerging almost on a daily basis. Some technologies, ome, are laden with risks and public needs to have a keen eye on such developments. In such a scenario, science journalism matters more than ever. It acts as an interface between science and society. (Machado, Rumjanek and Jurberg) science journalism through promise and potential of covering scientific research, has great potential to promote a deeper understanding, engagement and public participation in Scientific enterprise. Our media educational departments and institutes are yet to fully realize the full potential of this discipline both in terms of theoretical understanding as well as journalistic practice. The gap is glaring especially in developing and underdeveloped world, where we still are lagging than developed world, in terms of quality science journalism courses and fully trained science journalists. The need is to bridge this gap by mainstreaming science journalism education in media education institutes and also devising innovative curriculum for the media students.

In this special edition of the Journal we bring several such papers which explore the ways the science journalism can be made an integrative aspect of the journalism education and training. In his paper, **Threshold Concepts in Science Journalism**, Richard Evans provides a critical assessment and analysis of Journalism courses which have by and large skirted teaching and enhancing skills of students in science. He advocates for a more broader approach to science communication since the training is pivoted on teaching logical and reasoning approach as journalistic norms. In the post-truth era where conspiracy theories and misinformation abound on social media, informed and accurate reporting has never been more important than today. The dilemma of retaining the traditional stance of keeping reporting close to the surface does conflict with the skills and knowledge which science journalist is expected to have and some of which are counterintuitive to the traditional practices of the news journalist. However, these are transformative traits since they enable students to have a altogether different world view.

Evans explains that science journalism is more than just reporting science related news since it entails 'seven threshold concepts which are pivoted on scientific enquiry and acquisition of scientific analytical tools as the standard practice. Such conceptual familiarisation with scientific procedure would provide impetus to not just doing science journalism but allow dividends for the entire spectrum of journalism teaching and practice. The concept of news has primarily been underpinned by the art of telling stories of quirkiness, of drama, conflict and scare. Some of these elements find an echo in the way pandemic stories have been done in the media. Without fundamental understanding of science by the media, likelihood of distortion and twisting of scientific information results in circulation of false information which can have serious consequences as politicians have a penchant for media scientific stories in making policy decisions. Evans warns of the trend to claim coverage of scientific news whereas science requires critical faculties to

distinguish between serious scientific research and sensationalism or infotainment. The nature of science is different from epoch making sudden discoveries, since science is an iteration process, building on the past work and making it work better. 'Resistance to changing learning and knowledge skills make journalism education poorer since journalists tend to see themselves as literary intellectuals than scientists with well-informed understanding of data science'.

Uncertainties of science are inherent to the process of scientific results as it is termed as 'prediction uncertainty'. Inclusion of scientific process and procedure in the general journalism curriculum, either as part of a dedicated session on reporting science, health, technology and the environment or through more general discussion about news and current affairs would be a good beginning. In his paper **COVID19 pandemic, Uncertainties, and the challenges of science communications**, T.V. Venkateswaran takes a step forward in highlighting that three hoary practices of objectivity, fairness and balance in journalism generally fail to uphold scientific knowledge and can impede the process of news making in significant ways. The uncertainties in scientific discovery if seen from the journalistic frame can distort and lead to misinformation since paternalistic strategy eschews all uncertainties and presents science as an authority. Our vulnerability in placing faith in information that appears certain and fixed has had implications for presentation of news based on authoritative sources than evidence-based. This epistemic dilemma may have consequences for framing of news relating to sciences where knowledge seeking requires constant experimentation and incremental shifts in claims and counterclaims of ontological phenomenon.

The paper covers a wide spectrum of how uncertainties are viewed by the media and have a direct bearing on public debate about scientific discoveries, especially in the areas of climate change and health. The author examines how the deluge of mis and disinformation has led to a new trend of post-facto check of the published news as part of the post-truth era of scrutinizing media, especially social media as sources of news.

The author uses the example of pandemic and in the atmosphere of uncertainty, preceded by uncertainty and the speed at which the virus spread, the issues of balance and fairness portends nothing short of harm. Herein, three exemplars of media unwittingly spreading mis/disinformation while facing 'uncertainties' in science are presented. These messages were 'balanced' but could not be classified as 'fake news', but the journalistic practice of balance and fact check clearly was inadequate in presenting what constitutes evidence and fact.

He argues that the actual practice of fact checks, both ex-ante and post-ante are inadequate to deal with such disinformation arising out of uncertainties of the nature of science. Presented as incommensurable conflicting claims, the journalistic presentation polarises what essentially is an ambiguity in the face of 'unknown unknowns' as well as limited and evolving shreds of evidence available at hand. In this emergent "knowledge-based journalism" (Patterson,2013), environmental journalists have cast aside the traditional notions of balance and replaced them with newer notions of objectivity. By implementing a transparent method, these environmental journalist have pursued a new path that avoided 'false balance' and outright advocacy (Fahy, 2018). To mitigate the ills of false balance (Revkin, 2014), instead of looking for the extreme ends of a spectrum of opinion, such areas are needed where scientists are in 'deep consensus' than in conflict and controversy.

In presenting solutions to the problem of heightened crisis especially in coverage of climate change, Nicola Baird in the article, **Students and the climate crisis** presents the challenge teachers face in the classroom while helping students to sift through terrifying stories about climate breakdown making to the front pages.

The premise of holding attention of the readers in the contesting media landscape for attention and revenue, controversy and uncertainty in science journalism have become the primary vehicles. Consequences of such frenzy reporting of scientific claims may have unexpected consequences in terms of distress and ambiguity among the readers about the future. These are not benign reactions since these may lead to mental and depressive ideas about our abilities and mitigation efforts. Nicola directs her attention to practice and learning the skills of solution science journalism. Such education can help journalism students bring deep knowledge of climate change into their pieces without endangering their – or their readers' – wellbeing. The conventional news format that "if it bleeds it leads" works on skimming the surface but fail in critically analysing the shades of gray.

Research has even shown that solution stories about the environment motivate people to be more environmentally-friendly and it provides a new impetus to developing science journalism curriculum in an unconventional but innovative ways. From an academic perspective students of journalism are better introduced to neo-liberalism, environmental justice, the links between colonisation and the carbon economy and gain some thinking space about newer ideas such as the circular economy. Nicola describes this shift from a pure

watchdog role to a guide dog and affirms solution-based science journalism as the way for people to engage differently to news and heighten accountability of news media and the scientists.

In their paper **Development of Science Journalism in Bosnia and Herzegovina**, Anida Sokol and Ljiljana Đukanović cover a large spectrum of issues in science journalism which range from lack of interest of the journalists themselves and the readers 'interest in scientific issues' and where to look for scientific information.

Challenges of science journalism and communication may precede any efforts to address lack of interest of the readers or the ability of the journalists themselves not trained to understand the nuanced observations to define an obscurantist phenomenon. 'Journalists in the country lack skills and knowledge on how to find credible sources of science information and how to popularize scientific topics among the general audience.

The pandemic brought huge volumes of disinformation on an unprecedented scale – conspiracy theories about the origin of the virus and vaccines circulated on the internet and social networks. Sifting fact from misinformation becomes a struggle in absence of definite or confirmatory source to allay misgivings about the Covid-19 infection severity and mortality, and establishing a casual relationship between the two.

To reduce the scientific language to an easy way is a reductionist approach to make content readable but deprive the reader of an intelligent perspective since 'journalists use sources when covering such topics without questioning their credibility and common use of predatory journals and preprint works in journalistic content. The lack of quality, independent, analytical and well researched stories on climate change and protection of the environment contributes to the public's lack of information and interest.

The issue of false dichotomies or the persistent temptation to reduce complex problems to a "two-sided caricature", ranging from "mild" versus "severe" illness, saving Lives versus 'saving the economy'... A world of black and white is easier to handle for a journalist than one awash with grays. But false dichotomies are dangerous (Yong 2020) since such a stance is anathema to scientific culture and practice.

In the review article, **Understanding the art of science journalism: developed and developing country perspective**, Ashish Gosain, provides an expansive understanding of how boundaries and conditioning of science can no longer be seen from the prism of a specialised area of enquiry but as a socio-cultural right with inalienable implications for human survival and sustenance.

Emerging from the margins of the citizen or participatory science journalism, the indigenous systems of knowledge has remained consigned to ignominy and faced prejudice in absence of an epistemic approach. The article positions and underscores the inequities in the way science journalism or more appropriately science communication has remained entrenched in its dichotomous world-view based on Euro-centric scientific knowledge while undermining the claims of the developing countries'.

Underpinning 'how science is or could be more accessible and how scientific knowledge is made accountable', the democratic approach of science communication becomes central as an arbiter in disproportionate disease burden, vaccination development, environmental displacement, climate change controversy and racial inequities. The Tocquevillian ideal of participative democracy has multi-dimensional nature, which truly reflects the context of science communication. Despite emphasizing democratic ideals at the core of science communication, critical realism (sceptical and qualified realism) dictates taking an inward view of how the scientific community functions.

Media is no longer just a purveyor of scientific development but frames scientific innovations and uncertainties by weighing in its value on ethical dimensions than ethnocentric political stance or corporate profiteering. More than ever in the past, singular role of mass media in science communication has never been spoken of with both scepticism and with fervour in dealing with many sensitive but conflicting issues such as of climate change and Covid-19.

Major changes in the mass media technology have had far reaching impact on the way journalism is done, how people/viewers are dealing with the proliferation of news content, use of diverse sources and formats which impel us to analyse the context of the science journalism. In the changing context of a dominant techno-system where access to various delivery platforms is abundant, the flux caused by an increasingly digital, mobile, and social media environment, significant changes are occurring in the policy, regulatory and media market. These would have implications for (1) the public good of quality journalism, (2) competitive media market place, and (3) media and information literacy necessary to navigate the media environment effectively (Nielsen, et al, 2016). A surfeit of information channels and access routes invariably become compelling in unravelling more intrinsic issues in scientific enquiry and development. Science journalism teaching and training should be mandated as part of the mainstream journalism teaching since standards of logical reasoning, critical enquiry and interpretation of evidence are intrinsic to any area of journalism practice.

We need to seed the teaching curriculum with science journalism aspects by opening the area of enquiry into not just the procedure of appraising the scientific knowledge which would entail learning research, evaluating the scientific results and learning data interpretation. This perspective does not just provide an understanding of how scientific developments are shaping our world but how this complex system has to be evaluated in shaping the discourse of its iterative process than treating it as an established finality. Increased visibility through media coverage has increased public understanding of and engagement with scientific issues (Boykoff, M. 2008).which underscores the value of promoting science journalism and communication in different universities across the world.

Keeping in perspective, some of the issues spelled out here and with a zeal to broaden the discussion on science journalism education and practice, we are dedicating the special issue of Journalism Education to the theme, Science journalism in the world: education and practice.

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Articles

All papers in the Articles section are peer reviewed and discuss the latest research in journalism and journalism education. These are intended to inform, educate and spark debate and discussion. Please join in this debate by going to www.journalism-education.org to have your say and find out what others think.

Threshold concepts in science journalism

Richard Evans, City University

Abstract

Reporting of the COVID pandemic and the climate crisis has highlighted the importance of scientific literacy as a key skill for journalists. In the post-truth era where conspiracy theories and misinformation abound on social media, informed and accurate reporting has never been more important. The journey from news journalist to science journalist involves acquisition of specialist skills and knowledge, some of which is counterintuitive to the traditional practices of journalism.

Threshold concepts are transformative, troublesome

and difficult to grasp. They are conceptual gateways or portals in disciplines. They can cause students to become anxious and stuck but once mastered they are unlikely to be forgotten and can transform a student's view of the world.

Reflecting on teaching of a specialist science journalism module at two London universities, this paper will use action research to identify seven threshold concepts involved in the instructional journey from news journalist to science journalist:

- understanding of the scientific method;
- distinguishing the views of people with strong opinions from those with compelling scientific evidence;
- avoiding false balance;
- beware of the maverick and the miracle cure;
- correlation is not causation;
- chance event clusters;
- regression to the mean.

It is suggested that introducing these concepts into more general discourses in journalism education could illuminate and inform the reporting of science, health and the environment, broaden the education of journalism students and improve their employability.

Introduction

The COVID pandemic has highlighted the importance of scientific literacy as a key skill for journalists.

Since the pandemic began dominating global news agendas, news reporters have been required to get to grips with highly politicised stories often involving the interpretation of complex scientific and statistical analysis. Journalists face similar challenges reporting aspects of the climate crisis and other complex stories in the fields of science, health and technology. As misinformation and conspiracy theories circulate online and on social media, trusted reporting is at a premium.

The emergence of data journalism as a discipline has required journalism educators to integrate skills of statistical literacy into the curriculum. As Lewis, et al. (2020) suggest: ‘journalists in a shrinking job market can no longer afford to let a fear of numbers restrict their career options’.

Teaching a science journalism module to journalism students involves promoting understanding of other troublesome concepts which are often counterintuitive to traditional practices of journalism. Without them, effective reporting of science can be confused and obscured (Nelkin, 1987).

At the heart of the understanding required is a clash of cultures between the journalist and the scientist. Science is a slow, patient, precise, careful, conservative, complicated process. Scientists are sticklers for detail; they write in scientific language and can take months or years before they publish research usually focussed on a tiny piece of a puzzle.

The news journalist is hungry for drama, conflict, human interest, quirky stories, breakthroughs and scares. News journalists work to daily deadlines, write in everyday language and are required to report the whole story at once. Pressure on journalists has been exacerbated by changing audience habits, declining attention spans and less interaction with long form journalism. Increasingly audiences consume news through online and mobile channels and social media (Angler, 2017).

By focussing on initial misunderstandings and subsequent understandings involved in teaching journalism students how to report science, this paper proposes seven threshold concepts in the journey from general journalist to science journalist. It is suggested that understanding of these concepts can inform and improve the reporting of science and help define the discipline of science journalism.

Literature review - the misunderstanding of science

Government research suggests most of the UK population believes it is important to know about science, yet most feel poorly informed and generally distrustful of media reporting. Research conducted before the COVID pandemic suggested people were increasingly accessing information about science online. Most still felt the media sensationalised science and politicians were too easily influenced by media reporting of emerging science such as robotics, artificial intelligence, genome editing, and micro-plastic pollution for example (Castell, et al., 2014; Department for Business, Energy and Industrial Strategy, 2020)

A common thread in discussion of media reporting of science involves the ‘gulf of understanding’ between communities of arts and sciences first identified more than sixty years ago by the novelist and chemist C.P. Snow in his lecture and essay ‘The Two Cultures’. In it he describes:

‘Literary intellectuals at one pole—at the other scientists, and as the most representative, the physical scientists. Between the two a gulf of mutual incomprehension—sometimes (particularly among the young) hostility and dislike, but most of all lack of understanding. They have a curious distorted image of each other. Their attitudes are so different that, even on the level of emotion, they can’t find much common ground’ (Snow, 1963).

‘A crisis of trust’ in society’s relationship with science was highlighted in 2000 in a UK House of Lords Select Committee report which called for a sea change in favour of open and positive communication between the scientific community and the media (House of Lords Science and Technology Committee, 2000).

In the years that followed, the medical doctor and writer Ben Goldacre started his newspaper column focussing on pseudoscience and the misuse of science which coined the expression ‘Bad Science’. His subsequent best-selling book suggested that at the root of the problem was a historic issue in which ‘people who run the media are humanities graduates with little understanding of science who wear their ignorance as a badge of honour’ (Goldacre, 2009).

Other critics have accused news media of not fully understanding the nature of scientific discourse; ‘scientists who don’t speak English and reporters who don’t speak science and gatekeepers who are uncertain’ (Fox, et al., 2010; Hartz & Chappell, 1997; Jones, 2011).

Following the House of Lords report, organisations such as sciencemediacentre.org and senseaboutscience.org were established to promote public understanding of science. Briefing notes they produce provide journalists with context around scientific stories in the news (Science Media Centre, 2021; Sense About Science, 2021).

More recently, a small number of textbooks on science journalism were published. Whilst they acknowledge the importance of statistical literacy, they focus for the most part on interviewing, writing and storytelling techniques (Angler, 2017; Blum, et al., 2006).

A decline in professional training for journalists has left media organisations relying on the higher education sector for a trained workforce, although only a small number offer specialised modules in science reporting (Fox, et al., 2010). Some US universities offer postgraduate qualifications specialising in science journalism, a number of British universities offer postgraduate qualifications in science communication, yet a search of the UCAS website in 2021 suggests that only one British university was offering a specialist course in science journalism.

The Horizon 2020 funded Quality and Effectiveness in Science and Technology communication project has proposed an outline curriculum for an MA in Science Journalism. Alongside traditional reporting skills it includes understanding of science, media and society, ethics, statistics and the methods scientists use to gather and publish data (Schofield & Franks, 2020).

What is less prominent in these discourses is attention to fundamental understandings which underpin the reporting of science and reasoned discourses about science and technology. Such literacy is required to engage with science-related issues as a reflective citizen (OECD, 2019).

Misunderstanding of science, health and medicine has been highlighted by reporting of the COVID-19 pandemic. An acute public appetite for information has resulted in circulation of misinformation, misconceptions and harmful claims (OFCOM, 2021). The World Health Organisation and OFCOM have warned of an 'infodemic' of misinformation posing a serious risk to public health (World Health Organisation, 2021).

A substantial proportion of the UK population feels that media reporting has made the situation worse. In many cases, rather than being completely fabricated, true information is spun, twisted, recontextualised and reworked into misinformation. Whilst some social media platforms say they take steps to remove false and potentially harmful posts, by their nature their fact-checking processes involve selection bias and cannot address every piece of misinformation (Brennen, et al., 2020).

An information deficit model has been cited as a cause of a lack of public response to the climate crisis, alongside apathy, ignorance and self-interest (Norgaard, 2011). Whilst it is acknowledged that increasing knowledge alone does not augment public trust in science, an understanding of climate science is arguably essential in underpinning informed public debate around the greatest modern-day challenge of our age.

Threshold concepts

Threshold concepts are transformative, troublesome, and difficult to grasp. Conceptual gateways or portals in disciplines, 'jewels in the curriculum' they can cause students to become anxious and stuck but once mastered they are unlikely to be forgotten. They can open conceptual spaces and transform identities and views of the world (Meyer & Land, 2005).

Land and Mayer suggested they have seven characteristics:

- transformative (involving a shift in learner's perception),
- troublesome (alien, counterintuitive and subversive),
- irreversible (unlikely to be forgotten),
- integrative (in terms of interrelatedness of concepts beliefs and theories),
- bounded (constrains the boundaries of the subject),
- reconstitutive (repositioning in relation to content)
- discursive (involves gaining new language related to the content).

For the journalism student or journalist getting to grips with reporting science, the concepts described in this paper share many of those characteristics. They are key to the journalist's understanding or misunderstanding of science (transformative and constitutive) often run counter to the traditional practices of journalism (troublesome but integrative) and become part of the language of critical discussion (discursive). They can be conceptually difficult, are potentially irreversible and bounded in terms of defining the science journalism curriculum.

Methodology

Action research and documentary analysis was conducted by observing student learning and the evolution of the curriculum during the teaching, design, and delivery of a 15-credit elective module to third year jour-

nalism undergraduates at two London universities between 2013 and 2018. Such research is characterised by Glynis Cousin as ‘transactional curriculum design’ in which dialogue between teachers, students and educationalists identifies threshold concepts within a subject area (Cousin, 2009).

The module was taught in groups of between 10 and 22 students. Conversations were facilitated between academics from scientific disciplines and students of journalism, many of whom had little or no scientific education, mathematical or statistical literacy.

In one session, undergraduate students were taken into a research lab to interview PhD students about their projects. In another, a professor of public health who had managed high levels of public anxiety about a cluster of childhood leukaemia cases led a classroom discussion about her investigation and the sensationalised news coverage it attracted.

After initial discussion about students’ interests in and knowledge of science, health, medicine, technology and the environment, classes focussed on the relationship between science and society, the public’s appetite for and understanding of science and the complexities of science journalism.

Students were required to critically reflect in an assessed essay discussing whether journalists were obliged to give the views of people with strong opinions equal prominence with those with compelling scientific evidence, with reference to a scientific controversy agreed with their tutor. Students were required to pitch and present their ideas and discuss with the class.

The second half of the module required students to produce an original piece of news, feature or multimedia journalism for a specific target audience including quotes from at least three original interviews. Again, students were required to pitch and present their ideas and discuss them with the class.

Topics proposed by students included the climate crisis, legalisation of recreational drugs, organic food, pesticides, gene editing, GM foods, fracking, animal testing, safety of video games, creationism, alternative medicine, artificial intelligence, microplastics, 5G communications, the safety of the HPV and MMR vaccines and therapeutic cloning.

Student feedback on the module was positive. Satisfaction with the module scored 4.3 out of 5. Responses to the question ‘this lecturer is good at explaining things and has helped me understand the module’ scored at 4.8 out of 5, and to the question ‘this lecturer has made the module interesting’ scored 4.6. Student comments included ‘the lecturer encourages a lot of conversation between classmates which enhanced my learning and understanding’ and ‘we have been presented with many good resources and cases in order to further our understanding of the differences and similarities between general news journalism and science journalism’.

During repeated iterations of the course, it was found that discussion focussed and crystallised around key concepts which became transformative on student understanding. Particular attention is paid to concepts and ideas which could be considered counterintuitive to the traditional practices of journalism, connected to misreporting or misunderstanding of science or which became part of the language of discussion in the classroom.

In some cases, these became associated with ‘stuckness’ suggesting students might be caught in liminal spaces. These are proposed as threshold concepts involved in thinking like a science journalist rather than a news reporter and thus defining of the discipline of science journalism.

Understand the scientific method

Whilst the professions of science and journalism share significant characteristics (such as those of data collectors and a devotion to discovering the truth) their norms and practices of inquiry are fundamentally different (Schunemann, 2013).

In discussions about scientific experimentation it was found that many journalism students lacked appreciation and understanding of scientific methodologies and the language of reports. As a result, the purpose and meaning of scientific research was obscured.

It is acknowledged that the practices of the scientific community in constructing knowledge can be complex and influenced by societal and economic and philosophical considerations (Gregory & Miller, 2000). However, without basic knowledge and understanding of the practices of science it is impossible for the journalist to accurately depict the processes of science or critically interrogate scientific research.

The OECD suggests that scientific literacy involves not only content knowledge (the ability to recall and

use theories, explanatory ideas, information and facts) but procedural and epistemic knowledge of how scientific knowledge is established and an understanding of the common practices of scientific inquiry (OECD, 2019). Science journalists also need an appreciation of the limitations of processes of science and processes such as peer review (Blum, et al., 2006; Schunemann, 2013).

At its most basic, this involves an appreciation of how science collects and weighs evidence, makes declarations and predictions. Fundamental to much of that is an appreciation of the classic scientific method involving identifying a question and a hypothesis, setting up an experiment, analysing the resulting data and writing a report. Whilst on the surface this might appear similar to the practice of a news reporter, it is fundamentally different from the practices of journalistic inquiry.

In general, journalists use inductive reasoning, in which observations are questioned and hypothesised to reach a conclusion. Whilst scientists might use inductive reasoning to conceive a hypothesis or scientific experiment, the research itself involves deductive reasoning in which theories or hypotheses are tested to conclude whether they are true or false.

Deeper critical examination of scientific methodologies might identify issues involving sample sizes, control mechanisms, selective reporting of data, identification of research funded by industry or special interest groups or extrapolating results of tests on animals to humans. In medical and health reporting this might involve discussion about methodologies of clinical trials, randomisation, blinding or the placebo effect (European Communication on Research Awareness Needs, 2021).

Distinguish between the views of people with scientific evidence and those with strong opinions

Since debates over creationism and whether the earth was round or flat, views of scientists have been pitched against people who hold strong views which counter scientific consensus. Whilst few people would be inclined to say that the shape of the earth is still a matter of controversy, public disputes persist around science concerned with matters of belief or knowledge.

Such views may be influenced and informed by faith, personal beliefs, political or financial self-interest for example and may be justified and expressed in a number of ways. Statutory bodies such as legislatures, agencies and courts may be required to mediate between the views of establishment interests and challenge groups before making decisions. Objective scientific facts may influence their decision making but may not be the most important factor (Caplan & Engelhardt, 2003).

Increasingly scientific evidence is challenged using notions of ‘fake news’ and conspiracy theories. Such theories can often be driven by feelings of injustice, resentment or cynicism towards government experts and mainstream media and may proliferate on social media (Sense About Science, 2021).

Snow’s (1963) discourse about ‘confusion between the individual experience and the social experience, between the individual condition of man and his social condition’ is reflected in modern day narratives about the person who smoked all their life and lived into their nineties, the climate change denier during a spell of cold weather or the anti-vaccination campaigner discussing personal experiences around vaccination, for example.

In classroom discussion around reporting of the story involving the cluster of childhood leukaemia, stories involving unexplained cancer clusters or vaccination controversies, students often initially found it difficult to mediate between the evidence-based views of the scientific community and the strong views held by families of individuals who had been taken ill or died.

It is not suggested that such views should be dismissed or ignored in science journalism, particularly in ethical debates during which practices of science and technology are held to account in the public sphere. However, it is important that views and opinions and their motivations should be acknowledged and contextualised as such.

Beware the maverick and the miracle cure

The traditional practices of news journalism draw reporters to the unexpected, the unusual and the unlikely (McKane, 2014) yet in terms of critical reporting of science, such instincts can be unhelpful. As a result,

journalists who do not understand the nature of scientific discourse can pay undue attention to contrarian views because confrontation makes good copy. A fascination with unorthodox science can result in news media and social media offering a platform to amateur and unorthodox scientists and even conventional scientists who have been unsuccessful in publishing their work in peer-reviewed literature (Schunemann, 2013).

This can lead to misleading coverage of issues such as the climate crisis and vaccination, particularly in broadcast debates (Angler, 2017; Fox, et al., 2010; House of Lords Science and Technology Committee, 2000; Jones, 2011).

Whilst news journalists and social media audiences are naturally drawn to research producing unexpected or unlikely results, the scientific community is unlikely to draw conclusions from results of an individual study, particularly if they have not been confirmed in a replication study or elsewhere.

Journalistic use of the word “breakthrough” usually either overstates a finding or ignores the years of incremental successes preceding it. Stories of this nature might involve distortions, exaggerations, or changes of conclusions from research in press releases from universities (Goldacre, 2009; Sumner, et al., 2014) or as in the case of the MMR scare in 1998, giving prominence to the views of a rogue scientist.

Similarly, the ‘lone genius’ is a trope that gets aired routinely; ‘the man in the shed inventing cold fusion’. In reality, science is almost always carried out in collaboration, frequently across different institutions (Gregory & Miller, 2000).

Practices of effective science journalism require the critical faculties to distinguish between serious scientific research and sensationalism and ‘infotainment’ of the type parodied by the US satirist John Oliver in his sketch about meaningless popular science coverage (Angler, 2017; Schunemann, 2013; Oliver, 2016).

Some of these stories might involve promotional activity from universities or commercial organisations; an academic posing as a human cyborg who has implanted a chip in his arm or another funded by an ice cream manufacturer to ‘find a formula for the perfect way to eat ice cream’ (Goldacre, 2009).

Similarly, Goldacre (2009) suggests that reporting of ‘miracle cures’ should be treated with scepticism. Whilst acknowledging a golden age of medicine between 1935 and 1970 involving new treatments such as kidney dialysis, CT scanners, heart surgery, and vaccines, Goldacre suggests that modern medicine does not generally move ahead by sudden epoch-making breakthroughs but rather through the gradual emergence of small incremental improvements in understanding (Goldacre, 2009).

Avoid false balance

Journalism students are taught that conflict is the main constituent of news stories, alongside celebrity, human interest, quirks and occasionally genuine science research and discovery (McKane, 2014). As a result, views of maverick scientists or people with strong opinions may be set against established scientific opinion with equal weight and equivalence.

In the context of the climate crisis, the satirist John Oliver makes the point in the sketch in which a debate between a scientist and a climate change sceptic is halted and reframed as a ‘statistically representative climate change debate’ in which the voices of a studio full of scientists drown out the sceptic (Oliver, 2014).

More recently, arguments about false balance resurfaced in the context of political debate about Brexit when the BBC’s director of news suggested that an ‘unthinking insistence on balance’ between know-nothings and lightweights could have contributed to the problem of post-truth politics. Whilst acknowledging that it was not the BBC’s job to preside over the democratic process it was acknowledged that in order to ‘get beyond the noise to the news’ resources needed to be put into data analysis and context (Harding, 2016).

Statistical literacy

Numbers saturate news headlines, politics and public life and underpin many areas of medical and scientific research. However, they are often misused and misinterpreted by the media and sometimes by scientists. Their use in news coverage can be vague, patchy and imprecise yet they are sometimes neither questioned nor interrogated by journalists (Cushion, et al., 2016).

The emergence of data journalism as a discipline has introduced instruction in the acquisition, cleaning,

analysis and presentation of data to the journalism curriculum. Less common is detailed instruction in statistical literacy, samples and populations or the critical thinking to detect biased or manipulated statistics and consideration of the ethical issues involved (Lewis, et al., 2020).

Whilst a science journalist might not require a degree in mathematics, they require basic numeric literacy, skills, knowledge and scepticism to critically interrogate discourses about statistics, risk and certainty (Blastland & Dilnot, 2008; Blum, et al., 2006). These might include mathematical skills such as distinguishing between percentages and percentage points, knowledge of concepts such as probability, absolute and relative risk, rates, and averages for example (Angler, 2017; Blastland & Dilnot, 2008) but also procedural, epistemic knowledge to analyse and interpret data and draw conclusions (OECD, 2019).

Within this epistemic knowledge, it is argued, lie more transformational, threshold concepts which run counter to the intuition of the news journalist. The concepts listed here emerged in an extension of the language of the science journalism classroom, suggested that they had the discursive quality required.

Correlation is not causation

Listening to loud music is correlated with acne, sleeping with one's shoes on is correlated with waking up with a headache, and ice cream sales with drowning, but in mistaking correlation for causation, journalists can flout one of the most elementary rules of statistics (Angler, 2017; Blastland & Dilnot, 2008). In the cases described above, establishment of causation would involve identification of a mechanism linking two variables where there is none.

Science journalists need to have an appreciation of the impact of confounding factors such as age, consumption of alcohol or hot sunny weather which can erroneously suggest a cause-and-effect relationship. Such an attitude might run counter to the instincts of a news journalist who might be fooled into thinking that 'there is no smoke without fire'.

Confusion between correlation and causation may occur inadvertently in a badly-written headline or social media post but it might also result from more deliberate manipulation of statistics by reporters or researchers through practices such as data dredging, selective interference or 'p-hacking' in which data is selectively presented by scientists under pressure to publish or secure funding for research (Angler, 2017).

Blastland and Dilnot (2008, p.205) suggest that the ability to spot errors involving spurious correlation errors depends on how fast a better explanation comes to mind. They suggest the use of prompts to the imagination such as 'what else could be true of the group, the place, the numbers we are interested in? What other facets do they share, what else do we know that might help to explain the patterns we see?'

Chance event clusters

In health reporting, clusters of diseases in spaces around mobile phone masts, or in time around vaccination events, for example, may be explained as chance event clusters, patterns which appear in random distributions.

The practices of news journalism might encourage the identification of chance event clusters through the Texas Sharpshooter Fallacy, in which differences in data are ignored and similarities are overemphasised. The reference to the sharpshooter involves an unskilled gunman who shoots randomly at a barn and draws a target afterwards around the tightest clusters of holes (Blastland & Dilnot, 2008).

The news journalist trained to seek out the unusual might give undue prominence to such events in time or in geography. They may not appreciate that such patterns appear naturally, when rice is thrown on to a floor, for example, or outbreaks of disease are plotted on a map.

To illustrate the phenomenon, science journalism students were provided with an Excel spreadsheet which when refreshed produced a random distribution of cells all of which contained clusters of events.

Regression to the mean

Minor illnesses usually get better without treatment, football clubs at the top of the table rarely maintain their success and statistical variables with normal distribution which are extreme on first measurement tend to be closer to average on a second measurement. The phenomenon whereby things at extremes are likely

to settle back down to the middle is called 'regression to the mean'.

Critics of homeopathy maintain this explains its apparent success in treating back pain, and other episodic diseases (Goldacre, 2009).

Again, the inductive reasoning practices of news journalism would intuitively seek a cause for a statistical peak or decline. Whilst not all such peaks will regress, the science journalist should have the skills and awareness to recognise these patterns as such and consider them as part of their critical reporting skills.

Conclusion

Whilst science journalism might traditionally be considered a niche specialism, the emergence of issues such as vaccine hesitancy and climate change denial has highlighted the societal importance of accurate and informed reporting on the processes of science, technology, health and the environment.

Despite the emergence of data skills as part of the core journalism curriculum, journalism academics continue to broadly reflect the profile of the profession of journalism in which the majority tend to identify as literary intellectuals rather than scientists or statisticians.

Whilst concepts outlined above were identified during specialised training for science journalists, they are proposed for inclusion in the general journalism curriculum, either as part of a dedicated session on reporting science, health, technology and the environment or through more general discussion about news and current affairs.

Discussion of responsible reporting of the climate crisis might provide an opportunity to discuss false balance, correlation and causation and distinguishing between the views of people with strong opinions and those with scientific evidence for example.

Discussion around the reporting of COVID-19 vaccine hesitancy might involve discussion of maverick scientists. Chance event clusters can explain incidences involving vaccine side effects whilst regression to the mean remains a helpful concept in critical reporting on alternative medicine.

It is hoped that the by getting to grips with some of threshold concepts above, journalism educators could develop their own critical skills and those required of journalism students to report on science, technology and statistics.

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COVID19 pandemic: uncertainties, and the challenges of science communications

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Abstract

Objectivity, fairness and balance are the three critical, classic buzzwords of journalism ethics. Objective journalism asks the journalists to eschew bias and present the story with a balance. Accuracy needs ‘fact check’ and balanced story demand presenting all sides of the story, and fairness implies that the journalist should strive for accuracy and truth in reporting and not lead the readers towards a reporter’s desired conclusion. Balanced reporting is imperative for the media to play the role of the fourth estate in democracy. Nonetheless, in the paper, we present three case studies related to the COVID pandemic that adhere to the journalistic norms of fact-check, balance and news values yet are a misrepresentation. All these stories are related to uncertainties in science and conflating one type into another in the media framing leads to disseminating this misinformation. Showing fact check and balance are necessary but are not sufficient to eliminate misinformation stemming from a mix-up of various types of uncertainties, and some suggestions are made to the journalist as to how to deal with uncertainty in science while reporting them.

Introduction

In India, the southern state of Kerala reported the first case of Coronavirus disease 2019 (COVID-19) on January 27, 2020. Heeding the alarm raised by the World Health Organisation that the COVID19 is pandemic, the Indian Government imposed an unprecedented nationwide lockdown on the night of March 23, 2020.

The initial lockdown was extended three times, and the unlock process, that is, relaxation of lockdown condictions, gradually commenced from June 1, 2020. The active cases began to swell since June 2020, peaking in October 2020 and tapering off by December 2020. The 'second wave' mounted from February 2021 was, in comparison, swift, intense, and catastrophic. A lot more deaths are reported to have taken place during the second wave, and the health infrastructure was overwhelmed, creating a condition of chaos, gloom, and despondency.

As the World Health Organisation noted, the COVID pandemic was accompanied by an infodemic(W.H.O, 2020). Misinformation, disinformation, and malinformation were part of this infodemic. While some fake news raised hopes that the Government would disburse cash to every citizen, some were mischievous, claiming steam inhalation would cure the COVID. Others promoted enmity, hate and exacerbated anxiety and social tension.

Media resorted to 'fact check' and its related journalistic practices such as hoax busting and 'fake news' debunking to tide over the infodemic. Nevertheless, in this paper, we argue that 'fact check' and related journalistic practices are necessary but insufficient to meet various 'information disorders' resulting from science uncertainties.

The first section of the paper outlines the scholarly perspective on uncertainties in science and how media frames them. In the second section, we introduce the landscape of fact check and fake news in the wake of the COVID infodemic in India. In the third section, we present a snapshot of three exemplar stories on the COVID pandemic, stemming from the uncertainties that are characteristic of science. These stories were carried prominently in Indian media to demonstrate that 'fact check' alone is insufficient to arrest the information disorder. In the discussion section, we argue that how these media misrepresentations were created by everyday journalist practice such as fact check, balance and news value. These information disorders escaped facts check protocols. Further, taking a cue from studies on reporting patient autonomy in medical settings to climate change, we make some suggestions for journalists to deal with uncertainties in the science.

Science and uncertainties

Science is endemic to many varieties of uncertainties (Gooding, 1990; Pickering, 1995). The inherent variability and randomness of nature result in *objective* uncertainties. This is supplemented by *epistemic* uncertainties that result from our current lack of knowledge (known unknown). Our real experience is limited by the tools, techniques, and technology of the times (without radio telescopes, pulsars would have remained unknown-unknown) and the scientific models (and theories) we use to frame our understanding. Even though these models are complex and sophisticated, they essentially short of the real, resulting in prediction uncertainty. There is *ontological* uncertainty that comes from unknown-unknowns. Our knowledge of exotic objects such as neutron stars, supermassive black holes, dark matter, and dark energy are recent. A few decades ago, we hardly had any inkling of even their existence. Fourthly, the evidence available at hand may not be compelling to decide between two competing theories or models, resulting in *judgemental* uncertainty.

Manifestly the constitutional contingent nature of scientific knowledge presents an inherent tension in the communication of uncertainty in science. In the face of uncertainty, scholarship notes two extremes in journalistic practices; the first is total concealment of uncertainty in science. Premised on the assumption that the public prefers unambiguous, 'one armed' advice (David, 1975), the paternalistic strategy eschews all uncertainties and presents science as an authority that settles matters once and for all. As (Ebeling, 2008, p. 336) observes in media coverage, "uncertainty is stripped out of the discourse, and certainties about future expectations of a scientific discovery or a resulting technology are inserted and emphasised". The second response of media in the face of uncertainty in science is to reduce all uncertainties as a case of 'controversy'

or 'conflict'. Interestingly both responses naively view science as certitude (Stocking, 1999).

How do journalists and media handle scientific uncertainty if they choose to 'frame' it? Communications scholars see 'uncertainty in science' as a continuum that ranges from inexactness to lack of observations/measurements, practically immeasurable, conflicting evidence, reducible ignorance, indeterminacy, and irreducible ignorance (van Asselt & Rotmans, 2002, pp. 80–81) value diversity, technological surprise, ignorance and indeterminacy. – Uncertainty is usually treated as a marginal issue, as an additional physical variable, as a mathematical artifact. The current methods merely involve evaluation of the impacts of 'certain uncertainties', i.e. uncertainties for which estimates or probability distributions are available. – Current methods give no indication of the magnitude and sources of the various underlying uncertainties and the aggregated uncertainty measures are difficult to understand to decision-makers and other audiences. The threat of climate change, challenges from emerging technoscience such as nanotechnology and the conceptual, methodological, and ethical problems these entails has spurred the recent scholarship on the communication of scientific uncertainty (Guenther, Froehlich, & Ruhmann, 2015; Gustafson & Rice, 2019, 2020; Han, 2013; Kandlikar, Risbey, & Dessai, 2005; Morgan, 2009; Rabinovich & Morton, 2012; Rice, Gustafson, & Hoffman, 2018; Schneider, 2016; van der Bles et al., 2019). The evidence appears mixed regarding whether portraying uncertainty in science communication has positive or negative effects. Examining the extant empirical research, Gustafson, A., & Rice, R. E. (Gustafson & Rice, 2019) delineate four different types (deficient, technical, scientific, and consensus uncertainty) framing uncertainty in contemporary media practice.

The *deficient uncertainty* media frame foregrounds a general lack of knowledge (a 'known unknown'). This frame is communicated by showing a known 'gap in knowledge' or 'shortcomings of the research' (Gustafson & Rice, 2020, p. 618). Measurement error, approximations used in the modelling and other scientific methodological practices limit the scientific claims. These quantified errors, called *technical uncertainty*, is communicated by the media by including projected ranges, confidence intervals, and probabilities (Gustafson & Rice, 2020, p. 618).

The Intergovernmental Panel on Climate Change (IPCC) uses a set of seven verbal descriptions of uncertainty, such as *unlikely* and *very likely*, to convey the underlying imprecision of its forecasts and conclusions. The frames of *scientific uncertainty*, 'unknown unknowns', is often communicated by emphasising 'deficient in our knowledge is an inherent feature of the scientific process or that further research may uncover unknown errors in our current understandings (Gustafson & Rice, 2019, p. 682). It may be noted that scientific uncertainty is distinct from technical uncertainty, which is a "known, identifiable shortcoming in a specific area while the former is a general epistemological philosophy of unknown unknowns" (Gustafson & Rice, 2019, p. 682).

Consensus uncertainty, is portrayed as disagreement among two sets of experts, experts and public or as uncertainty within the body of evidence itself is presented in the frame of 'disagreement,' 'conflict,' or 'controversy' (Gustafson & Rice, 2020, p. 618).

In addition to the above, one of the critical challenges for media is the motivated '*manufactured uncertainty* based on 'junk science', giving rise to non-existent 'controversy'. Since the 1990s, scholars have unravelled how industry-funded 'research' construct a 'contested expertise', with a motivated intention to confuse the audience with contradictory claims and seed doubts. The motivated propaganda uses public relations tactics to attack reasonable scientific evidence as 'inconclusive' to argue against regulation on issues ranging from tobacco (Barnes, 1998), sugar (Kearns, Schmidt, & Glantz, 2016), pharmaceuticals (Fugh-Berman, 2013) and climate change (Oreskes & Conway, 2012). As Tuchman (1972) notes, adhering to the "strategic ritual of objectivity", journalists unwittingly sow doubts about claims that are nonetheless backed by considerable evidence and expert consensus.

With a view to 'balance', the media often provide 'equal time' to "claims-makers who offer contrary views however outrageous ...because their inclusion reinforces the impression of journalistic objectivity" (Stocking & Holstein, 2009, p. 28). These are framed as consensus uncertainty, and the claim is unwittingly presented as 'unsettled science' as is the case with climate science and tobacco research (Oreskes & Conway, 2012).

Landscape of infodemic in India

As was the case elsewhere, the pandemic in India was accompanied by intensive infodemic. Analysing the infodemic circulating in the social media during January to May 2020, a report by BOOM FactCheck, India (Sutaria, 2020) identified 178 'fake news' that were either medical misinformation or wedge driving mes-

sages, exacerbating “existing tensions in the country, particularly long-standing rifts between the country’s Muslim minority and Hindu populations”.

A study conducted by the author (to be published elsewhere) catalogued 2,119 ‘fake news’ circulating in India related to COVID19 between January 2020 and July 2021. Of this, 598 were ‘wishful thinking’ (UV rays from the Sun will kill the virus; gargling with hot water will prevent the virus from taking foothold), 803 were dread rumours (contracting the virus is sure death; lockdown would be extended; mosquito and housefly can transmit the virus and spread the infection) 637 were wedge driving (blaming cultural habits of specific communities for the origin of the pandemic and spread of the infection) and 81 anticipatory (with the lockdown the ozone hole has healed; peacocks roaming on the streets).

Interestingly 678 (nearly 32%) of these were during the January-March of 2020, when COVID19 hardly impacted India. The tide of certain rumours seems to have ebbed by the time the active cases increased and spread across the nation. Jamuna Prasad (1935), studying the spread of rumours after an earthquake in Bihar, India, in 1934, perceptively observed that “widespread emotional disturbance which persists over a more or less extended period, prepare the soil for the growth and spread of rumours”(Prasad, 1935, p. 6) and with “the return of emotional stability, rumours practically ceased to grow” (Prasad, 1935, p. 6).

In the Information Disorder report for Council of Europe, Claire Wardle and Hossein Derakhshan (2017) identify mis-, dis-, and malinformation as three types of bad- information contaminating the journalistic norm of ‘truth telling’. They argue that flaws can occur at all the three phases of communication: creation, (re)production, distribution, and all the three stakeholders, agent, message, interpreter, contribute to the information disorder. Fact check is seen as a panacea to arrest the information disorder at the site of its creation (media) by the agent (journalists). No wonder the media in India too took recourse to ‘fact check’ to tide over the infodemic threat.

Since the founding of the first fact check group in the US (FactCheck.org in 2003), according to a report by Duke Reporter’s Lab, as of August 2021, there are 348 active (and 113 inactive) fact check organisations worldwide. Relying on verifiable information from experts, academia, governments agencies, ex-post fact-checking examines the claims of public relevance circulating in legacy media and social media trends. The fact-check agencies have evolved a code initiated by The International Fact-Checking Network (IFCN) [Available at [https://www.poynter.org/international-fact-checking-network-fact-checkers-code-principles.](https://www.poynter.org/international-fact-checking-network-fact-checkers-code-principles/)] ‘Fact Check’ and its related journalistic activities such as ‘hoax busting’, ‘debunking’ were deployed in the media in response to the challenges arising from the COVID-infodemic.

In the emergence of hybrid media, hoax busting, and fact-checking have emerged into a new genre of reporting in the legacy media, occupying significant column space and airtime. The Government too initiated to disseminate ‘fact check’ information through its official press release channel, Press Information Bureau(<https://pib.gov.in/factcheck.aspx>). A large number of scientists, science communicators and designers came together into a voluntary platform ‘Indian Scientists Response to COVID 19’ (ISRC) (www.indscicov.in) and as one of their activities undertook ‘hoax busting’; which critically examined many of the mis, dis and mal information circulating in the public sphere in India at that time.

Insofar as journalism is a ‘discipline of verification’, ‘fact check’ is not new. The ex-ante fact check is now supplemented by an ex-post fact check that goes beyond ‘two sides’ but adjudged the claim’s veracity in the worrisome context of post-truth and explosion of user-generated content in social media. A subset of this ex-post ‘fact-check’ is ‘debunking’ of fake news and viral hoaxes, using a specific set of skills that are in common with ‘verification’ (Mantzaris, 2018).

Scientific uncertainty and misinformation

True to the journalistic dictum of educating and informing, the media presented the facts and figures related to the scale and extent of the infection and deaths and communicated the pandemic protocols to be followed by the citizens for their safety and protection. Novel coronavirus, SARS-CoV-2, had most likely spilled over to humans around October- November 2019. Various characteristics of the pathogen such as life cycle, pathogenicity, its routes and modes of transmission, clinical manifestation, mutation rate and immune response were all unknown- unknowns or known-unknowns. Our knowledge about the nature of the virus, modes of transmission, ways of detection, discriminating symptoms, clinical manifestation and efficacious treatment is still evolving even after two-plus years since the onset of the pandemic (Cao, 2020; Shi et al., 2020). Along with *epistemic* and *ontological* uncertainty, our knowledge was also handicapped by *technical*

uncertainty. As this unprecedented global disaster unfolded, the knowledge and consequently our response was evolving. Thus, it was unclear if masking in public as a public health measure should be mandated at the early stage of the pandemic (Peeples, 2020). In these ambivalent times, the media had a challenging role as the scientific uncertainties loomed largely.

This section will briefly present three exemplars of media unwittingly spreading mis/disinformation while facing 'uncertainties' in science. These messages were 'balanced' and cannot be classified as 'fake news', and hence the journalistic practice of balance and fact check clearly was inadequate.

Indian exceptionalism

At the height of the global surge, around August 2020, the death rate in India (and some of the South Asian countries) due to COVID 19 appeared to be inexplicably low. "The mystery of India's low coronavirus death rate" ("The mystery of India's low coronavirus death rate," 2020) screamed a headline in a newspaper. It further stated that India has the "lowest number of deaths per 100 confirmed cases...at 1.5 percent...In comparison, the United States, the most infected country, has a death rate of 2.8 percent...India's number of deaths per 100,000 population is 7.73, compared with 64.74 in the United States."¹ The Indian exceptionalism was maintained because in India as people are "habituated to dwell in lesser hygienic condition and with lesser medical attention throughout their lifetime", and consequently, they have "naturally acquired better immunity and more resilience against many infective diseases" (Roy, 2020).

Airborne controversy

While the early pandemic protocols emphasised handwashing, fearing the transmission through the 'fomites route', the potential for airborne transmission came as a rude shock. "After insisting for months that the novel coronavirus is transmitted via respiratory droplets produced when an infected person coughs or sneezes, the World Health Organization (WHO) on Tuesday said that the airborne spread of COVID-19 cannot be ruled out" (Phelamei, 2020) says a news item reporting the modified advisory from World Health Organisation (WHO) on the transmission modes of SARS-CoV-2 virus. The shift in the policy recommendation in the light of lingering uncertainties and uncovering of new knowledge was framed as a 'failure' of science institutions, thereby weakening confidence in public institutions.

Stoking fear of vaccine

Early on during the pandemic, amid unprecedented lockdowns imposed, vaccines appeared as the last hope; but with numbers dwindling (and before the second wave ravaged), suspicion, mistrust and fear of side effects resulted in vaccine hesitancy. '23K adverse events post vaccination in India: Govt' says The Tribune ("23K adverse events post vaccination in India: Govt," 2021) reporting on the press release issued by the National Adverse Event Following Immunization (AEFI) Committee (Ministry of Health and Family Welfare & Division, 2021).

The Government of India rushed to approve the Covaxin "for restricted use in clinical trial mode...through an accelerated process on the basis... incomplete data on the vaccine's efficacy for peer review... [raising] more questions than answers" (Mohapatra & Mishra, 2021) . The clinical trials were marred with allegations that illiterate volunteers were recruited, who cannot read the consent forms, nor are they able to report adverse events (Bhuyan, 2021a). (In hindsight, though slow to come, the clinical trial results of the Covaxin are more than satisfactory.)

Vaccine hesitancy, defined by the World Health Organization (WHO) as a "delay in acceptance or refusal of vaccines despite availability of vaccination services" (MacDonald, 2015), is a crucial hindrance for massive vaccination drive worldwide. "Questions about vaccine efficacy, potential side effects, or speeding through regulatory approval processes" (Hotez et al., 2021) are found to be the critical drivers of hesitancy in the context of the COVID19 vaccines. The vaccine trials and approvals, particularly around Covaxin,

¹ See (Cohen, 2021) for a discussion on this theme. See also ("India has one of the lowest Covid mortality rates in world but each death painful: Vardhan," 2021) and ("At 1.11%, India's Covid fatality rate lowest in the world, says Harsh Vardhan as toll crosses 2 lakh," 2021) for similar media stories.

India's first home-produced vaccine, have been criticised (Thiagarajan, 2021). While scholars warned that "medical therapy approved for public use in the absence of extensive safeguards has the potential to cause harm, not only for COVID-19 prevention efforts and vaccine recipients, but also for public trust in vaccination efforts worldwide" (Troger, Oshinsky, & Caplan, 2020). When the vaccines were rolled out with ambiguous safety and efficacy scrutiny, it was accompanied by misinformation and mal-information linking the vaccine to deaths (Srivastava, 2021a).

Meanwhile, in the absence of public data on adverse events following immunisation (Bhuyan, 2021b), concerns were expressed by the experts (Thacke, 2021). Although not easy (Remmel, 2021), transparency in AEFI would help the hesitant section gain confidence and shun reluctance. Following public pressure, the Government responded with data (Ministry of Health and Family Welfare, 2021). Harnessing this well-placed public criticism of policies, the anti-vaxx groups had the field day by linking deaths after vaccination as deaths due to immunisation (Srivastava, 2021b).

All these uncertainties had policy implications; if indeed the Indians are less susceptible to the COVID19, then the crippling lockdowns are excessive; if the airborne transmission is the main route, then masking within home and dwelling would be necessary; if indeed the vaccines are unsafe, it would not be a panacea for the pandemic.

Discussion

All the three cases presented above are illustrative. The media citation is also indicative; almost all mainstream media carried similar messages. In the first part of this discussion, we will show that these messages are not mal-information or dis-information but are definitely misinformation. They do not do justice to the norms of journalism of 'telling truth'. We will further show that these framing emerged out of the regular everyday journalistic practices and are not attributable to the bias of the particular journalist or media channel. We would also argue that the actual practice of fact checks, both ex-ante and post-ante are inadequate to deal with such disinformation arising out of or uncertainties in the science. Lastly, we suggest that journalists have a lot to learn from the strategies evolved to deal with scientific uncertainties in climate change science.

Misinformation arising out of uncertainty in science

The indices, case fatality ratio (CFR) and the 'deaths per lakh population' used to establish the Indian exceptionalism suffer from 'denominator fallacy'. The 'figures' used to make the Indian exceptionalism are eminently 'fact checkable'; the numbers are actual. However, the claim is misplaced.

The fact check process first identifies 'fact-checkable claims', then look for the best available evidence regarding the claim at hand, and finally, the relative truthfulness of the claims is arrived at. The sources are evaluated on the parameters of proximity, expertise, rigour, transparency, reliability, and conflict of interest to evaluate the reliable evidence. The central quest of the ex-post fact check is "scrupulous analysis driven by one basic question: 'How do we know that?'" (Mantzaris, 2018). However, as Shapiro et al. (2013, p. 668) note, "zeal for accuracy is a professional norm, but also that it is a norm of compromise – the compromise being simply understood rather than articulated. A small, easily checkable, fact needs to be checked, a larger but greyer assertion, not so much, unless it is defamation" (Shapiro, Ivor, Brin, Colette, Bédard-Brûlé, Isabelle, and Mychajlowycz, 2013, p. 668).

CFR is the ratio of actual infected cases as the numerator and the total susceptible population as the denominator. Serosurveys conducted in India clearly show that the infection spread gradually, and the prevalence of infection in rural, urban, urban slums and non-slum urban areas differed considerably. In short, the spread of the infection was uneven spatially and temporarily, between regions and even within different city locations. Thus, in computing the CFR or deaths per million, taking India's whole population as susceptible is a grave error. Epidemiologists use a more reliable infection fatality rate (IFR), the proportion of the actually infected to the actual death. Amid the raging pandemic, this measure is not easy to come by. However, a study (Cai, Novosad, Tandel, Asher, & Malani, 2021) found that among men aged 50–89, IFR is 0.12%

in Karnataka, 0.53% in Mumbai, but it was as high as 5.64percent among migrants in Bihar.², bursting the myth of ‘Indian exceptionalism’³.

Evolving science and constructing conflict

Since the outbreak in December 2019, scientists are continually unveiling new and novel knowledge about the novel coronavirus. Nevertheless, at all stages, the epistemic uncertainty remains exceptionally high. In the early days of the pandemic, most of the case studies across the globe on the transmission undertaken by tracking and tracing the infection suggested direct droplet inhalation or fomite route of transmission (Q. Li et al., 2020; W.H.O, 2020). Suspecting airborne transmission, air samples were collected in COVID hospitals and other places. The results were dodgy, with some showing and some not, and in most, the attempt to culture failed. The public health officials, including WHO, suggested specific pandemic protocols such as face masks, hand washing, and physical distancing based on the evidence available. Two significant developments led to a fresh perspective.

Meanwhile, scientists working with aerosols mimicked the emission of droplets and droplet nuclei from the human mouth and nose using nebulisers in laboratories. These suggested that tiny droplets could linger in the air for a prolonged duration and traverse a greater distance. Nevertheless, there was hardly any case study that suggested airborne transmission.

In the iconic case study of a super-spreading event in a Chinese restaurant, the infection spread to those in the direction of airflow, and the rest of the diners at the adjacent tables were unaffected (Y. Li et al., 2021). This particular case, while pointing out that the droplets could be carried by air currents to longer distances, at the same time strongly suggested against airborne particles that can distribute throughout a room. In contrast, a ‘super spreading event’ associated with the music event held at Mount Vernon, Washington, in March 2020, all but eight of the sixty-one became sick, despite the members practising physical distancing and hand sanitisation. Two people died. “We believe it likely that shared air in the fellowship hall, combined with high emissions of respiratory aerosol from singing, were important contributing factors,” the study concluded (Miller et al., 2021). Slowly studies on super spread events, where one person infected many, began to accumulate, suggesting aerosol transmission. As more and more cluster cases were intensely analysed, it was evident that in some of the clusters, particularly in poorly ventilated and crowded indoor spaces, the spread of the infection could be explained only with an airborne hypothesis. In the light of the new knowledge uncovered, WHO recommended that crowded and closed unventilated space should be avoided along with the mask, hand wash and physical distancing, modifying its earlier public health measures.

The terminology also played a part in the confusion. In the epidemiologist lexicon, the terms “droplets” falling off to ground and “droplet nuclei” lingering in the air are classified based on a size threshold of 5µm. However, for an atmospheric aerosol researcher, whatever floats in the air for more than a few seconds are ‘aerosols’.

This episode was simultaneously a case of epistemic uncertainty evolving into judgemental uncertainty as more and more evidence accumulated and an ontological uncertainty, as many things about the virus were still evolving knowledge. Nevertheless, the media coverage framed these developments as ‘conflict’ between ‘independent scientists’ and the ‘WHO institutional experts’; or as ‘experts in disagreement’, treating this as a case of mere ‘judgemental uncertainty’. Sure, experts did differ from each other; but the disputation was about data, what airborne droplet means, and what implications can be drawn from the available data for public precautions and probable protective measures.

Presenting the debate as a controversy between a ‘good guy’ and a ‘bad guy’, the conflict frame at the same time appear to meet the journalistic norm of ‘objectivity and ‘balance’ and helps create an engaging story⁴.

2 “The severe economic and physical distress during the arduous return journey, piled on top of their poorer baseline health may have made migrants highly vulnerable to death after infection. The same phenomenon could explain why mortality was higher in Mumbai than in the southern states — because Mumbai’s outbreak was concentrated among a poor slum population with poor health and worse access to care,” speculate the authors.

3 The same study points out another puzzling phenomenon. The death rate in India of those over the age of 60 is less than in the developed world. “Most of India’s mortality advantage occurred among those over the age of 60. Our study cannot explain why this was the case, but one explanation likely has to do with the types of people who make it to old age in India relative to in other countries. Many of the most vulnerable may already have died, leaving a relatively robust group of elderly survivors, who further may have immune systems strengthened by a lifetime of viral exposure,” speculate the authors.

4 Stocking and Holstein (2009) detail four kinds of journalistic attitudinal clusters to how journalists treat conflicting views in scientific controversies; Lehmkuhl & Peters (2016, p. 11) note that in the face of encountering scientific uncertainty, journalists “addressed this perception in their decision-making process by choosing at least one of four strategies: Omission, he says – she says,

However, to scientists, polarisation is “a source of irritation . . . because scientific standards of objectivity require not balance or equal time but empirical verification of opposing hypotheses” (Nelkin, 1996, p. 1602). Sandman (1988, p. 37) puts it, ‘For science, objectivity is tentativeness and adherence to evidence in the search for truth. For journalism, objectivity is balance’. When faced with two confounding accounts, the journalist fulfilled their obligation to objectivity by balancing ‘two sides’. Presented as incommensurable conflicting claims, the journalistic presentation polarised what essentially was an ambiguity in the face of ‘unknown unknowns as well as limited and evolving shreds of evidence available at hand.

‘Man-eating-dog’ criteria going awry

The theory of news values, the concept of news factors, describes why a topic is newsworthy and therefore selected by the media for circulation. “[T]here is evidence that science is being progressively fitted into the news story format, which demands recency as a news value, as opposed to features-style reports” (Taylor, 2010, p. 221); consequently, news factors influence the selection and presentation of science news too. One of the classical news factors is ‘range’, that probe whether ‘nobody’, ‘a few people’, ‘specific group’, or ‘all citizens of at least one nation/region’ are directly affected by an event (Badenschier & Wormer, 2012, pp. 70–71). In science, communication, particularly regarding risk, tends to explore potential harm, probability of damage, and personal relevance of risks. This is often measured by the number of people affected. Also, the dictum ‘what bleeds leads’ indicate that disasters, destructions, and deaths are tantalising for media coverage.

When reporting the loss of life and injury in a disaster, reporting the number of deaths, or affected in the headline is standard journalistic practice. In such calamity, the number of deaths or affected suggest the magnitude of the suffering. However, reports such as ‘23K adverse events post vaccination in India’, without indicating the proportion, are least to say misleading. Out of the 75,435,381 vaccine doses that had been administered until then, 23,000 adverse events were reported, of which only 700 cases (@ 9.3 cases / million doses administered) were reported to be severe nature; the rest ‘mild’ such as headache, low-grade fever, chills and so on. The potential thromboembolic (clot in a blood vessel) major worry from covishield was around 0.61 cases/ million doses.

Vaccine hesitancy differs from resistance; while hesitancy is being unsure about taking a vaccine, resistance is absolutely against vaccination. While the gaps in transparency for vaccine approval in India is reported to be one of the critical factors influencing hesitancy, the misinformation and lack of information on vaccine safety and efficacy add to the confusion. Unwittingly presenting the adverse events without indicating the proportion exacerbate the anxiety and reinforce the reluctance.⁵

Reporting uncertainty – some suggestions

The three stories discussed above clearly does not meet the journalistic norm of telling ‘truth’ and ‘objectivity’, although none of them can be faulted for not adhering to the usual journalistic practices of the fact check, balance and news value. In the case of Indian exceptionalism, it was a clear case of ‘denominator fallacy’ while the ‘airborne or not’ controversy is a journalist narrative to get an engaging story by creating a conflict frame. The story reporting deaths from AEFI was misled by not giving the proportion of the risk. Neither the ex-ante nor the ex-post fact-check process can capture these media misrepresentations and force a re-look by the editor/journalist. In the light of these discussions, some suggestions are made for the journalist while reporting uncertainty in science.

Presenting ‘uncertainty’ as part of the science communication message is not just an add-on of supplementary information but fundamentally “shapes the meanings, interpretations, implications, and schema activated regarding the ambiguity, imprecision, and confidence of the message and the messenger.” In the face of more than one opinion, media often uses the ‘balance’ concept to report both sides. Climate change communication scholars warn that ‘she said/ he said’ type ‘false balance’ media coverage under-represents overwhelming scientific consensus and results in “intentionally biased coverage of global warming” (Boykoff & Boykoff, 2004, p. 134). A journalist needs to be wary of ‘false balance’.

Negotiation (with scientific sources), Structure and/or Language”

5 Of course, “current data on vaccines also shows that other big obstacles to vaccination are vaccine shortages and mismanagement” (Tarfe, 2021) and all the ills cannot be laid at the door of vaccine hesitancy.

Scholars have observed that the ‘Merchants of Doubt’ have “intentionally manufactured distrust around the science of climate change, exaggerating areas of uncertainty while downplaying areas of strong consensus and agreement” (Corner & Clarke, 2017, p. 54). The journalist needs to be aware of this danger and not be carried away. Opinion divergence may mean ‘disagreement’ (say the view of two scientists in the absence of overwhelming evidence of the airborne potential of novel coronavirus), or a ‘controversy’ (a long-standing rift in the scientific community, say the durability of immunological memory from COVID 19 infection or vaccination) or a ‘scepticism’ (as in lay meaning, that is questioning the scientific consensus, but not open to evidence, such as anti-vaxx arguments). Rice et al. (2018, p. 6) point out “former type of opinion divergence is likely to be both frequent and accurate, while the latter two would likely be misrepresentations of scientific opinion.”

A grounding in the ‘nature of science’ would help. Latour and Woolgar (1986) suggest that the nature of scientific conclusions range from speculative conclusions (type 1) to well-accepted facts (type 5). As the knowledge evolves, as in the case of the pandemic, scientific conclusions move from type 1 to type 5 and the degree of uncertainty shifts from high to low uncertainty. In the midst of the evolving knowledge, such as the pandemic or climate change, “Type 2 or Type 3 statements in the Latour and Woolgar typology, precisely the zone where hedging, qualifiers and other linguistic strategies for the communication of uncertainty play an important role” (Kandlikar et al., 2005).

Further, journalists need to discriminate between ‘technical uncertainty’ and ‘deficient uncertainty’. Rice et al. (2018, p. 304) warn conflating them in the media framing. For example, a journalist reporting that technical uncertainty on the side effect of vaccines (for example, estimates of the likely rate and amount of AEFI) would not be misrepresenting science. However, if it were portrayed as deficient uncertainty (for example, ‘we are in the dark about the adverse effect of vaccines’), it would be a misrepresentation because studies have quantified the potential adverse effects. Studies (Smithson, 1999).

From simply communicating news about research by simplifying and reducing the complicity, the role of contemporary science journalist has expanded “performing a wider plurality of roles, including those of curator, convener, public intellectual and civic educator, in addition to more traditional journalistic roles of reporter, conduit, watchdog and agenda-setter” (Fahy & Nisbet, 2011, p. 778)⁶. In this emergent “knowledge-based journalism” (Patterson, 2013, p. 7), environmental journalists have cast aside the traditional notions of balance and replaced them with newer notions of objectivity. By implementing a transparent method, indulging in pluralistic search for consensus, and what Daston and Galison (2010, p. 314) defined as “*trained judgment*”, these environmental journalist pursued a new path that avoided ‘false balance’ and outright advocacy (Fahy, 2018). To mitigate the ills of false balance, (Revkin, 2014, p. 157) suggests that instead of looking for the extreme ends of a spectrum of opinion, seek areas where scientists are in ‘deep consensus’. Dunwoody (2005, p. 90) suggest “weight-of-evidence” reporting to not fall into the trap of manufactured doubt. Alternative or minority views are presented, along with information on where the proportion of scientific knowledge and expert opinion lies on a given issue.

The dangers of mis/dis/mal-information – infodemic co-emerging with the pandemic can be addressed to a great extent by ex-post fact-checking. Nevertheless, uncertainties inherent to science and the ‘doubts’ seeded by motivated groups to portray scientific opinion as ‘unsettled’ using ‘junk science’ present a challenge. The journalist needs to negotiate these uncertainties and seed doubts with a better understanding of the sources of scientific uncertainties and the varied media frames used to communicate them. The journalist must encourage the citizen’s exercise of autonomy while at the same providing epistemic guidance. Scores of studies from patient autonomy in medical settings to climate change show that readers are not always averse to uncertainties; laypersons encounter various uncertainties all through their lives yet make decisions. By presenting qualified judgements and critical commentary on these judgements by experts, journalists could empower laypersons to identify choices that serve their self-defined best interests.

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Development of science journalism in Bosnia and Herzegovina

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Abstract

Science journalism is greatly underdeveloped in Bosnia and Herzegovina. Media outlets do not have journalists who are specialized to report on science and there are no TV or radio shows wholly dedicated to science and technology. Most media outlets in the country lack financial resources and capacities to train their journalists to report on science. The level of media and information literacy of citizens is considered poor since media and information literacy is not taught at primary and secondary schools. In addition, the popularity of disinformation on COVID-19 demonstrated that there is an urgent need for the development of science journalism in Bosnia and Herzegovina.

The aim of this paper is to assess the needs of journalists and media outlets in Bosnia and Herzegovina for science journalism and present recommendations on how to advance science journalism in the country. The paper is based on a mixed methodology, with quantitative data giving objectivity and qualitative data providing explanations to the research topic. The results of the research

indicate that journalists in the country lack skills and knowledge on how to find credible sources of science information and how to popularize scientific topics among the general audience. Some of the main obstacles identified by the respondents in the research are disinterest from the public towards scientific topics, lack of science experts and scientific illiteracy among journalists and the general public.

Introduction

Science journalism is greatly underdeveloped in Bosnia and Herzegovina (BiH). The media landscape in the country is characterized by a large number of media outlets and by low marketing revenues, which have fallen significantly over the past decade.

In total, there are three public broadcasters, 107 television stations, 157 radio stations, 8 news agencies and 8 dailies, 200 different publications and magazines and over 600 online news media.¹ Digital transformation impacted the production, consumption and distribution of news and shortened the news cycle, which, coupled with competition for audience share and profit demand, led to a decline in journalistic standards (Sokol 2021b). The media moved away from the values of verification of information and quality reporting towards sensationalism and content that often contains only one source (Sokol 2021b).

The mainstream media publish content on a variety of topics with a focus on current and political events, but there is a lack of in-depth reporting and specialized reporting on issues such as ecology, science, and economy (Sokol and Jukić-Mujkić 2021). Many local and regional advertisers moved their ads from traditional media to digital platforms impacting the traditional media's revenues that have been falling consistently (Petković and Hodžić 2019). Due to the shortened news cycle and lack of financial sustainability, media outlets do not have sufficient revenues and capacities for science journalism. In addition, media outlets in the country have been suffering financial losses during the pandemic of COVID-19 (Sokol and Jukić-Mujkić 2021). Media outlets do not have journalists who specialize in science reporting and there are no TV or radio shows wholly dedicated to science and technology.

Eleven universities, both public and private, offer media-related studies but none have specialized courses on science journalism (Sokol and Jukić-Mujkić 2021). Media organizations and journalist associations, on the other hand, have been providing educational activities for professional journalists on media literacy, disinformation and verification of information but there is a lack of experts, educational materials and courses on science journalism. In addition, the level of media and information literacy among citizens is considered poor and it is not part of primary and secondary school curricula (Hodžić, Bašić-Hrvatinić and Petković 2019). A recent study demonstrated that only a quarter of BiH adults (24 percent) believe in their ability to identify false information in the media and more than half of adults who use the internet (56 percent) do not perform any fact-checking of information they encounter online (Hasanagić, Popović and Lević 2021).² Another study showed that young people are especially vulnerable to problematic content online and when faced with examples of disinformation many were not able to recognize them (Hodžić and Sokol 2019).³

The need for science journalism was especially visible during the pandemic of COVID-19. The pandemic was followed by infodemic – large volumes of information and disinformation about the virus that left the public confused and unable to recognize reliable sources.⁴ The pandemic brought huge volumes of disinform-

1 Information has been retrieved from the registers of the Regulatory Agency for Communication of BiH and the Press Council BiH. A recent study by Osmančević (2021) identified the number of online news media.

2 The sample size was 1,450 respondents.

3 The study was based on focus groups with young people across BiH.

4 See the definition of the World Health Organization. https://www.who.int/health-topics/infodemic#tab=tab_3

mation on an unprecedented scale – conspiracy theories about the origin of the virus and vaccines circulated on the internet and social networks (Krupalija et al 2021; Sokol 2021a). Poor communication from health authorities and the lack of an official government's campaign on the importance of immunization further undermined the public's health response (Sokol 2021a). In November 2021, despite the availability of vaccines, only 20 percent of the population of Bosnia and Herzegovina got vaccinated (Augustinović and Milojević 2021). Such a situation demonstrates that there is an urgent need for the development of science journalism in BiH.

Conference on science journalism in Bosnia and Herzegovina

The Bosnian-Herzegovinian American Academy of Arts and Science (BHAAS) in partnership with Mediacentar Sarajevo, in April 2021, started a project named Development of Science Journalism in Bosnia and Herzegovina, supported by the Open Society Fund in Bosnia and Herzegovina. The nine-month project consisted of various activities primarily aimed at educating journalists about science journalism and raising awareness on the importance of this type of journalism among media workers and the general public. The project developed under the premises that accurate reporting on scientific matters is a relevant issue during the COVID pandemic and that it will be one of the crucial elements of our societies that are about to face colossal challenges of scientific nature such as global warming, sustainability, novel pandemics, etc. Science journalism is also an important weapon that must be utilized in the fight against disinformation.

The central activity of the project was a three-day Science Journalism Conference held in July 2021 that gathered science journalists and scientists from Bosnia and Herzegovina and the region (Serbia, Croatia, and Slovenia). The main purpose of the conference was to offer editors, journalists, and others interested in the topic, useful knowledge, experiences and advice from expert science journalists and scientists from the region. The conference included sessions such as creating popular radio and TV shows on science, selecting and interviewing scientists, interpreting statistical data, finding reliable sources and fact-checking information on science. Prior to the conference a survey and a focus group were conducted, which helped define the needs of journalists, scientists and science communicators, whose results are integrated into this paper.⁵

Methodology

The aim of this paper is to assess the needs of journalists and media outlets in Bosnia and Herzegovina for science journalism and suggest recommendations on advancing science journalism in the country. The paper is based on a mixed methodology, with quantitative data giving objectivity and qualitative data providing explanations to the research topic. The main research questions were:

- What are the needs of journalists and media outlets for science journalism in BiH?
- What are biggest challenges/problems when it comes to reporting on science?
- What is the quality of media reporting on science in BiH?

The findings of the paper are prepared based on a survey conducted in May 2021 among journalists, journalism students and students of scientific studies and a focus group discussion with scientists and journalists, representatives of the mainstream media outlets held in June 2021. The survey and the focus group were conducted in order to better understand common challenges and identify specific needs of media outlets for science journalism in Bosnia and Herzegovina.

The survey included 95 responses: out of which, 35 percent were journalists, 16 percent editors, 14.9 percent students of medicine or natural sciences, and the remaining included media experts and other professions. Besides basic professional and personal information, respondents were asked to select topics on science journalism about which they are interested to learn and to describe in a few sentences the specific challenges when it comes to reporting on science in Bosnia and Herzegovina.

The focus group was held in June 2021, which included ten participants, scientists, medical doctors, representatives of the media and the fact-checking organization. The aim of the focus group was to discuss in-depth the challenges and needs of the media in Bosnia and Herzegovina in reporting on science, the attitudes of scientists towards media content on science in BiH, their communication with journalists and the

⁵ About the conference see: <https://bhaas.org/konferencija-naucnog-novinarstva/>

experience of journalists in covering scientific topics. The discussion also focused on media reporting on the virus COVID-19 and vaccines.

This is a first study of its kind focused on the needs and challenges the media outlets and journalists face in BiH when covering scientific topics. The studies on the media sector in BiH mostly focus on issues such as media policies, protection of journalists, hate speech, regulatory and self-regulatory frameworks, media literacy or analysis of media reporting on specific topics, such as gender-based violence. There is a need for more research on media reporting particularly related to science, ecology and climate changes.

Media reporting on science and climate changes in BiH

Journalistic in-depth reporting on science is absent in the BiH media. The media have been reporting about the results of certain surveys, statistics and research sensationally, one-sidedly, without explaining the shortcomings of a study and often without sources (Kalinić 2021a). They largely focus on news from the fields of health, lifestyles, nutrition, use of supplements, but lately, also about COVID-19 and vaccines. Jelena Kalinić, a science communicator in the country, analyzed how journalists use sources when covering such topics without questioning their credibility. It was found that, when covering topics on food and health, journalists only publish data without emphasizing what scientific method was used (Kalinić 2021a).

She provides an example of news that was published in many international and local media about a study on how bee venom destroys cancer cells. She argued that in most cases the media omitted the fact that it was a preliminary study *in vitro*, on cell cultures, and the path from such studies to clinical use is quite long. Another issue that she identified was the use of predatory journals and preprint works in journalistic content which have not yet been reviewed and the methods and procedures on the basis of which the research was conducted have not been verified as credible sources (Kalinić 2021b).

Media outlets do not have specialized journalists and special columns or programmes dedicated to climate change and environmental protection (Vatreš 2021). Although a globally relevant problem with potentially irreversible consequences, the issue of climate change in BiH media mainly comes down to informing the public about gatherings of world leaders, such as the 26th UN Conference on Climate Change held in Glasgow. Media reports on air pollution in urban areas during the winter, on the struggles of the local population against the construction of mini-hydropower plants and protests against illegal landfills are reactive and daily, created to convey information about an incident or protest. The lack of quality, independent, analytical and well researched stories on climate change and protection of the environment contributes to the general public's lack of information about these problems (Vatreš 2021).

Results of the survey

The aim of this research was to better understand common challenges and identify specific needs of media outlets for science journalism in Bosnia and Herzegovina. In the survey respondents had to choose three out of twelve topics in science journalism education about which they wanted to learn more and needed more skills and knowledge. The five most popular science journalism education topics identified by the respondents were: Choosing credible sources of information and fact checking (53.7 percent); How to become a science journalist and how to win media space with science topics in BiH (52.6 percent); How to make an attractive science journalism story about local science and scientists (42 percent); Reporting on a controversial topic (32.6 percent); Creating a TV or radio program about science (30.5 percent).

The five most popular science journalism education topics:

1. Choosing credible sources of information and fact checking (53.7 percent)
2. How to become a science journalist and how to win media space with science topics in BiH (52.6 percent)
3. How to make an attractive science journalism story about local science and scientists (42 percent)
4. Reporting on a controversial topic (32.6 percent)
5. Creating a TV or radio program about science (30.5 percent)

The questionnaire included an open-ended question about the biggest challenge/problem when it comes to

reporting on science in the BiH media. A large number of respondents expressed the view that the biggest challenge to science journalism in BiH is the disinterest of the public due to which the media do not report on scientific topics. Other most common challenges that were identified included: scientific illiteracy among journalists and the general public, lack of science experts, lack of financial resources, and disinformation on scientific topics.

The five most common problems/challenges for journalists when reporting on science:

1	Disinterest of the public
2	Lack of scientific literacy among journalists and the public
3	Lack of experts who would be available as sources to journalists
4	Lack of financial resources
5	Disinformation

Discussion: needs and challenges of media outlets

The results of the questionnaire demonstrate that journalists in BiH need more training in finding credible sources of information when reporting on science and skills about conveying complex scientific topics to the general audience. Some of the biggest challenges identified by the respondents include disinterest from the public, scientific illiteracy among journalists and the general public, lack of science experts, lack of financial resources, and disinformation on scientific topics.

Finding and choosing credible sources of information and fact-checking have been especially problematic for journalists in BiH, particularly on topics such as science, technology, climate change, and ecology. The fact-checking platform has debunked numerous examples of disinformation on scientific topics coming from mainstream, non-professional and anonymous media and content for using non-reliable sources (Krupalija et al 2021). Media representatives, on the other hand, argue that they do not have time to fact-check information, especially when it comes from sources such as news agencies, which they assume must be credible (Sokol and Jukić-Mujkić 2021). Previous studies have pointed out that most articles on online media in Bosnia and Herzegovina have only a few sources, many only one (one-source journalism). They also showed that when reporting on vaccines, for example, the most dominant sources are political figures (Sokol and Jukić-Mujkić 2021). One respondent wrote that the main challenge to science journalism is: "The availability of credible sources, as well as verified information. Today's journalists do not have enough time and resources to investigate due to the rapidly developing media and the speed of information flow".

Focus group participants confirmed the difficulty to find and choose credible sources especially on topics about which journalists are not familiar with.

"I am also not sure every time whether a certain study is credible or not credible and I sometimes need five days of inquiries, conversations with experts, checking what that journal is, what was the methodology of the study and the like, to make a conclusion whether it is a generally credible source that I may put into my text. Journalists do not have time for that." Representative of the fact checking organization, Bosnia and Herzegovina, focus group, June 2021

Another common problem in media reporting on science is the phenomenon of false balance, in which journalists present an issue as being more balanced than the evidence supports. Reporting on COVID-19, especially at the beginning of the pandemic, included interviewees who represented the scientific consensus and those who claimed that the virus was artificially created or did not even exist. Such reporting, according to the participants of the focus group, highly influenced the attitudes of the public. It made scientific consensus appear as a debatable issue. Another reason for the phenomenon of false balance and non-verified sources in the traditional media, as mentioned by focus group participants, is that conspiracy theories and disinformation are attractive to the public and the media publish them with the aim to attract readers' attention and thus more revenues.

The biggest challenge identified by the respondents when it comes to reporting on scientific topics is the disinterest of the public. One of the respondents wrote that the main challenge to science journalism is "Disinterest from the audience. These are texts that are otherwise longer and 'tiring' for the audience and it is believed that they would not choose to read such texts." Focus group participants argued, however, that the main problem is the lack of specialized journalists who would translate the language of science to the general public in an easy and interesting way. The results of the questionnaire demonstrate that journalists

need more knowledge and skills in order to convey complex scientific topics to the general public.

It should be noted, however, that there are no in-depth research studies on the audience needs in BiH. Media outlets in Bosnia and Herzegovina mostly publish content that attract their readers' attention and consider more complex and longer reads uninteresting for their readers. A recent study on media consumption habits of adults in BiH demonstrated that BiH adults are most likely to watch/listen to/follow the news and informative content (71 percent). This is followed by entertaining content (64 percent), feature films and shows (51 percent), sports (39 percent), documentaries (35 percent) and various topics that interest individual adults (37 percent). Educational content is watched/listened to/followed by a quarter (25 percent), while content on their hobbies by a fifth (21 percent) of adults. Nearly a fifth (18 percent) watch/listen to/follow cultural content, and slightly fewer (15 percent) religious content (Hasanagić, Popović and Lević 2021). There are no research studies on how many people follow scientific topics and whether they would like to have more media content on science in BiH. A research study on media consumption habits of youth in BiH showed that young people are interested in topics on science and ecology (Sokol 2021c).

Another obstacle identified by the respondents towards the development of science journalism in BiH is the lack of science experts. According to the respondents, there are not many experts for particular scientific fields in the country and often experts are unavailable to the media either by personal or institutional choice, and are not always reliable in terms of the information they provide. Respondents also argued that some experts are unable to explain complex scientific topics to the public and that there is a lack of a systematic support for science in the country. According to one respondent, the biggest challenge in science journalism is "scientists and experts who do not know how to adequately explain scientific facts and are unaccustomed to communicating with journalists".

Focus group participants claimed that, for example, during the pandemic only a small number of experts were available to the media and that there is a need for a registry of scientists whom journalists could contact for specific topics. One participant stated that there are many professionals in the country but they do not have the necessary skills for communication and that there is a need for a systematic support to equip such individuals with better communication skills, especially during the periods of crises. Finding a competent interviewee on scientific topics is a challenge for media outlets. Journalists need to be trained where to search for experts and how to prepare questions for interviews (Đukanović 2021). Journalists in the focus group stated that they had difficulties in obtaining information from public institutions and especially health institutions, which they claim are not open to the public. Even though the country has good Freedom to Access Information laws, their implementation is inadequate and journalists struggle to obtain information from public institutions (Media.ba 2019).

Conclusion and recommendations

Science journalism is underdeveloped in Bosnia and Herzegovina. Most media outlets in the country have been suffering financial losses, lack of proper financial revenues and capacities to train their journalists to report on science. Media outlets do not have journalists who are specialized to report on science and there are no TV or radio shows wholly dedicated to science and technology. Respondents in the questionnaire and participants in the focus group discussion identified a number of challenges to the development of science journalism in BiH including disinterest of the public, lack of science experts, scientific illiteracy among journalists and the general public, difficulties in obtaining information and distinguishing reliable and non-reliable sources. The pandemic of COVID-19 demonstrated that there is an urgent need to develop science journalism in BiH and to raise the capacities of journalists to report on scientific topics. Due to this, it is very important to provide educational courses and materials on science journalism to journalists, provide education in public communication to science experts and conduct awareness-raising campaigns on the importance of science journalism in BiH.

Recommendations

Departments of journalism and media organizations should provide educational activities and educational materials for journalists on science journalism regularly. Such educational activities should include training modules on locating credible sources on science and translating difficult scientific language to the general

public. Training courses in communication should also be given to scientists who should be equipped and capacitated to work with the media.

Media organizations together with scientific institutions should prepare and update regularly a registry of experts on scientific topics whom journalists could contact for information.

Media organizations and scientists should conduct advocacy and awareness-raising campaigns on the importance of science journalism and should work on its popularization in BiH.

The state, foreign donors and media organizations should provide grants to media outlets and freelance journalists to report on science, climate change, ecology and technology.

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Widening the horizons of journalism students reporting the climate crisis

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Abstract

This article concentrates on teaching journalism students to widen their horizons with regard to the climate crisis. It asks us to move away from the limiting pattern of news headlines concentrating on a single, identifiable event in order to tell a story and look at broader underlying issues, using the solutions journalism methodology. This is partly to better tell the story of climate change but also to develop a more positive mental attitude to such stories both for reporters and for readers. This is an approach that should spark considerable interest with our readers.

Introduction

The climate crisis spent years not being properly talked about or covered in the press. The rise in the planet's temperature due to humans' addiction to fossil fuels has long been the overheating elephant in the room. Now that frankly, rather terrifying, stories about climate breakdown are making the front pages, how can you help journalism students bring deep knowledge of climate change into their pieces without endangering their – or their readers' – wellbeing?

At the University of the Arts London, I've been working with 3rd years on one assessed unit to help them become critical practitioners who have a mix of skills - an understanding of key media concepts and well-honed writing skills showcased in a DTP magazine designed by the class. For the past two years students on the Contemporary Media Cultures BA have also been asked to embed an environmental crisis theme (about the city and/or nature) in their portfolio and assessments. The risk is that the grand aims of this unit will backfire as their tutors, all hired because they are specialist writers or photographers, will steer the students to focus on headline environmental bad news such as melting glaciers, worldwide forest fires, climate refugees and lost species. Although it is factually correct that we are at a tipping point with methane leaking out of the tundra, the slowing of the Gulf Stream, the jet stream changing and

the Greenland ice sheet retreating (www.UN.org/en/climatechange)¹, just sharing a smorgasbord of horror facts is also a recipe for undermining students' positive headspace and their power to develop their creative skills. It's not great for the tutors' wellbeing either.

Methodology

As a run up to the COP26 meeting to be held in the UK in the autumn of 2021, the London College of Communication's (LCC) internal Climate Action Group provided funding for a 24-page online magazine, *What's next: COMMUNICATING CLIMATE CHANGE* for publication in July 2021.

It was written by LCC staff member Nicola Baird with help from two students (Y3 Emily Moore-Watts in a design role, and climate activist and Y1 student Caoime Bergin as a contributor) for all staff at the University of the Arts London (UAL) – and more specifically the London College of Communication (LCC) – but it has tips in it that might help anyone faced with the requirement (or wish) to include the biggest challenge in their teaching practice. As chair of the Climate Action Group, Nicky Ryan, Dean of LCC's Design School explains: "We funded this project because of its innovative approach to a subject which can often seem overwhelming and frightening. Instead, the perspective offered here is one of hope, resourcefulness and the power of human agency."

At about the same time the UN published on 9 August 2021 a pre-COP26 devastating report with a "Code Red warning for humanity" from Secretary-General António Guterres, if rapid cuts in CO2 emissions are not made by 2030². Speaking personally, I felt – and still do – slightly sick reading this report, as if nothing anyone does will make any difference. And if that's true – nothing will make a difference - there is no motivation for anyone, including our students, to make any changes. Interestingly the first reviewer of this paper (anonymous) said "the problems of mental health deterioration of students, teachers and readers and the way that most news presentation of the climate crisis [plays] to that sounds like an interesting problem and one that needs to be developed. I have noticed over the past year my own deteriorating mental health dealing with a pandemic/climate crisis and an incompetent government..."

For clarification, please note that solutions journalism began life as constructive journalism.

Feedback

Feedback from using the magazine has come from students and staff *What's next: COMMUNICATING CLIMATE CHANGE*. Endorsements include:

Susi: "Loved the focus on positive action! And the invitation to interrogate what you're being told."

Jason: "A really great set of resources."

Zafer: "Fantastic."

Gracia: "I like the breadth of it, and the many specific examples and resources to look at. Definitely useful for teaching. I was recently thinking of where to find examples of sustainable filmmaking and indeed, this has led me to one."

Caoime, Y1: "Getting into the youth and active climate scene there's a lot of doom and gloom, from teenagers and young adults who are going through a lot, and especially with Covid. A lot of people look at climate change in a very negative way rather than the positive side of what's going well. I feel positive news is really important."

Wellbeing

It might seem a big ask for all tutors, and especially those employed on an hourly basis, who often have very limited amounts of time to write courses, to go another extra mile adapting their core practice. For ¹ www.un.org/en/climatechange is a good place to direct students for factual information as it also includes global efforts to tackle these challenges.

² See press release: <https://www.un.org/press/en/2021/sgsm20847.doc.htm> (accessed 14/12/21)

those people who've not spent years thinking about the environment (and in my case this also includes working in the publications department of Friends of the Earth for 10 years and writing/co-writing and editing 10 books on eco-topics) the short cut method of including a climate crisis theme is to follow the conventional news format that "if it bleeds it leads".

This idea was identified in 1989 by writer Eric Pooley in a now-famous piece, Grins, gore, videotape: the trouble with local news, originally published in New York magazine³ (and if you're trying to get this kind of climate crisis fact-fest Wikipedia is your friend), which flagged up the way local TV news was about violent local deaths.

"People don't want more news, they want better news," concluded Ulrik Haagerup from Denmark as he began to shape the elements of solutions journalism in his book *Constructive Journalism*.⁴

However, emotionally-triggering news – so often accompanied by detailed accounts of blood, death and devastation – is problematic for all media outlets which have seen big circulation falls and ad revenue drop offs in recent years (although bad news headlines might not be the only reason given the challenge from online sources). However, when this kind of journalist formula is applied to the awfulness of the climate crisis and the best front page story keeps charting the hottest, the wettest or a woman's howl of misery in front of dreadful flames echoing the photo of the running 'napalm girl' from the Vietnam War⁵ few of us have the mental strength to keep reading. It is far easier to maintain wellbeing and sanity by just getting on with life and ignoring the climate crisis. Worse, it might be adding to our students' pressures. We already have a situation where The Royal College of Psychiatrists (RCP) reports that more than half (57%) of the specialist child and adolescent psychiatrists in England are seeing children and young people distressed about the climate crisis and the state of the environment.⁶ Eco-distress symptoms identified by RCP include low mood, helplessness, anger, losing sleep, panic and guilt.

This may not be mental illness, but it is not easy to focus on learning in this state. Indeed, Dr Bernadka Dubicka, Chair of the Faculty of Child and Adolescent Faculty at the RCP points out that: "The climate crisis is clearly affecting children and young people's mental health. Younger generations are growing up with a constant backdrop of understandable fear and worry about their future and the future of the planet. We need to be able to have open conversations and really listen to our young people. Empowering young people to engage with constructive, positive action, should absolutely be supported." RCP recommendations include listening to young people; spending time in nature; supporting young people to take action and feel more in control; calculating your family's carbon footprint and reminding, "your child that there are lots of people working on solutions that will make the world happier, healthier and safer."⁷

Solutions

Lecturers may not be legally in loco parentis, but we are pretty close to this responsibility – and we are the ones writing course units. For those of us teaching traditional media skills it is challenging to realise that we can choose to be a big part of the problem... or not. As Giselle Green, solutions journalism advocate and trainer, points out: "Regular news with its negative bias, leaves us feeling depressed, disempowered and disengaged from our world. By contrast, solutions journalism, in exploring what's going right rather than just reporting what's going wrong, has been shown to improve our mood, reduce anxiety levels and encourage us to get involved with responses to problems. Research has even shown that solutions stories about the environment motivate people to be more environmentally-friendly."⁸

And from a commercial point of view – either for clickability and social media sharing or buying physical publications - the Solutions Journalism Network claims: "solutions stories outperform problem-focused

3 Pooley E., 1989, Grins, gore, videotape: the trouble with local news, New York Magazine (not on line)

4 Haagerup U., *Constructive Journalism, the next mega trend in journalism* (Aarhus University Press, 2017)

5 See <https://www.theguardian.com/world/gallery/2021/aug/09/greece-fires-wildfires-attica-greek-islands-evia-fire-in-pictures> in particular "elderly resident reacts as a wildfire approaches her house in the village of Gouves, on the island of Evia. Photograph Bloomberg/Getty Images (accessed 14/12/21).

6 See <https://www.rcpsych.ac.uk/news-and-features/latest-news/detail/2020/11/20/the-climate-crisis-is-taking-a-toll-on-the-mental-health-of-children-and-young-people> (accessed 14/12/21)

7 See <https://www.rcpsych.ac.uk/news-and-features/latest-news/detail/2020/11/20/the-climate-crisis-is-taking-a-toll-on-the-mental-health-of-children-and-young-people> (accessed 14/12/21)

8 See www.ncvo.org.uk/guide-to-constructive-journalism (accessed 30/09/21)

news; are more interesting, trustworthy, and uplifting; and inspire people to get involved.”⁹

We found students felt somewhat similar. Commenting on what might make a sustainability workshop (or topic theme) engaging, Lillie, Y1, said: “Finding out solutions is the optimism I’m looking for.” While Katy, Y3, said: “From the standpoint of a final year student I think some discussion around green and sustainable careers would be worthwhile. I feel many believe if they aren’t developing solar panels or working for the UN your career isn’t part or climate advocacy, when in reality, all fields, particularly creative, can do good towards the action of slowing and preventing climate change. Even if it’s just creating a platform for education or promoting sustainable creators or working for companies which have a climate action plan in place.”

Our students, in particular those from Gen Z (currently aged 16-25-years-old), have already had to cope with lockdowns. We want them back at university, learning with a certain amount of joy. Yes, they need to know what’s happening on the climate front, but they also need to be empowered to use their creativity and skills to help heal the world. We don’t need to mess with their wellbeing by pushing out eco-disaster facts as if we were the editors of the worst tabloids or curating an unpleasant Facebook page. Instead, as tutors we can be the facilitators able to share the good ideas and the solutions already out there.

To help tutors take this further at LCC we made a mini magazine *What’s next: COMMUNICATING CLIMATE CHANGE*¹⁰ available for anyone. It aims to help people working in tertiary education broaden the climate crisis conversation in their teaching – and learning by using the tips from the newish reporting method, constructive or solutions journalism.

One definition of solutions journalism is “rigorous reporting on the responses to social problems.” Practitioners tend to be very committed to this method (which is perhaps a weakness) and seek to rebalance the news so that people are exposed to stories that help them understand problems and challenges, and read stories that show potential ways to respond. A good example of a fully solutions journalism model is the UK magazine *Positive News*.

From a solutions journalism point of view the tragedy, for example, deaths from extreme weather, isn’t the story. Instead, you can look at angles that will throw up new information that gives wider context to the story. Ideas that offer a mix of solutions and calling out that from an eco-perspective might include looking at:

What are communities doing to tackle climate change?

How does a citizen’s assembly work – and why do they want free buses?

Who is making the switch to bike travel?

Can women save the planet – and if so, how?

What’s the thinking behind ‘system change not climate change’ and why and how is this concept gathering strength in the poorest communities?

How are councils (in your local area) tracking zero carbon targets?

The solutions journalism format should also help students ask critical questions of organisations so they cannot continue to get away with greenwashing with carbon and nature offsetting (eg, selling items from paddleboards to coffee beans as ‘zero carbon’)¹¹ or purplewashing (eg, engaging some women, in particular in STEM careers, at the same time as operating unjust and misogynist practices when extracting resources in the global south)¹².

Not only do students develop their agency as they are introduced to solutions journalism approaches, from an academic perspective they are better introduced to neoliberalism, environmental justice, the links between colonisation and the carbon economy and gain some thinking space about newer ideas such as the circular economy.¹³

As LCC’s Alejandro Abraham Hamanoiel pointed out: “Social justice journalism can be a tool for social change. [On this teaching unit/Journalism BA] “we hope to equip students with the critical skills to understand the complexities of environmental reporting while highlighting the imminent challenge of the

⁹ <https://www.solutionsjournalism.org/> (home page, accessed 14/12/21)

¹⁰ Free download of this 24pp magazine/booklet at <https://cmelcc.wordpress.com/2021/06/28/ways-to-include-climate-change-in-your-teaching-focus-on-solutions/>

¹¹ See <https://policy.friendsoftheearth.uk/insight/dangerous-distraction-offsetting-con> policy paper by Mike Childs and Paul De Zylva, Friends of the Earth 22 October 2021 (accessed 14/12/21)

¹² See World March of Women https://marchmondiale.org/wp-content/uploads/2021/10/EN_Documento_Contexto_EI_MMM-1.pdf (accessed 14/12/21)

¹³ Interesting approaches to the circular economy include the various Green New Deals and also Raworth K, *Doughnut Economics: seven ways to think like a 21st century economist* (Random House Business Books, London, 217).

climate crisis and the ethical imperatives of recognising and fighting against social inequalities.”

What next?

One of the key differences when using a solutions journalism approach is the need to prioritise the question ‘What next?’ after Who, What, Where, When, Why and How have been asked.

Helping journalism students to ask ‘What’s next?’ immediately empowers them to dream up, share, discuss, try out and write about/critique solutions that can tackle the climate crisis – from switching to slow fashion or following dismantling of neoliberalism with its unrealistic obsession for growth – in whatever way they want.

As we also strive to decolonise the curriculum and help all our students with attainment and progression – wherever they sit on the privilege scale – we certainly need to recalibrate how to communicate about the structural and environmental effects of climate change at a global scale. It’s not fair that young women like Mitzi Jonelle Tan in the Philippines grew up being “afraid of drowning in my own bedroom” thanks to storm surges and sea-level rise. But this info also needs to be shared – fortunately Mitzi does a good job at this on her hugely popular Instagram page @Mitzijonelle .

It was the 14-year-old Greta Thunberg (born 2003) who started School Strike for Climate – a movement that has spread globally, so we know this generation of students are hungry to do more with their learning than just pass tests. As Beatriz Silva, Y1, in the *What’s Next: COMMUNICATING CLIMATE CRISIS* booklet points out: “We can and should discuss the best ways to tackle the climate crisis and collectively come up with solutions to better our lives and stop the worst-case scenario from becoming a reality.”

The UN’s COP26 meeting in Glasgow, in November 2021, saw world leaders try to take a big view in a bid to slow down the climate crisis – and our students were watching as the headlines poured out stressing the world’s failures. Their efforts focused on cash, coal, cars and trees to reduce greenhouse gas emissions and keep the temperature no higher than 1.5C above pre-industrial levels.¹⁴ ¹⁵ These conference promises need following.

As tutors we can help our students navigate this age of panic, and learn skills, but for me it is helpful to revisit the definition of this cultural shift from old style ‘bad’ news to a solutions focus on the Solutions Journalism Network site which in addition to a bank of solutions journalism (SJ) stories says: “We’re talking about a shift from a pure watchdog role to a guide dog. In addition to uncovering what’s wrong, we also uncover potential responses. When we do that, we shift the way people engage with news and we heighten accountability. When we introduce solutions, we are proving that problems can be solved.”¹⁶ And that’s a powerful idea for all the players: learners, writers, readers, creators.

So, if you’re being asked to bring in the climate crisis angle for a unit, or an essay or even for just an hour’s seminar here’s hoping that a focus on the solutions will make the experience far more meaningful than the usual summative assessment. Maybe the booklet *What’s Next: COMMUNICATING CLIMATE CRISIS* will also offer you some inspiring teaching ideas. Good luck and please do share your experiences.

You can see and download the full magazine from London College of Communication’s Contemporary Media Cultures’ course blog <https://cmclcc.wordpress.com/2021/06/28/ways-to-include-climate-change-in-your-teaching-focus-on-solutions/>

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¹⁴ See post COP26 summary by Fiona Harvey <https://www.theguardian.com/environment/2021/nov/14/cash-coal-cars-trees-and-choreography-how-britain-kept-cop26-alive> (accessed 14/12/21)

¹⁵ Info about the thinking about human-induced warming and 1.5C see <https://www.ipcc.ch/sr15/faq/faq-chapter-1/> (accessed 14/12/21)

¹⁶ <https://www.facebook.com/solutionsjournalism/> (accessed November 2020)

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Book review: **Understanding the art of science journalism: developed and developing country perspective**

Toss Gascoine, Bernard Schiele, Joan Leach, Michelle Riedlinger (Eds) with Bruce v. Lewenstein, Luisa Massarani, Peter Broks (2020), “Communicating Science: A Global Perspective”, Australian National University Press, ISBN: 9781760463656 (Print edition). Reviewed by:

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Abstract

The book positions the right to science, as a socio-cultural right, in the contemporary context. It does so in terms of discussing the pedagogical counterparts of public understanding of science and science communication. It begins by articulating the boundary limiting features of this field of academic discourse, by establishing its emergence, using developmental activities signifying policy and academic impetus like the establishment of science communication centres, the establishment of dedicated academic journals, academic and research courses etc. The author introduces the sociology of knowledge perspective to an aspect crucial to science communication: its professionalization.

In terms of particular fields of communication, the authors trace and offer deep insights into how science communication has as a field come into its unique trajectory, using the ignored contestation between science com-

munication per se and public understanding of science. Thus, the gap between public perception of science and scientists as an epistemic community of practice is under exploration. This attempt occurs in an infrastructural setting of lack of specialized science Journalists, especially in Developing Countries.

Among other themes under exploration in the book relates to participatory or citizen science and its interaction with indigenous knowledge systems, cultural cartography approaches exploring evolving dynamics of different domains of knowledge and practice. Particularly those knowledge domains, whose boundaries reshape, due to epistemic and extra-epistemic factors, to name a few. This book provides insights into the key debates in the theoretical realm and informs the practice of Science Communication, more precisely, Science Journalism, from many theoretical empirical and methodological lenses.

Introduction

Science Journalism is often under critique for its limitations in terms of infrastructural, capacity-linked and human capital aspects across contexts. In this context, the socio-historical shaping of science communication forms part of the discussion in this book.

In the preface to this book, Professor John Leach outlines the provocative incantation of a ‘right to science’ from a civil or human rights perspective. He tempers it with a realistic ordering within other firmly entrenched human rights. While recognizing the power of science to offer partial solutions to many problems, he underscores how understanding science can help avoid problems science has already caused. In his conceptualization, communication is both a tool and an enabler to science. His view states that access to science and its attendant benefits and opportunities is uneven in its distribution across the World. He attributes this to the concentration of gains from scientific knowledge in wealthy regions of the world. This concentration of benefits contrasts with the shifting of costs of its production to the poorer regions. Improving access to science through science communication, howsoever modest, serves to address this inequality.

The book is part of an ongoing mission philosophy of the Australian National Centre for Public Awareness of Science aimed at fostering the ‘democratic ownership of science’ and involves the cataloguing of stories of science communication from across the world. This cataloguing of case studies accounts for how science is or could be more accessible and how scientific knowledge is made accountable. This attempt at case studies involving timelines of the emergence of forms of science communication and the stories, however, avoids the ‘origin stories’ standpoint of science communication. He juxtaposes the Australian example of a rich history of sharing knowledge to countries of a relatively recent origin. In the former, he underscores the

academic and professional nature of the activity, irrespective of increasing or decreasing government support. This contrast in motivations to pursue science communication by the epistemic community provides a sharp contrast to countries, where communication is a form of activism and others, an extension of science itself. The goals of science communication have an articulation as education at certain times and a way of sharing the creation of knowledge in others and addressing items of concern - health, climate, environment, technology, and so on.

The beginning made in this field by this book outlines the ‘mess’ caused by containing all the different possibilities that a story can tell. This ‘messy evolution’ forms the character of science communication in the historical context. The methodology employed in this book includes methods of history, particularly archival, telling stories and narratives. The methodological aspiration comprises guiding future work in the field.

Transitions from a deficit model of science communication

The emergence of science communication as a field of academic discourse is traced in its historical aspects through global trends in an emerging field, highlighting a multiplicity of understandings (Toss Gascoigne and Bernard Schiele, Introduction to the book, 2020). Concerning science communication, this diversity of interpretations is from researchers and practitioners in the field. The book has 39 country-level case studies predicated on generating an evidence base and attempting theoretical development, guiding best practices. The book also aspires to explore the interaction between indigenous or local knowledge and scientific knowledge - an area hitherto neglected. The aim of the book is engagement with people and outcomes related to that. This engagement with people and outcomes is by a participative and deliberative role for citizens. This participative and deliberative formulation of science communication is in contrast to the deficit model of science communication. The case for the deficit model of science communication understood from an activity standpoint by independent journalism (SciDev.Net, Editorial, Global Edition, June 24, 2005, quoting C.P Scott, The Guardian, June 2005) was phrased in the popular statement: “Comment is free, but facts are sacred”. The creation of a more egalitarian formulation is an important challenge for the dialogue between science and society. A critical conceptual focus is on countering irrational beliefs based on religion, superstition, ideology, pseudoscience, or anti-science. The book provides a rich comparative analysis, not based on quantifiable data alone, but on the overarching dynamics in terms of the narrative.

Among the different approaches adopted in this context to address practical problems include training of science communicators, establishing science centres and museums, organizing campaigns to lift health outcomes, science festivals and public events, media coverage of science, programs to train scientists how to communicate, besides countering superstition and fake news. Thus, the book deals with the cross-cutting issues in science communication, identify common themes, recurring challenges, and potentially adaptable innovations.

It is, therefore, apposite to discuss that some voices within developed countries reflect upon communication with the public, as one impinging on the art of science communication, as opposed to the communication within Science (Dan Rather, CBS Correspondent, 60 Minutes). This alternative conceptualization of science communication emphasizes epistemic communities of practice in shaping the boundary spanning objects of science journalism with society. There has for long been a tussle between scientists and journalists for “squaring it off” over the coverage of science in popular media and getting the details accurate (“Scientists and Journalists Square Off Over Covering Science and Getting it Right”, [Dana Smith, 2018](#), in [www.undark.org](#)). While scientists seek a “right to review” for accuracy, journalists seek privilege over sources based on ethical arguments of journalistic integrity. The photograph below shows how they are currently working at cross purposes.

Picture Showing the “Squaring off in Science Journalism” through the coverage of Science in Popular media versus the need for accuracy (Source: Dana Smith, 2018; Photo Source: [www.undark.org](#), Malte Mueller, Getty Images).

This conflict has contributed to the prioritization and selection of specific values in journalistic practice. Kartik Shanker, Vaishnavi Rathore and Henry-Count Evans, 2021 emphasize how values of brevity, approximation, use of the personal, colloquial, and immediate stories, words, being right now are in tension with that of science. On the other hand, science values detail, precision, the impersonal, the technical, the lasting, the facts, number, and accuracy (Quentin Cooper, Material World, BBC Radio Science Program, 2011). But a curious question concerning the aim of this book in tackling the onslaught of misinformation

is that to what extent do we have independent shaping of journalistic ethics on a cultural basis and specific to the case of Science communication to the public. It is also an institutional question as to the pursuit of certain practices in the context of tackling misinformation and its potentially undesirable social outcomes. The answers to it in the contemporary matrix of the rise of post truth across the developed world has skewed the narrative in developing countries already suffering from capacity differences. This issue of misinformation finds a general emphasis in the context of how undemocratic governments rely on falsehood. (Address by Chief Justice of India, D.Y Chandrachud, Supreme Court of India at M.C Chagla Memorial Lecture, 2021). The issue of pseudoscience and irrational beliefs based on religion, superstition, ideology has been a recurrent theme in the Indian context. During the pandemic, it has brought doctors in a sharp division with practitioners of Ayurveda, a medical system based on natural and holistic medicine on the principle basis of their fundamental tenets of practice.

The persistence of a knowledge deficit communication model accounts for four factors (Molly J. Simis et al., 2016). Firstly, scientists training results in a belief that the public audience can and rationally do process information. This belief of rational agency rests on a fundamental premise of rational choice theory and the conceptualization of democracy by Plato and Aristotle. According to some authors, citizens are rationalizing instead of rational (Lodge and Taber, 2013 in Molly J. Simis et al., 2016). Secondly, seen as a product of current institutional structures, it is due to a lack of training in communication in science, technology, engineering and medicine graduate programmes. Here, scientists having less positive attitudes about the social sciences tend to reinforce the deficit model of communication. This reliance on the deficit model depends on how scientists conceptualize the public and its link with attitudes towards it. There is a close link between scientists perception of knowledge deficit and the individuals that comprise the public. Another reason for its self-perpetuation arises from its ability to shape public policy for science issues. Here again, community engagement is a crucial strategy to uproot the deficit model of communication. The role of knowledge arises in this context, yet trust and other predispositions displace knowledge in certain situations. The rationale for scientists is not to garner support for their work alone but are instead motivated by various intrinsic and extrinsic factors and the benefits from such communication in generating an informed citizenry.

The book commences with documenting a timeline analysis of key science communication events. These survey responses are from 17 respondents concerning details of 15 timeline events on a pilot basis. Events include viz. establishment of first University course training science communicators and developing research pedagogy on the academic field. Further, forming organizations and associations of science communicators, conferences, meetings, and publications in this area professionalized science communication practice. In addition, employment avenues followed by the development of a vocabulary of science popularisation, public understanding of science, vulgarisation, social appropriation of science did characterize the National experience in this context. Later, the number of respondents went up to 45. The development of the book on the back of a single case study from Ireland and Conference proceedings is an interesting case in the functioning of the communities of practice within Science Communication in itself (pp. 2-4). The evolution of the book into a more inclusive and diverse focus is particularly demonstrative of how western deficit of science communication models have come under transition. The overall project is to enhance science communication's overall visibility within society and measure the same.

In the same movement, all the surveys conducted aim to assess the level of science culture of given populations and the indicators developed to this end, coupled with the surveys of all university-based science communication programs carried out in the European Union. Sociology demonstrates that the legitimization of a domain has links with its historicization and the growing interest in the history of science communication.

Origins of modern era of science communication and post World War II narrative - golden age over or age of confusion?

In answering the nagging question as to the origins of the modern era of science communication, the book holds that the timelines vary from country to country. The authors divide this into the post war period (aluding to World War II) and the 19th Century golden age of science communication, before the war, as two discernible phases of its development. The latter period was under the influence of conflict, and accessible communication was not allowed on national security grounds.

The structural changes that ensued in the post war period resulted in interruptions to the normal processes.

The post war period demonstrates the social driving role of science and technology as the critical vehicle for social, cultural, and economic change matched with the pace of integrating the sciences and the economy. Among the key factors responsible for the sustainability of this movement involve training of a workforce (whose function is to develop new knowledge and new applications and acquire the skills to use the applications) in their professional and daily life.

Further, the ability and willingness of the population to adopt advances in technology and the rapid expansion of higher education came into sharp focus during the 1960s. The evolution of the post war period is rendered incomprehensible, absent an understanding of this dynamic. The narrative bears out in reports from the Organization for Economic Cooperation and Development (OECD). The emphasis on the link of national competitiveness to innovation qua the new knowledge and applications sustaining this pace of economic development. A second factor is the mobilization of national governments as key actors through the development of Ministries of Science and Technology in these countries, followed by science policy formulations. Lastly, mobilization at the population level through the development of science culture by implementing programs to promote and propagate scientific thinking and scientific knowledge. The paradigm change justifies the focus of the book on the post war period.

The modern era of science communication varies between countries depending on their situation before the Second World War and the pace of change thereafter. The authors were to select the most appropriate dates between 1945- 1980. The justification of this choice was because, during the 1970s-80s, there was a step change in the form of new interactive science museums, new employment, the opening of courses at universities to meet the demands of a career in science communication. The consolidation of this trend was evident from the formation of journals, associations and conferences devoted to this purpose and new programs to engage with the public at large. This period, the author believes, is when science communication asserted itself as a social necessity. A group of social actors is said to have emerged with shared values and practices, inventing terminologies to describe those practices and recognized as a group committed to the cause of science communication. Over the years, a second group has emerged of scholars and academic researchers who study science communication. The authors observe that they are in constant interaction. It is slightly difficult to comprehend how this happens in a scenario of multiple meanings and definitions.

The diversity of countries embodied through the case studies includes 11 from Asia, the most influential continental group after Europe and Australasia. The criticism of the eurocentric nature of the discourse arises in this context (Sara Demas, London School of Economics, 2020).

Defying Euro centricism through sites of resistance?

According to this critique, a discursive analysis of resistance through various controversies and student protest movements, particularly the controversy within the National Communication Association in the United States, explores the epistemic strands of calls to ‘decolonize the academy. The argument rests upon examining how communication scholarship responds to epistemic eurocentric dominance. This response to eurocentric dominance provides a Faircloughian critical discourse analysis of fourteen abstracts from three influential journals. The challenge of these forms of resistance is in terms of feeding into broader political decolonial discourses. In the words of lyricist Andre Dallas (Rhoades must Fall, Oxford, 2018, 17), “... It’s the other side of history that our syllabus lacks”. The lyrics chronicle the Rhoades must fall movement in 2015 against white supremacism. This movement was where calls for decolonizing education and the reorganization of spatial relations was first under deliberation. This campaign led to Georgetown University’s decision to allow admissions on a preferential basis for descendants of slaves in atonement for their connection with slavery (Swarns, 2016). Examples abound within the western world on this front in the Goldsmiths University of London Anti-Racist Action movement (2019).

This contemporary effort of rearticulation of the decolonization project within science communication has yet to occur in developing countries. A few notable efforts by people of colour and their white allies have tried to address the systemic lack of diversity for years, with calls to ‘de-westernize’ or ‘internationalize’ dating back to the 1990s and 2000s. (Downing, 1996, Curran and Park, 2000; McMillin, 2006). Yet years later, the developed nations struggle with student and activist movements - forms of communication within society on assimilating the egalitarian ideals of justice, equality, and fraternity in ordinary life. Regular newspaper images of activist movements serve as a reminder of how easy or difficult it is to bring sites of resistance within society and to feed into the broader political decolonial discourses, in general.

Recent attempts by scholars like Paula Chakravorty, Rachel Kuoad, Victoria Grubb's article # Communicationsowhite, published in 2018 in the International Association of Communication's Journal of Communication, underscores the dominance of white male scholars and the perpetuation of the same in a normative manner. Through an analysis of primary authors and citation in top association journals, a total lack of representation of non-white scholars in 'publication rates, citation rates and editorial positions' was seen (Chakravarty, 2018: p. 254). The resulting conclusion was that the economy of knowledge production in communication scholarship 'perpetuates the ongoing universalization of a specific expression of humanity' and, in doing so, institutes 'racial subjection' (Chakravarty, 2018: 263). A need arises to unveil the colonial 'legacies of knowledge production and a desire to decenter the Eurocentrism that pervades academic scholarship, both in its content and overrepresentation of white males as knowledge producers. The various issues that have brought this to the forefront include de-westernizing/Internationalising media and communication scholarship, postcolonialism and decoloniality. These approaches have gained traction in particular periods as dominant paradigms of resistance and different levels of radicalization. Particularly political is the case of decoloniality. The legacy of this transvaluation translates in the background as we grapple with more inclusive criteria for promoting diversity, an egalitarian ideal within science communication.

Diversity, optimism, doubt and challenges: towards more inclusive criteria

The book begins by basing the case studies in their appropriate context. However, its primary theses are that the disparities in wealth can sharply magnify problems, attitudes, and actions. Articulating implications in terms of defining issues and where science communication would offer a solution is apposite. While the nature of the problem and its being contingent on attitudes is somewhat evident, it results from a disparity in wealth alone. The ability to undertake appropriate actions is a funding or allocation problem that does not justify the dimensions underlying the capacity differences in undertaking appropriate actions and is slightly reductionist. The reliance on criteria like gross domestic product to base this is as flawed as it is in the developmental context. Further, their articulation of the role of religion in the social construction of knowledge, essential to the context of science communication, needs discussion. This role of religion and culture within social constructivism has implications for its project of countering irrational beliefs based on religion, superstition, ideology, pseudoscience, or anti-science.

Role of religion in social constructionism -

Further, the understanding that religious attitudes shape and influence national policies on research and practice in science with consequent implications for science communication is flawed. Within the social construction theories, the role of religion often has significant overlap with more prominent, secular aspects of culture, which is a fallacy. The influential works within social constructionism like Peter Berger's *Invitation to Sociology* (1963) and his collaborative work with Thomas Luckmann, *The Social Construction of Reality* speak of the meaning of reality and knowledge as they understood it (Garrison, 2002: 236) in this context. When they spoke of reality, they meant "phenomena...having a being independent of their own volition". They spoke of a real-world, a natural world that exists apart from our knowledge of it. Knowledge, in this context, is understood "...as the certainty that the phenomena are real and possess specific characteristics". Thus seen, knowledge is a mental construct of what the World is. Lastly, despite the all-encompassing socially constructed nature of knowledge, it may or may not reflect reality. It is the view of those who hold it and is, in a sense, the natural reality of their place and social reality. This social construction of knowledge, according to Berger, is central to the "sociology of knowledge". His rejection of the pretence of thought in isolation of the social context within which things find interpretation connects the thinker to his social world. Society supplies norms, values and logic but also the store of information that institutes our knowledge.

Among the various challenges to it, the one presented by religion is that the relativism of social construction denies absolutes and undermines truth and is destructive of religion, society, and humanity. The hedonistic and relativistic nature of standards has arisen in the absence of absolutes, leading to pollution of all aspects of morality (Hamilton, 1997 quoting Francis Schaeffer in Garrison, 2002). Even secular humanists argue against embracing social relativism, as it rejects the universal nature of human rights, fundamental

premises they vigorously defend. Even Postmodernism challenges classical notions of truth, reason and objectivity. Berger's social constructionism is in the tradition of enlightenment, rationalism and empiricism. It appears as the process by which people encounter the world, interact with it, and from cultural traits that make sense. Thus, clarity in presenting the social construction of knowledge is imperative. In the variant of sceptical and qualified realism (within the critical realism tradition), Ian Barbour, Arthur Peacock, and John Polkinghorne (all men of science) are of the view that problems exist with scientific work, in contrast to received realism, where science has a primal role to science, as regards uncovering the hidden mechanisms of the world and showing us as it is there in reality. However, recent trends in science communication research, intrinsically an inter-disciplinary endeavour, are limiting as they present theoretical and strategic prescriptions that do not adequately reflect the variety and cultural diversity of science communication internationally. In this direction, an inclusive definition of science communication must revolve around the social conversation around science. (Massimiano Buchi and Brian Trench, 2020).

It's truly about democracy- isn't it?

The use of the democracy index seems apposite to classifying countries, according to the developmental stage science communication has achieved. Primarily democratizing the expression of facts and opinions has been the fundamental goal of public understanding of science. The Tocquevillian ideal of participative democracy has multi-dimensional nature, which truly reflects the context of science communication. The astounding variety of science communication modes of mediation are under discussion in the book. The mainstreaming of efforts to develop scientific temper through public science events, using conventional and new age media enables a decentralized architecture for science communication. The novelty in the book lies in new approaches to science communication and practices. Science communication has actors always have to work and modify their work and discourse in response sensitive to the context, the power play involved and the social, economic and political imperatives that constitute their environment. Despite emphasizing democratic ideals at the core of science communication, critical realism (sceptical and qualified realism) dictates taking an inward view of how the scientific community functions. That view must emerge from the history of science communication.

The misplaced optimism of militarisation of science - the post World War II narrative.

Before World War II, Science communication was under the self-regulation of scientists and enthusiasts. It was only in the 1970s; governments began to assert their role spurred by the direct nature of the impact of science and technology on society. But governments with a consistent record of promoting science communication activities of diverse nature are rare. A noteworthy science fair takes place in Johannesburg, South Africa, every year in the first two weeks of December. In a society currently torn by ethnic strife, this highlights the co-existence of the defective cultural enmeshing of science communication with all parts of civic life implicating irrational beliefs of any description-social, cultural, economic or political with egalitarian efforts at science communication. Despite it being low on budgetary allocation and government priority through a combination of institutional apathy, competition for funding, lack of overall commitment (despite promises of support repeatedly reaffirmed) or because resource constraints impose a form of bounded rationality in investing in such efforts.

The role of governments has assumed a passive dimension and created space for external institutions and individuals to make the necessary effort. The unsavoury state relations of propaganda and science led to private foundations funded ambitious programs to train science journalists. In the United States, the absence of a strong central agency allowed many institutions, funding bodies and societies to enter a field described as 'vibrant', 'jostling' and 'cacophonous' and characterized by a lack of coordination and centralization. Whether that helps even in resource affluent settings to a moderate role for science communication that is responsive to the needs of society at large is another matter.

Also notable is that governments have been hostile to the idea of science communication at specific points in history. Here, the role of the state became a determining factor. On a general note, governments became more interested in science and science communication when there emerged a growing belief in the power of science to unlock a bright future. Vannevar Bush, Director of the US Office of Scientific Research and Development, responded to the possibilities of science during times of peace. The visions outlined by visionary leaders underscored the need for aligning the mindset of people with science. However, the develop-

ment of scientific temper in developing countries is particularly monumental on changing long-held beliefs and attitudes, opening the people's eyes to the possibilities for better approaches to health, agriculture, and industrialization, and paving the way for people to a new future. The promotion of science communication is a life-threatening project in countries like India, on account of the nexus between the right-wing political forces and violent religious organizations resulting in anti-science statements made by the political establishment finding their way into policy instruments, invasion of scientific spaces and reducing of scientific output (Gauhar Raza et al., 2018: 40). An implicit need arose in this context for public acceptance, awareness, and education. The role of organizations like the Organisation for Economic Cooperation and Development is to assert the fundamental role of the sciences and modern technologies in modern societies and insist on government science policy formulation to foster growth. The second report in 1971 embraced a broader view of science, putting forward its social and cultural aspects. The entry of science communication into the political discourse has occurred on the back of these developments.

Challenges to science communication: Indifference, scepticism, or superstition?

The book identifies a few challenges to science communication faces: fear of change, indifference, scepticism, superstition, competition for funding or resources, and cultural or religious differences. The different experiences of a collision between 'white man's science' and indigenous knowledge are under assessment, with resolution in sight for a few. Despite a general expectation that scientists will discuss their work and engage with society (the 'third mission'), there was limited interest by institutions, funding agencies and governments in rewarding communication work. The problematization offered in the book is one of lack of incentives for the scientific community to communicate their work to the public and the frustration resulting from the non-inclusion of their inputs into policy instruments. The question is whether the role of Media is independent of the scientific community.

In this regard, Chapter 2 outlines the timelines for developing science communication and as a media subfield. The specific indicators provided are the starting dates of radio programs or television programs. The caveats the authors outline concerning the predictive value of these indicators apply in respect of actors participating in the production of these programs and their role in other activities like the establishment of science centres, training programs etc. The internal variation between the timelines found in respect of radio and television programs shows the lack of continuous development of the former and certain context-specific factors that influence the feasibility of each medium. The discussion on the digital medium is not part of the articulation at all, perhaps because of its recent origin. The lack of neat, theoretical explanations in this context explains the overall debate on the pioneers regarding various activities, without clarifying whether the pursuit of one activity benefits from the other or merely appears as a discontinuity. The role of media is seen as consolidative of activities like the development of a journal and not in its independent right either.

Chapter 3 outlines the specific case of health communication in Africa (Margaret Kasege and Verah Okeyo, 2020 in Toss Gascoigne and Bernard Schiele, 2020). The development of the discipline in Africa was markedly distinct from the global north. This development points to a neglected contestation in the field between the public understanding of science, a paradigm that anchors the justification for science communication and science communication per se. The definition used for the latter is as a form of contact for sharing information on science in society using various means, including institutions and communication entities such as media houses'. Another definition of science communication is the 'use of the impact of the media and other channels of communication to disseminate scientific findings' with a focus on a communication process reliant on multimedia through journalistic reporting on mainstream and social media, and science exhibitions in museums (Du Plessis, 2011 in Margaret Kasege and Verah Okeyo, 2020).

In contrast, public understanding of science communication is a multifarious activity to narrow the gap between science and the people (Bauer, 2008 in Margaret Kasege and Verah Okeyo, 2020). It includes research that uses and appreciates empirical methods to investigate the public's appreciation and uptake of science- or its lack and variations across time and context. In the developed countries, the disciplinary boundaries are clear, and however, it is not the case in South Africa. This divergence on the clear disciplinary boundaries is attributable to the introduction of science in each region.

Several authors have alluded to this gap between science and the people and the common public understanding of basic science or the benefits arising from the same (Bensaude-Vincent, 2001). However, some have seen this perceived deficiency of scientific knowledge of the members of the public on the assumption

of insufficient coverage of science in the mass media and other public fora (Lubliski et al., 2014; Murcott and Williams, 2013 in Margaret Kasege and Verah Okeyo, 2020). Among the many explanations for this gap are the ivory tower approach of scientists and the arcane nature of its practices, as well as the ostensibly dispassionate scientific discourse in use by them (Allan, 2009 in Margaret Kasege and Verah Okeyo, 2020). The various measures, in terms of efforts to make the knowledge production in science - open and accessible, training scientists to be media savvy and improving the quality of science journalism are crucial. Science journalists face significant challenges while reporting scientific research in socially beneficial ways. There is an opportunity for science journalists to contribute to the open science movement by identifying and explaining significant value judgments in scientific research for the public at large. Journalists are uniquely situated as they act as gatekeepers of information, and their investigative skills should be useful in identifying value judgments (Kevin C. Elliot, 2019). This access issue is particularly relevant in the health domain because the information available to populations who depend on active personal engagement with health providers faces structural impediments. The content and scope of science education as part of the Larger Project is aligned with its unique colonial experience.

The utilitarian justification for the adoption of science education was to enable populations to improve their living conditions. Science education had mandates to improve agriculture and animal husbandry production practices. Populations could boost food production for individual use, export, and sale and improve overall health and life expectancy. Science education influenced attitudes and behaviour of the population, whereby practices were “civilized” if they emerged from science education and “uncivilized” if they were grounded in people’s beliefs and practices. Thus science communicators used this approach with media and schools. The colonial government’s attitudes were narrow concerning the provision of science education to their territories. The conduct of Higher education took place in territories elsewhere, intending to fulfil their need for a trained workforce. Thus, even when African countries became independent, science communication was limited to basic sciences to train the workforce to govern the country. Therefore, they had developmental and economic growth as priorities, accelerated through education, technology and human resources. However, the institutional transfer of power from colonizers to colonies was visible in every sphere of public life. Politics was an instrument of consolidation of the rule of governments in such newly independent countries.

The alternative of evidence-based solutions through science communication did not appear very strongly in this scenario. The public acceptability of science was lower than in the education system due to research institutions being the primary custodians of science communication. According to science communication researchers, this gap created the self-legitimization of scientists as brokers of science communication. The starting point of the Chapter is the acceptance of third parties in the development and practice of science communication in Africa. This point of reference is in terms of interests, methods and effect of third parties in the Media as the arena. This arena includes the impact of public relations and funding on science journalism, conceptualizing it under Habermas’ notion of the ‘public sphere.’ This notion of the public sphere refers to the inherent purpose of the speech act, i.e. mutual understanding through human’s communicative competence as a form of agency. The South African example demonstrates that having structured science communication events does not compensate for the absence of media coverage of science in mainstream offline media. Authors like duPlessis, 2017 in Margaret Kasege and Verah Okeyo, 2020 emphasize the importance of political factors in a society divided by colonization and racial apartheid in muzzling the development, research and use of science communication in higher learning institutions. Despite these structural constraints, science communication is a subject of research in higher education institutions. Particular examples talk about media coverage in specific issues like genetically modified crops in Kenya, provision of health information through radio communication and new age media like the Internet. Funding these research projects underscores the dependency on Western countries, which is structural to science communication as a field of study in all colonies.

The Chapter traces the trend of scientific research under private patronage since the 1970s and the imperatives of reputation management and securing market share guiding the development of knowledge products. This model of professional public relations for science appears as a domineering and generalized practice. The competition from social media platforms to traditional means of communication has changed the public communication character of science communication. The resultant pressure on science communication manifests in compromising the public nature of communication and knowledge dissemination and focus becoming skewed towards few scientists, products, and research institutions framing the discussion. The result is the risk of scientific fraud and lowering of the quality of social conversation of science. The chapter also outlines the structural constraints arising from the situation, like fewer resources to check the information. The requirement of a public sphere is thus necessary for the development of science communication through

independent scrutiny of the knowledge production process and support for peer review mechanisms. The authors link the diminished public participation on health issues and challenges with the development of practical insights into issues affecting the same and the provision of viable long-term solutions for them. The development of science journalism as a specialist field has been inclusive of scientific communities perspectives. It influences the entry-level requirements and pedagogical development of courses and the background of instructors that conduct teaching activities. The situational factors of professionalization of science communication have led to the development of structured courses at universities, research institutions etc. The future directions of a trained workforce specializing in research on science communication entrench itself firmly in this context. They discuss how the current research environment can widen the gap between scientists and the public at large in view of the unidirectional exchange of information from the public to scientists. The relative non-communication of outcomes generated from research to the public widens the Informational deficit between the two. This increased gap occurs because of the lack of feedback mechanisms with and to the public at large.

A few universities have undertaken the implementation of rural engagement on mapping community perception on various research projects. The increased gap between research and the public, along with structural and cultural issues, is responsible for program failure, despite funding of projects. Access to public debates and the Media is limited in nature. The specific example of GM or genetically modified crops in Kenya reveals the lack of access to research results, compared to public perceptions about the same. There are strong parallels in this context with the rollout of genetically modified crops in India, save for the fact the Kenyan example is a case of bounded rationality of actors, shown in the passive adoption of GM crops, due to constraints of food supply. This adoption took place due to a vacuum in the public debates, informed by an evidence base. What emerges is despite a public institution dominated ecosystem, facilitation of information flow has not taken place, which brings into question capacity constraints of a different nature than are routinely argued in the case of knowledge production.

Recent research seeks to reorient scientific communication to relationships with specific communities over time for meaningful engagement ([Lindy A. Orthia et al., 2021](#)). The particular engagement with various levels in the book points in this direction but does not consolidate its contribution to academic discourse in science communication. science communication in the South African example claims a universality that overlooks society's inequalities that public relations create. This notion of universality rests on the public sphere, which facilitates discussion and debate and influences public policy formulation. It is carried out on social media or at meetings (Butsch, 2007; 2011 in Margaret Kasege and Verah Okeyo, 2020, p. 58). The role of social differences in barring access to virtual information spaces is particularly visible. Fraser, 1992 outlines this public sphere's "rational deliberation" as a bourgeois individualistic social practice that the privileged meet to pursue their individualistic needs. This characterization of rational deliberation is usually seen, except for some instances, where the government tries to include all concerned in the spirit of collectivism, like in Tanzania. The authors discuss the increasing role of science communication of research funding agencies in the contemporary development of science communication. The authors outline the pressures and challenges on media houses arising from declining advertising and how foundations are attempting to finance journalism for the actual production of science journalism and capacity building. The implementation of capacity-building efforts is through training and fellowships to alleviate gaps in science journalism, viz., coverage gaps in content or depth; outright partisanship; lack of professionalism; laziness and lack of ethics. The foundations' role and activities are subject to criticism due to their alignment with areas of interest to these foundations. The authors outline the priorities of the Kenyan education system regarding agricultural subjects and the impact on education in health communication limited to few students in select institutions and therefore reduced access to science communication for the public at large. Despite these challenges, science journalism has been a cause for social change, especially in positive health-seeking behaviour. The chapter provides a discursive analysis from an evolutionary perspective in a sense with rudiments of historical development. However, the richer discourse could have been in the public understanding of science perspective, better revealing the realities. That discussion was part of the attempt in a piecemeal manner. Seeing science communication against the backdrop of science events and advances in the western world is evidence of the extent to which institution and capacity building was a primary focus of educational institutions in colonial times. The specialist needs of health communication are markedly different from science communication in general and outcomes from science-based events. The significant event of the Alma Ata Declaration, 1978, marks the watershed development in the history of health communication. Here again, the role of community health workers and their engagement within society finds emphasis. The emergence of HIV and AIDS placed the health agenda differently due to its global impact. The need for innovative information exchange mechanisms came to the forefront. The narrative on the health communi-

cation interventions attempts to address misinformation by addressing failures in implementing outcomes. The reorientation towards positive patient outcomes like mainstreaming of affected people and their rehabilitation forms an example in this context. The role of politics in health communication emphasizes this discussion through the intervention of promoting testing and counselling.

Therefore, the model of science communication appears as two distinct groups, namely those who possessed the science and those who received it as information. The context of globalization frames the discussion with an emphasis on food production and agriculture. Unique examples of community engagement for developmental initiatives with rural communities form an interesting study in storytelling and role-playing. Community health issues like the large number of deliveries done by untrained professionals is another example. Similar events and initiatives for primary and secondary school children like visits to museums, animal reserves and orphanages by popularising science are part of a bit of discussion. ScienceLink events organized and SciBraai are examples of social media using digital media. The involvement of local community platforms and coalitions promoting enhanced participation of marginalized groups like women etc., discusses diverse approaches for particular sexual and reproductive health issues, besides AIDS and HIV. The barriers to information in terms of the digital divide, state control of media and education, etc., are worth mentioning. The evolution of access to affordable treatment emerges from early-stage control of information about the state of public health facilities, arising due to political difficulties. The digital context outlined raises issues of misinformation and trust deficit. The development of science communication between researchers and users of technologies raises the true nature of communication due to a lack of feedback on the process and content of research studies. Communicating research to cause behavioural change has its challenges arising from this gap between researchers and users. The resistance to scientific findings that appeared in a socio-economic setting or on account of socio-cultural beliefs and practices provide the context-specific factors to be taken care of in science communication. The sources of information in the post-independence era underscore the role of radio as the vital source of information. The enhancement of literacy levels helped create a more extensive reach for mainstream media like print media. An optimist outline of outcomes in health communication results through this discussion.

In addition to the themes listed above, the book presents such interesting case studies on the development of science journalism. The contrasts that emerge between case studies of developed countries and newly independent colonies underscores the various facets of science communication on a culture and context-specific basis. Particularly noteworthy is the case of New Zealand (Chapter 4) on Bicultural knowledge communication and participatory science (Chapter 4), which signals a paradigm shift towards environmental activism and facilitation of other sustainable development goals. This case underscores the value of indigenous knowledge in different cultures as regards the content of science communication. Such culturally embedded approaches provide useful pointers to developing an organic form of science communication striking the right balance between the public and the research community. The authors outline how indigenous knowledge, knowledge systems and engagement processes is respected and incorporated into nationwide funding, research practice and public engagement (Jean S. Fleming, Nancy Longnecker, Rhian A. Salmon and Daniel C.H Hikuroa, 2020 in Toss Gascoigne and Bernard Schiele, 2020, p. 71, 72). Here, the initial response of the scientific community was to provide more information to address the deficit in knowledge in public. Compared to the South African example, this provides a sharp contrast in approaches. At the same time, both recognize the validity of cultural factors in shaping social realities in science communication on the ground. The importance of dialogue with the public found recognition in the early part of the 21st Century. The role of public dialogue in establishing multiple versions of the National Science Challenge underscores the science in society entanglement of science communication. Innovations in National Funding initiatives in science communication form part of numerous attempts to foster participatory science (Jean S. Fleming, Nancy Longnecker, Rhian A. Salmon and Daniel C.H Hikuroa, 2020 in Toss Gascoigne and Bernard Schiele, 2020, p. 73). European colonizers' influence in this process includes wetlands, changed land-use patterns, commercialized hunting of whales, etc. The specific context is that of geology and natural history museums. The origins of public acknowledged scientific research in the late 19th Century was driven by funds from individuals from different walks of life. The establishment of universities and the Department of Scientific and Industrial research parallels the Indian example. The professionalization of science as an academic activity frames this discussion. The emphasis on obtaining external funding and research for commercialization was a key plan. Push for modern developments in science communication came due to the perceived needs of the scientific community for gaining acceptance for new ideas or technologies. The weak development of media in this context is traceable to demographic factors. Differences of opinion arose concerning the quality of reporting between the scientific community and communication advisers. In response to the challenges, publicly funded science media centres were established and are a

key development in New Zealand. The context of disasters and specific environmental case studies, including the introduction of genetically modified crops, contrasts the South African example, where passive resistance resulted from a lack of debate in public on the science behind genetically modified organisms. The fate of the various science challenges and their subject area coverage frames the discussion on greater public engagement. This discussion appears their mission-led and interdisciplinary research nature of programs with a greater public engagement component. Addressing the deficit in public understanding of science remains a top priority. The ineffective use of a non-dialogic and deficit approach appears as an example to argue for more participatory forms of science communication. Most of the public engagement with scientific issues has been concerning health and environmental degradation, besides disasters. The structured use of mapping surveys to gauge the public understanding and attitudes towards science has been a systematic exercise. The various citizen science initiatives form part of the discussion in the chapter. Certain culture-specific practices of science communication by Maori researchers spark debates on a new vision of science. The authors offer a critique of the national science challenge on the marginalization of Maori researchers and the consequent debates arising on account of indigenous knowledge, and the dominant values of the scientific community in New Zealand offer interesting insights into the value of indigenous knowledge in framing and shaping the knowledge production and its communication. The role of education and training to facilitate these mandates finds emphasis. The success story of a bicultural science community arises in this context and greater public engagement with science.

Among other notable case studies with demonstrated discursive and theoretical divergences are the case of Argentina (where the decline of science journalism forms part of the discussion of actors and ecosystem in science communication using a cultural cartography approach), Australia, India, to name a few. Thus, the book provides a rich canvas for discussion of various theoretical approaches with a key theme of making science communication more participative and responsive to the needs of society. This exercise of socio-cultural factors and their interaction with epistemic and non-epistemic elements in the framing of science communication, particularly in the mass media, is a good read.

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Books for your science journalism reading lists

Journalism Education has looked for recent publications on science journalism that you might find useful if you are planning sessions or even a module teaching science journalism or communication. Most of these are readily available for ordering for your library or to put on student reading lists.

Science Journalism: An Introduction by Martin W Angler

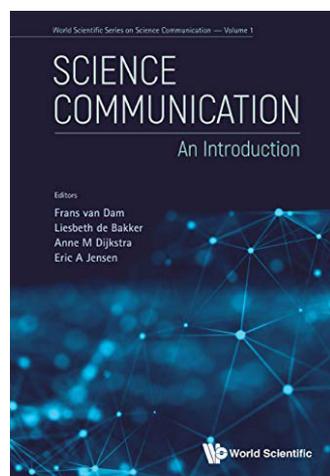
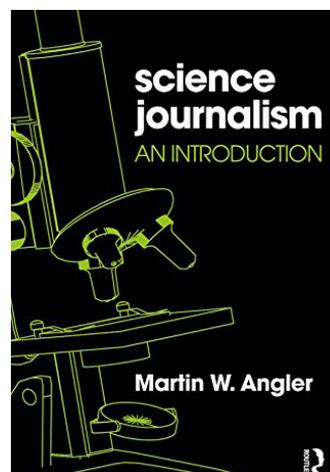
Kindle Edition: £31.49; Hardcover: £151.72; Paperback: £33.99

Science Journalism: An Introduction gives wide-ranging guidance on producing journalistic content about different areas of scientific research.

It provides a step-by-step guide to mastering the practical skills necessary for covering scientific stories and explaining the business behind the industry. **It is written by Martin Angler**, a freelance science journalist with a background in technology and environmental journalism.

Martin W. Angler, an experienced science and technology journalist, covers the main stages involved in getting an article written and published; from choosing an idea, structuring your pitch, researching and interviewing, to writing effectively for magazines, newspapers and online publications. There are chapters dedicated to investigative reporting, handling scientific data and explaining scientific practice and research findings to a non-specialist audience. Coverage in the chapters is supported by reading lists, review questions and practical exercises. The book also includes extensive interviews with established science journalists, scholars and scientists that provide tips on building a career in science journalism, address what makes a good reporter and discuss the current issues they face professionally. The book concludes by laying out the numerous available routes into science journalism, such as relevant writing programs, fellowships, awards and successful online science magazines.

For students of journalism and professional journalists at all levels, this book offers an invaluable overview of contemporary science journalism with an emphasis on professional journalistic practice and success in the digital age.



Science Communication: An Introduction (World Scientific Series On Science Communication Book 1) by Frans van Dam, Liesbeth de Bakker, Anne M Dijkstra, Eric A Jensen

Kindle Edition: £20.00; Hardcover: £36.48; Paperback: £25.00

A concise, coherent and easily readable textbook about the field of science communication, connecting the practice of science communicators with theory.

In the book, recent trends and shifts in the field resonate, such as the transition from telling about science to interacting with the public and the im-

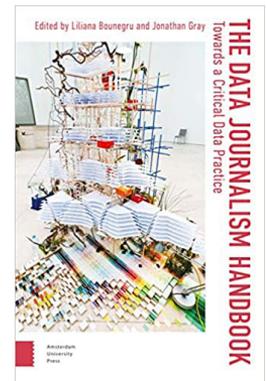
portance of science communication in health and environmental communication. The chapters have been written by experts in their disciplines, coming from philosophy of science and communication studies to health communication and science journalism. Cases from around the world illustrate science communication in practice. The book provides a broad, up-to-date and coherent introduction to science communication for both, students of science communication and related fields, as well as professionals.

The Data Journalism Handbook: Towards A Critical Data Practice: 1 (Digital Studies) by Liliana Bounegru and Dr. Jonathan Gray (Eds); Paperback: £37.72

The Data Journalism Handbook: Towards a Critical Data Practice provides a rich and panoramic introduction to data journalism, combining both critical reflection and practical insight.

It offers a diverse collection of perspectives on how data journalism is done around the world and the broader consequences of datafication in the news, serving as both a textbook and a sourcebook for this emerging field. With more than 50 chapters from leading researchers and practitioners of data journalism, it explores the work needed to render technologies and data productive for journalistic purposes.

It also gives a “behind the scenes” look at the social lives of data sets, data infrastructures, and data stories in newsrooms, media organizations, start-ups, civil society organizations and beyond. The book includes sections on “doing issues with data,” “assembling data,” “working with data,” “experiencing data,” “investigating data, platforms and algorithms,” “organizing data journalism,” “learning data journalism together” and “situating data journalism.”



Telling Science Stories: Reporting, Crafting and Editing for Journalists and Scientists by Martin W. Angler



A practical manual for anyone who wants to turn scientific facts into gripping science stories, this book provides an overview of story elements and structure, guidance on where to locate them in scientific papers and a step-by-step guide to applying storytelling techniques to writing about science.

In this book, Martin W. Angler outlines basic storytelling elements to show how and where fledgling science storytellers can find them in scientific output. Journalistic techniques like selection through news values and narrative interviews are covered in dedicated chapters. A variety of writing techniques and approaches are presented as a way of framing science stories in ways that are informative and compelling in different media – from short films to news articles. Practical examples, selected interviews and case studies complement each chapter, with exercises and experimentation suggestions included for deeper understanding. Review questions at the end of each chapter cement the newly gained knowledge to make sure readers absorb it, with links to articles and on-line tools inviting further reading.

A valuable resource for students of journalism and science communication as well as professional journalists, scientists and scientists-in-training who want to engage with the public or simply improve their journal papers. This book is a one-stop shop on science storytelling with a clear focus on providing practical techniques and advice on how to thrive as science writers and communicate science in all of its complexity.

Interactive Journalism: Hackers, Data, and Code by Nikki Usher

Kindle Edition: £14.74; Hardcover: £57.93; Paperback: £18.05

Interactive journalism has transformed the newsroom. Emerging out of changes in technology, culture, and economics, this new specialty uses a visual presentation of storytelling that allows users to interact with the reporting of information.

Today it stands at a nexus: part of the traditional newsroom, yet still novel enough to contribute innovative practices and thinking to the industry.

Nikki Usher brings together a comprehensive portrait of nothing less than a new journalistic identity. Usher provides a history of the impact of digital technology on reporting, photojournalism, graphics, and other disciplines that define interactive journalism. Her eyewitness study of the field's evolution and accomplishments ranges from the interactive creation of Al Jazeera English to the celebrated data desk at the Guardian to the New York Times' Pulitzer-endowed efforts in the new field. What emerges is an illuminating, richly reported profile of the people coding a revolution that may reverse the decline and fall of traditional journalism.



Forthcoming books in 2022

And finally, a couple of useful looking books due out later this year.

Journalism in the Data Age by Jingrong Tong

This book, due in March 2022, is your guide to understanding what journalism is and could be in an age of digital technology and datafication.

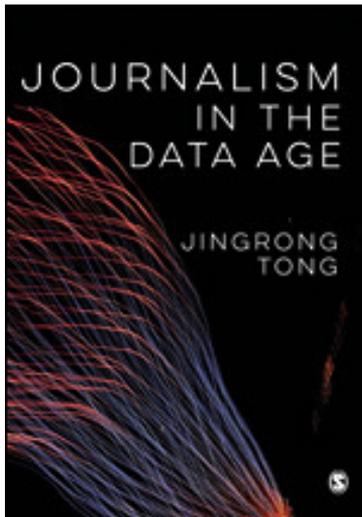
Journalism today is entwined with the digital. Stories can come from crowdsourcing and content farms. They can incorporate data visualisations and virtual reality. Journalists can find themselves working as self-employed digital entrepreneurs or for tech giants like Google and Facebook.

This book explores the development of journalism in this era of digital tech, and big and open data. It explores the crucial new developments of **online journalism**, **data journalism**, **computational journalism** and **entrepreneurial journalism**, and what this means for our understanding of journalism as a profession, and as a part of society. Using a wealth of international case studies, Jingrong Tong explores contemporary issues such as:

- AI, Automated news, 'robot reporters', and algorithmic accountability.
- Digital business models, from venture capital to tech start-ups to crowd-funding.
- Audiences and dissemination in and age of platform capitalism
- Questions of censorship, democracy and state control.
- Digital challenges to journalistic autonomy and legitimacy.

With clear explanations throughout, Journalism in the Data Age introduces you to a range of ideas, debates and key concepts. It is essential reading for all students of journalism.

Dr Jingrong Tong is Senior Lecturer in Digital News Cultures at AJE member, the University of Sheffield.



Mobile and Social Media Journalism: A Practical Guide for Multimedia Journalism by Anthony Adornato

Paperback: £35.99; Hardback: £96.00; eBook: £35.99; 386 pages; ISBN 9780367460969

Now in its second edition, *Mobile and Social Media Journalism* published by Routledge continues to be an essential resource for learning how journalists and news organizations use mobile and social media to gather news, distribute content, and engage with audiences.

Merging theory and practice, the book includes checklists and practical activities in every chapter, enabling readers to immediately build the mobile and social media skills that today's journalists need and which news organizations expect.

Author Anthony Adornato is an associate professor of journalism at Ithaca College's Roy H. Park School of Communications in New York state. His teaching and research focus on the role of mobile and social media in journalism. In 2020,

The second edition retains a focus on journalism's core values, such as authentication, verification, and credibility, while guiding readers on how to apply them to digital media activities. The book also offers an in-depth discussion of the audience's active role in producing content, how mobile devices and social media have changed the way the audience consumes news, and what these changes mean for journalists. Updated to address the latest trends in multimedia journalism, the second edition includes two new chapters: "Writing mobile-friendly web stories" and "The spread of fake news".

This is a valuable resource for journalism students, as well as media professionals seeking to update their skills.

The book also features a companion website at www.mobileandsocialmediajournalism.com, providing online resources for students and lecturers, including video tutorials, industry news, and sample assignments. The book's Twitter account (@MobileJourn) and Facebook page (fb.com/MobileandSocialMediaJournalism) share the latest industry trends and offer tips for teaching the topic.



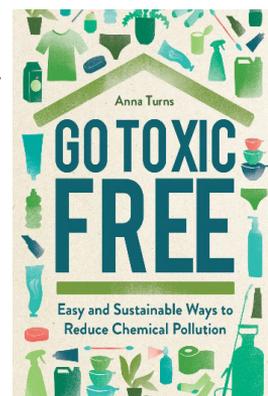
Go Toxic Free by Anna Turns

Hardback £14.99 Michael O'Mara Books

Anna Turns is an environmental journalist specializing in sustainability issues who writes regularly for *The Guardian* and *Daily Telegraph* teaches on the journalism programme at Plymouth Marjon University.

In 2020, she joined the Integrity Council for Provenance, which aims to combat greenwashing and create standards that better enable transparency. Her new book, *Go Toxic Free* is a practical, in-depth, myth-busting guide revealing the impact of toxic chemicals commonly found in the home, with simple swaps and habits that can make a BIG difference. It's a thought-provoking and comprehensive book looking at common household products from their raw materials to disposal – so we can truly each reduce our "chemical footprint" on the planet, and improve our health.

Go Toxic Free is a vital guide to help us all make important changes to our lifestyles and consumption to help reduce the devastating impact of chemical pollution. Plastic pollution has been headline news since David Attenborough's shocking *Blue Planet II*. But plastics are only part of the story, and the invisible world of chemical pollutants – in the soil, the air, our water systems and our own bodies – is just as concerning when over 70% of chemicals used in the EU have been labelled hazardous for health or the environment. From your kitchen cupboard to your bathroom cabinet to your garden shed, Anna Turns reveals the harmful chemicals inside your home and helpful tips to avoid them wherever you can.



Books

The books pages are edited by Tor Clark. If you have a book you would like to review or have come across a new book we should know about please get in touch. Also if you have recently had a book published and would like to see it reviewed or promoted, please contact Tor on tor.clark@leicester.ac.uk or ajejournal@gmail.com

Welcome to the reviews section

Tor Clark, University of Leicester, UK, Journalism Education reviews editor

This edition's reviews section takes a suitably global look at journalism, with four fascinating recent books which will inform students and their tutors about how journalism is developing all around the globe.

2021 began with the storming of the US Capitol, provoked by US president Donald Trump using the media, broadcast and social, and those events, and the presidential election which preceded them, are covered in detail and with supreme knowledge and insights into the journalistic craft in *Unpresided* by BBC North America editor Jon Sopel.

This book is enjoyed by Sara McConnell of the University of Sheffield's respected Journalism Studies Department, who recommends this not only as a rip-roaring good read, but also as a rare and fascinating insight into the journalistic practice of a top foreign correspondent.

The bedrock of all journalism across the world used to be the local media, but it has suffered terribly in recent decades because of the impact of the rise in use of the internet.

The state of local journalism in the UK, US, Australia and a host of other countries is examined in detail in a collection of 46 chapters edited by Agnes Gulyas of Canterbury Christchurch University and David Baines of Newcastle University in *The Routledge Companion to Local Media and Journalism*. Local journalism is an under-examined part of the media landscape and this edited collection goes a long way to shine a light on important aspects of it across the world.

Finally, the third volume in a trilogy, *Populism, the Pandemic and the Media: Journalism in the age of Covid, Trump, Brexit and Johnson*, edited by John Mair, Tor Clark, Neil Fowler, Raymond Snoddy and Richard Tait, aims to examine how global political events and themes have impacted journalism since 2020.

Reviewer Alan Geere of Guandong University of Foreign Studies recommends this latest instalment to students and their tutors, especially for what it has to say from big name UK journalists about the events on the US from November 2020 to January 2021.

Students of Journalism can learn a lot to inform their own knowledge and practice by looking further afield than their own immediate environs and this edition's featured books encourage a wider worldview, which is always a good thing for a student of Journalism or any other subject.

Finally professor Rex Li of Liverpool John Moores University looks at *The Image of Africa in Ghana's Press: The Influence of International News Agencies* by Michael Yao Wodui Serwornoo, a book he finds ideal to add to the reading lists of his International Journalism programmes.

If you would like to review a book or suggest a book for review please contact reviews editor tor.clark@leicester.ac.uk

UnPresided by Jon Soper

Review by Sara McConnell, University of Sheffield, UK

A year on from the 2020 US presidential election, Donald Trump's bizarre one-term presidency and its chaotic ending seem like a bad dream for his many detractors. But as Trump threatens (or promises, depending on your point of view) to run again in 2024, the saga of the reality TV show host turned president is far from over.

So *UnPresided*, the new book from BBC North America editor, Jon Soper, is a reminder of what US voters might be in for in three years' time. But it is also a personal, behind-the-scenes account of an election campaign conducted with unusual viciousness (even by US standards), against the backdrop of a deadly pandemic which had taken the lives of more than 400,000 people in the US by the time Trump left office in January 2021.

Soper's original intention was to finish his book with a blow-by-blow account of election day on November 9, 2020. But like everyone else, he was unprepared for Trump's refusal to concede and his increasingly desperate attempts to demand recounts as he saw Biden overtake him.

This was too good a story for an experienced journalist like Soper to leave out, so the paperback has an extra chapter on the events leading up to the storming of the Capitol on January 6 2021. This is in some ways the most interesting chapter in the book, as Soper describes the grim gathering of tens of thousands of Trump supporters outside the White House and the shift from celebration to aggression.

Soper reports: "These people bought totally the assertion that the election had been stolen from Donald Trump. When you asked for evidence, they said it was everywhere but couldn't point to a single specific that would have altered the outcome of the election."

But reflecting on the start of Joe Biden's presidency after the drama of Trump's departure, Soper is honest enough to admit that journalistically, Trump had been a gift. "With Donald Trump, I was outside the White House nearly every night. It was a TV journalist's version of a daily blow-out meal." And Soper's verdict on Biden? "Dull, dull, dull."

The campaign diary itself starts in June 2019 as the rival candidates criss-cross the country in a bid to win their party's nomination for President and Trump rallies his supporters in state after state, while at the same time fighting impeachment proceedings. Soper has a front row seat at the latter, but only after battling against some of the tightest security he has ever experienced and being instructed: "No phones. No talking. No standing. Go where you are told."

These descriptions of the reality of being part of the Washington press pack are what makes Soper's book so interesting. Yes, he has dinner with ambassadors and interviews Steve Bannon and is told by Trump that he is 'fake news', but less exotically, he is forbidden from going to the toilet by security at Trump's first campaign rally, is forced to leave hotels at unearthly hours of the morning to catch a plane out of obscure parts of the Mid-West, and struggles to work out how to record a podcast on his phone with Emily Maitlis. Wi-fi breaks down mid-broadcast in ill-equipped hotels. He is apart from his family because of Covid, eating TV dinners in his rented Georgetown flat with a box set, permanently exhausted from constant travel, keeping up with Trump's Twitter feed and listening to the President recommending bleach to stop the spread of the corona virus.

Fortunately, none of this stops Soper's continuing sense of excitement at having a ringside seat when news is breaking and his fascination with the country he has been covering since 2014. Many trainee journalists and broadcasters in particular should find his enthusiasm infectious and be relieved that even high-profile journalists have their low moments.

***UnPresided* by Jon Soper, published 2021 by BBC Books, pp368, £9.99 PB.**

The Routledge Companion to Local Media and Journalism, edited by Agnes Gulyas and David Baines

Review by Tor Clark, University of Leicester, UK

For 300 years a combination of print and broadcast journalism kept the world informed of what they needed to know from the grassroots up.

That information ranged from late-opening chemists and cinema times to the actions of politicians on our behalf. That information also formed the grassroots of the whole news ecosystem, with large numbers of national and international stories originating as local stories.

Now there is growing concern about the demise of local journalism and its impact on the quality of information on which the public can base their choices and opinions.

If local people can't find the information they need to make informed choices locally then local societies will lose cohesion. If local news is not reported it will not be picked up and developed by national publications.

People will always be able to find news they want, but local journalism always also, and importantly, supplied news they needed – especially in coverage of local government and also in campaigning for local issues and investigating local wrong-doing.

An absence of trusted local news helps create a local credibility vacuum into which misinformation and disinformation can grow and prosper. The triumph of Leave in the 2016 UK EU Referendum and the election of Donald Trump in the USA that same year are suggested as examples of where populism thrived in the absence of widespread reliable local information to counter or challenge some of the populists' wilder claims.

At the same time, coverage of 'the media' has usually been focused on the national and international, on national newspapers and broadcasters in the UK, for example, with very little attention paid to local media by scholars or commentators, with a few heroic exceptions.

So this new collection of articles, edited by two respected Journalism academics, well known to AJE members, Agnes Gulyas of Canterbury Christchurch University and David Baines of Newcastle University, is both timely and useful.

Gulyas and Baines have assembled a huge range of useful and interesting contributions from every corner of the globe, featuring well-known contributors from all over the world, but among them plenty with long AJE and UK credentials, including Tony Harcup, Rachel Matthews, Lily Canter and James Morrison.

The book is helpfully broken up into sections covering histories and legacies of local media and journalism; local media policies; local media, publics and politics; ownership and sustainability of local media; local journalism and journalistic practices; communities and audiences of local news; and local media and the public good.

The various contributors cover the UK, US and Australia in good depth but their individual studies also feature the Pacific Islands, Columbia, Ghana, Japan, Belgium, Bulgaria, New Zealand, Russia, France, the Czech Republic, China, Sweden, India, Poland, Kenya, Spain, Norway, Brazil and the Caribbean, so whilst not systematically comprehensive, it's probably about as wide a global coverage as you are likely to ever find in one volume and the editors are to be congratulated for casting their net wide enough to ensure the world's diversity of local media is properly represented.

So in a book of so many different chapters it is impossible to distill central arguments, but a central theme is very apparent – local journalism is crucially important across the globe and lacks sufficient coverage and perhaps even recognition from government and even the publics it serves.

This collection goes a long way to point out how important local media is to all our communities and starts to right the imbalance of coverage. It is to be hoped it can find its way onto as many reading lists as possible so as to bring this vital sector to the attention of more scholars of Journalism and Media.

The Routledge Companion to Local Media and Journalism, Edited by Agnes Gulyas and David Baines, Published by Routledge, 2020, pp498, £152 HB, £31.99 ebook.

Populism, the Pandemic and the Media, edited by John Mair, Tor Clark, Neil Fowler, Raymond Snoddy and Richard Tait

Review by Alan Geere, Guangdong University of Foreign Studies

Perhaps the key to this latest engaging quick turnaround from Mair et al is in the title's

subdeck: *Journalism in the age of Covid, Trump, Brexit and Johnson. Two divisive characters and two disruptive events on the global stage at the same time that gave journalism an unexpected jolt and brought our brave industry back into the popular spotlight.*

If journalism is famously ‘the first draft of history’ then books by journalists about current affairs journalism must surely qualify for a position on the grid in that historical grand prix.

Credit to the book’s editors who have cajoled and inveigled 44 heavyweight authors to submit a chapter. From broadcast A-listers Clive Myrie and James Mates through the ex-editor common room of Alan Rusbridger and David Banks to academic heavyweights Professor Julian Petley and Sir John Curtice, every page earns its place.

The book starts with a blockbuster of a section, portentously entitled ‘January 6 and the end of Trumpism?’ which is a vehicle for, among others, the reporting and reflections of ITV News US correspondent, Robert Moore, and BBC North America Editor, Jon Sopel, who both suddenly became the face of America in the UK living room.

Moore, famously embedded inside the Capitol when the January 6 outrage kicked off, thoughtfully suggests that segments of the media should, at a minimum, examine their coverage and ask some difficult questions of themselves. Beneath the subhead ‘Inside the mob on January 6’ Moore writes: “ITV News had seen the signs of the rumbling volcano of white supremacist sentiment in America because we were looking, listening and newsgathering, and not studio-based.” Ouch! 1-0 to boots on the ground journalism.

Moore concludes with another dig at the strident, personality-led genre of TV news that is currently making stately progress across the Atlantic to home-grown UK output. “Facing a crisis of trust in television news, organisations need to revert to first principles, showcasing editorial balance and listening to people with diverse perspectives far beyond the studio, voices which may sometimes be the softest-spoken,” he writes.

“Above all, we must remember we are newsgatherers or we are nothing but noise.”

Over at the BBC Sopel has just finished his six-year stint as BBC North America Editor. Perhaps the defining day of his assignment was November 7, 2020, as the US election result became clear. “What a day. Tumultuous and astonishing don’t begin to describe it,” he writes. It is a day that unfolds in multiple locations at different times and his inside scoop – minute by minute from 8am until midnight – is as meticulous as it is revealing.

Away from Trumpism and on to Covid-19, Prof Curtice looks at public reactions to Brexit and Covid-19, Mark Easton, BBC Home Affairs Editor, investigates how Covering Covid reveals uncomfortable truths and a man who should know, Dr Julian Barwell, Clinical Geneticist and Honorary Professor in Genomic Medicine at the University Hospitals of Leicester NHS Trust, explores ‘The view from the hospital frontline’.

In a welcome section entitled ‘Outside the metropolitan elite’, Scotland (via John McLellan), Wales (Martin Shipton) and Northern Ireland (Gail Walker) all get a look in as well as honourable mentions for the provincial press. The ‘Boris and Brexit’ section does a worthy job of deconstructing the major media interests of the very recent past, but the latter phenomena of the US election plus aftermath and Covid are rightly given pride of place up front.

This book is the third in a trilogy after *Brexit, Trump and the Media in 2017* and *Brexit, Boris and the Media in 2020*. It is John Mair’s fortieth book as an editor and the fifth he has put together with Messrs Clark, Fowler, Snoddy and Tait over the last five years.

Academic librarians are notoriously snifty at ordering publications that are not, er, publications. But I exhort anyone in any position of influence to ensure this one takes its place on the shelves as a valuable resource to students, academics and anyone who values journalism’s position in a historical context.

Populism, the Pandemic and the Media: Journalism in the age of Covid, Trump, Brexit and Johnson. Edited by John Mair, Tor Clark, Neil Fowler, Raymond Snoddy and Richard Tait. Published by Abramis Academic Publishing, 2021. Pp330. £19.95 and by Routledge as an ebook.

The Image of Africa in Ghana's Press: The Influence of International News Agencies by Michael Yao Wodui Serwornoo

Review by Professor Rex Li, Liverpool John Moores University

The representation of Africa in the international news media has been an area of intense debate for many years. However, much of the extant literature tends to look at the reporting of Africa in the Western media. This book examines the coverage of Africa in the African press, focusing specifically on the influence of international news agencies or actors on the portrayal of the African continent in the foreign news reporting in Ghana.

The author argues that 'sources play a significant role in news construction' because 'the ideology of news rarely permits receiving journalists to make major changes to what their fellow journalists have communicated' (p3). Yet, the 'deeply-rooted questions' relating to sources have often been overlooked in the literature. This study raises the issue of 'whether African journalists writing for their local newspapers are capable of any resistance towards the influences of the international press' (p3). Through a systematic and in-depth analysis of the reporting of Africa in the Ghanaian press, the author seeks to investigate the level of Western dominance in the foreign news coverage of developing nations and African countries in particular. This, it is argued, would help us gain a better understanding of the persistent 'inequalities and imbalances in international news flow'.

The book is organised around seven chapters. Following a brief Introduction, Chapter one provides the historical background to the study looking at the political and academic contexts of the debate. It considers some key literature on Africa's media image with special reference to the media environment in Ghana from the pre-independence years to the post-independence era. Chapter two offers a critical review of the scholarly literature on the coverage of Africa in the Western press. This is utilised to support the argument that 'continuing hegemony of foreign news production have contributed significantly to how Africans view themselves' (p29).

Chapter three reviews the theoretical literature on the postcolonial theory and the theories of newsworthiness and intermedia agenda-setting. The discussion is used to inform the development of a theoretical framework for the analysis of the empirical data in this study. Chapter four covers the chosen methods for the research project and the related methodological issues. The following two chapters present the research findings from the ethnographic content analysis of the Ghanaian newspaper articles and the interviews with selected journalists and editors in Ghana. The final chapter discusses the findings in response to the research questions outlined in the Introduction. The author concludes that 'the coverage of foreign news in the Ghanaian press reinforces existing postcolonial trajectories and relationships that contribute to the existing imbalance in international news flow in the world' (p8).

Based on the author's PhD thesis, the book presents a meticulous review of a wide range of studies in the field and shows how it contributes to this body of literature. The analysis of the foreign news coverage in Ghana's newspapers is underpinned by the relevant theoretical perspectives. Perhaps it is not surprising that the BBC World Service plays a dominant role in shaping the news coverage in Ghana given its colonial links with the UK. But the empirical evidence from the study indicates that Ghana's media representation of the African continent is no longer driven entirely by the Western press. It reveals a potent Chinese influence in Ghana's newspaper industry as a result of China's active soft power and public diplomacy activities on the African continent. The frequent use of material from Xinhua News Agency in the news reporting by various Ghanaian newspapers is cited as a prime example of this 'unequal power dynamics' (p182).

All in all, the analysis of Africa's image in the Ghanaian press in this study is rooted in the pertinent literature and fully integrated with various theoretical arguments. It has made a significant contribution to the ongoing academic debate on news coverage of Africa. This is an important contribution from a researcher who has demonstrated an ability to draw together the extensive debate on media representation of Africa with empirical analysis of the reporting of the continent in Ghana's newspapers. Scholars and students of international journalism and global media will benefit considerably from reading this book. I will certainly put this on the reading lists for my MA and PhD students.

The Image of Africa in Ghana's Press: The Influence of International News Agencies by Michael Yao Wodui Serwornoo, published by Open Book Publishers, 2021, pp242 ISBN Digital (PDF): 9781800640436

Helping students to become story smart to stay safer

STORYSMART is a set of free-to-use online training modules to help journalists and other media workers minimise physical risk and keep source material secure.

They cover physical safety in potentially dangerous places, and medical aid and trauma care in the field, as well as data security and confidential working practices. They are no substitute for face-to-face training, but cover the basics, quickly, conveniently and at no cost.

Developed by the NUJ, they can usefully be recommended to students to sit alongside reporting teaching to help develop students' understanding of how

to gather news as safely as possible both for themselves and their sources under a wide range of difficult conditions.

Journalism has never been more important. Our world is shaped by toxic populism, secretive governments and unaccountable corporations. The light shone by quality reporting into the murkiest corners is a vital bulwark, protecting human rights and safeguarding a semblance of decency.

Amazing stories abound, but for those stories to achieve the impact they deserve, journalists must be brave, resilient and wily, and must pit their wits against physical hazards, mental stress and sophisticated technological impediments. Finding the story is not enough. Good reporters have to gather, verify and shape it into a compelling narrative – without compromising themselves or their sources.

Doing this requires a tradecraft quite different to note-taking, AV editing or taught composition. It means keeping out of harm's way when missiles fly; keeping in check trauma, both physical and mental; and protecting data, however ingeniously others pursue its compromise.

In an ideal world face-to-face training in all these skills would be easily available to journalists, but cost and time constraints rule this out for many. Even at university there is limited and facilities to provide extensive training of the sort required to cover all eventualities. The following modules, therefore, are designed to equip reporters with the basics and flag up areas where further investment in training would be wise, depending on the type of work students envisage taking up.

These modules are rich in peer-to-peer advice from seasoned practitioners, as well as distilling and anonymising the personal perspectives of real journalists (where the latter is the case, only first names are given).

StorySmart, available at www.nuj.org.uk/learn/storysmart.html is a product of the [National Union of Journalists in UK and Ireland](http://www.nuj.org.uk) with support from the [Google News Initiative](http://www.google.com/news/initiative/). The project was managed by Tim Dawson who can be contacted about Storysmart at info@nujstorysmart.com.



Style guide

Please provide a title and an abstract and author details together with a 50-70 word biography for each author on a separate sheet to allow for anonymization. This sheet will be separated from the article before being sent to referees so please put the title only at the start of the article.

- Sub-heads should be in bold
- Second order sub-heads should be in bold italic
- Please use single quotation marks (double quotation marks for a quote within a quote)
- Indent long quotes of two lines or more.
- Please do not use the enter button to insert space between paragraphs or headings.
- Use percent not % as in '12 percent' not '12%'.
- All illustrations, tables and figures should be sent separately as attached JPGs. Clearly label approximately where they should be placed with "put fig 1 here", "Put table 1" etc.

Citations and bibliographic references should be in Harvard style.

Part I: Citations

Place references in your work in the following order: Name, Date: page number(s)

For example,

1. Directly quoting an author

It is sometimes forgotten that 'English is one of the most flexible and expressive languages in the world' (Hicks, 1993, p.1)

He goes on to say, 'In brief, the reigning media consensus has been characterised either as overly liberal or leftist or as conservative, depending on the view of the critic' (McQuail, 1992, pp.255-6).

2. Indirectly quoting an author (where you sum up what is being stated in your own words). This must be grammatically correct, as well as accurate.

E.g.: Hargreaves (2003, p.47) believes that Henry Hetherington's populist journalistic techniques, employed by him in the 1830s, were the basis of tabloid journalism.

3. Referring broadly to ideas you have read in a publication (not to a specific point/quote). You don't need to cite page number in this case. E.g.: Franklin (1997) has highlighted the effects and reasons for so-called dumbing down in the media.

4. If the same person is referred to immediately after a previous citation, you can use *ibid.*

5. If there are more than two authors, you can use *et al.*

Part II: Bibliographic References

A list of Bibliographic References is required at the end. Please provide the FULL name of the author (including first name) and provide references in alphabetical order of surname. With an author who has written a number of books and articles that have been cited, list them all separately, with the most recent first (see Manning).

Examples of how to present Bibliographic references for Journalism Education are given below. **Please include forenames, not just initials.**

Bibliographic references

Franklin, Bob (2003) 'A Good Day to Bury Bad News?': Journalists, Sources and the Packaging of Politics in Simon Cottle (Ed.), *News, Public Relations Power*, London: Sage pp. 45-61

Hall, Stuart, Critcher, Chas, Jefferson Tony, Clarke John, and Roberts, Brian (1978) *Policing the Crisis. Mugging, the State and Law and Order*. London: Macmillan

Harcup, Tony (2004) in Susan Pape and Sue Featherstone (2006) *Feature Writing*, London: Sage.

The next edition of *Journalism Education*

The next edition of *Journalism Education* is planned for late spring

The journal editors are always happy to see new papers submitted either for full referee or as a shorter un-refereed Comment and Criticism essays. Experienced researchers are very welcome to submit papers about journalism education or about journalism as it affects students or lecturers. However, *Journalism Education* was started by the AJE with less experienced researchers in mind and was structured to give members new to research a place to publish, where their lack of experience would not be held against them. The editorial policy is to give a helping hand to new academic authors who may be highly experienced writers, but less experienced in academic research. We want to publish the best papers and cutting edge research about journalism education but we believe we have to work closely with less experienced academics to help them get their paper into a publishable form. In order to facilitate that, please don't be afraid to contact the editors to discuss ideas and proposals. We will be happy to advise over what would work, and how to go about it and to make suggestions for improvements in paper proposals. Of course even experienced researchers find such discussions useful! You can get in touch at AJEjournal@gmail.com.

Academic papers to be submitted to referees

Papers should be between 5,000 and 8,000 words and involve some aspect of journalism education, teaching, research or pedagogy. The pandemic obliged much innovative teaching and new study methods, many of which add to students' experience and are more than a simple necessity during periods of lockdown. These experiences deserve a wider audience. We also welcome papers that have followed your favoured area of research.

Papers should be produced to the style on the previous page. Please read this style carefully to avoid leaving the editors with annoying tasks such as removing double spacing or tracking down reference forenames that become very irksome when dealing with a number of papers!

Illustrations whether pictures, tables or figures should be sent on a separate sheet either in Word or as JPGs with their position in the article clearly marked. And please, a final plea from a weary editor, check those references!

Essays, comment pieces or criticisms of published work

Journalism Education welcomes essays commenting on, criticising or describing innovative teaching practice, research methods, or scholarly debate on issues of journalism that crop up in your teaching. Debate and discussion is a key method of advancing good practice and is particularly important for an academic field that often welcomes experienced practitioners to become academic practitioners in mid career. Essays can be of any length from 1,000 words upwards. Please follow the style advice.

Book reviews or promotions

Book reviews are always useful in informing us of what has recently been published and giving careful guidance about why it might be useful. Similarly, if you are due to or have recently had a book published, write to us and tell our readership about it. Publishing a new book is a big deal for any author and it's important that people know that it is out there and available. Telling us about it will allow us to put it in our new books section, keeping other members up to date with the latest publication.

Guest editing

If you are considering running a conference on some aspect of journalism in the near future then why not contact us to discuss the possibility of guest editing a future edition with articles from conference speakers?

We welcome guest editions where journalism lecturers and researchers are able to expand on their special interest either by inviting colleagues to produce papers to a particular theme or by organising a conference and inviting colleagues to submit paper ideas.

Guest editors are responsible for identifying potential authors, inviting them to contribute, finding referees for their papers and then submitting the final version to the *Journalim Education* team. The team will then pull the journal together and send PDFs back to authors and editors for a final check before publishing.

This is an excellent way to spread your academic wings by making contact with authors and referees, assessing papers and deciding what is publishable and steering the research profile of journalism for at least one issue.

Talk to the editors

You can talk to the editors by emailing AJEjournal@gmail.com with your proposals, ideas, or finished papers. We look forward to hearing from you. Book reviews should be sent to Tor.Clark@leicester.ac.uk.

Submission deadline for the next issue is March 17, 2022 for refereed articles- Copy for comment and criticism essays or book reviews would not be sent to referees would be edited in the usual way and so can be submitted by the end of April, 2022.

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Development of science journalism in Bosnia and Herzegovina by Anida Sokol Sarajevo School of Science and Technology and International Burch University in Sarajevo and Ljiljana Đukanović, University of Belgrade

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BOOK REVIEW: Understanding the art of science journalism: a developed and developing country perspective by Ashish Gosain, Centre for Studies in Science Policy, Jawaharlal Nehru University.

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Editorial: Storysmart

Style guide and future editions

Journalism Education is published by the Association for Journalism Education and you can contact the editors on AJEjournal@gmail.com