Non-News Values in Science Journalism
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Non-News Values in Science Journalism

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In February 2011, a team of scientists announced that they couldn't see the space beneath a lump of crystal.[1] Of course, they didn't put it quite like that in their paper in *Nature Communications* and nor did the journalists who picked up the story. Rather, converting a highly-constrained instance of non-seeing into a newsworthy event, both scientists and journalists referred instead to the creation of an 'invisibility cloak'. As the *Daily Star* put it: 'Scientists have created a real-life Harry Potter style "invisibility cloak".'[2]

As some of newspapers made clear, this 'cloak' was actually more suited to hiding a paper clip than making a schoolboy vanish, and was more akin to hiding something under a carpet than donning a cloak. But the promotion of the research as the creation of an invisibility cloak helped journalists and public relations officers construe the story as newsworthy. In this chapter, I draw on a sample of ten years of coverage of invisibility cloaks in UK national newspapers to show how the construction of scientific developments as news privileges some aspects of the scientific enterprise to the exclusion of others. The chapter asks: what is absent from the news reporting of science and how do these absences bound the meaning of science in news discourse?

The selective gaze of the media inevitably means that inclusion in news coverage also entails exclusion – media presence produces media absence. In what follows, I argue that as well as filtering events through a standard set of news values, science journalists also adopt a set of 'non-news values' – features of science that are systematically deemed un-newsworthy and are excluded from news reports. Furthermore, I suggest that this pattern of media absences can have a specifically social and ethical dimension. In this way, the absences of routine science journalism serve to construct the social and the ethical as a non-concern for science.

Transforming transformation optics into news

The 2011 research involved the construction of a 'carpet cloak' out of some carefully arranged pieces of calcite crystal which were viewed with polarised light. Carpet cloaks had been demonstrated before by researchers using a new mathematical technique known as transformation optics. But, along with another independent experiment published a couple of weeks earlier,[3] this was the first time that a carpet cloak had been constructed that worked on a scale visible to the naked eye.

As well as referring to a specific mathematical technique, 'transformation optics' also refers to the broad field that seeks to construct devices that can manipulate light in novel ways, especially using new artificial materials known as metamaterials. Earlier attempts to make invisibility cloaks had projected the surrounding scenery onto screens to create a perfect camouflage. By contrast, transformation optics involves the direct manipulation of the light falling on an object.

Transformation optics first came to the attention of the media in May 2006, when John Pendry of Imperial College London and colleagues at Duke University in the US

presented the mathematical description of a new metamaterial, to be constructed on the nanoscale, that could bend light around an object rather than absorbing or reflecting it.[4] Light from behind an object cloaked in this material would emerge unaltered on the other side so that the object itself would become invisible. A few months later, the team announced that they had created just such a device, a few inches across, that could render small objects 'invisible' to microwaves.[5] The work was quickly followed by numerous attempts to make cloaks from other materials and to produce devices that could work for visible light. Since 2006, the UK press has reported on these efforts two or three times a year, albeit often in short articles placed deep within the newspapers.

Converting a scientific paper about the optical properties of a nanoscale material or a prism of calcite into a story worth reporting in a newspaper requires the adoption of a set of news values. Journalists talk of having a nose for news or an eye for a story, the intuitive and unarticulated criteria by which they identify the most newsworthy stories. Journalism studies academics have tried to be more explicit, producing lists of the factors that guide journalists' selection of news stories.

The foundational study of news values, by peace researchers Johann Galtung and Mari Ruge, examined the reporting of foreign crises in Norwegian newspapers. Galtung and Ruge identified twelve factors – such as reference to elite people, negativity, and cultural proximity – that determined the likelihood that an event would be reported in the news.[6] The more factors that were present, the more likely an event would be reported, but not all factors had to be present to make an event newsworthy.

Galtung and Ruge's list of news values has since been refined and modified many times. Today, lists of news values appear in journalism textbooks and thus form an explicit part of the training of many journalists. The precise wording of these lists varies, and some include news values that others leave out, but overall these lists share much in common. Allan Bell, for example, proposes the following twelve news values relating to the content of a story: negativity, recency, proximity, consonance, unambiguity, unexpectedness, superlativeness, relevance, personalisation, eliteness, attribution, and facticity.[7]

Most of these are self-explanatory and sum up some commonsense notions about the nature of news: bad news is good news, old news is not news, and here is always more interesting than there. Whilst several news values (unexpectedness, superlativeness, eliteness, and many instances of negativity) point to events that differ from ordinary and routine happenings, the news values of relevance and consonance value the familiar. Relevance means that journalists will try to draw out the ways in which a news event connects with the lives of the news audience, and consonance means that a story is more likely to be reported if it can be made to fit a familiar script or common stereotypes.

It is rare for a single story to hit all possible news values, but for a news story to be reported it will usually have the potential to express many of them. Thus the announcement about the calcite invisibility cloak could be construed as newsworthy thanks to its recency (the news reports appeared just a day after the research paper was published), its proximity (the research was led by scientists based at Birmingham University and Imperial College London), its unexpectedness (the ability to render

objects invisible is unusual and novel), personalisation (the cloak was the result of the actions of specific individuals not of abstract structural or institutional forces), eliteness and attribution (the research was conducted at elite universities and published in a top international journal), and facticity (factual details about the experiment could be reported).

Importantly, news values influence not just *which* of the infinity of real-world events get selected for news coverage, but also *how* the selected events are reported. Thus the scientifically-insignificant detail that some of the scientists were based in Britain became a key feature for *The Sun* newspaper, which opened its short report about the calcite experiment with a reference to: 'Jubilant Brit scientists'.[8] This may also be one reason why, a few weeks earlier, only one British newspaper had covered the demonstration of a similar calcite cloak by researchers in the US and Singapore.

The role of news values in shaping how a story is framed also accounts for the most notable and consistent feature of the news coverage of transformation optics: its presentation of experimental devices as 'invisibility cloaks' and the frequent references to fictional accounts of invisibility, most commonly to Harry Potter or Star Trek. Such is the newsworthiness of this fictional allusion that news reports are sometimes accompanied by feature articles describing the history of fictional treatments of invisibility.

The recourse to fiction, perhaps surprising in a genre that foregrounds claims to represent reality, attests to the importance of the news values of relevance and consonance in the reporting of science. Careful arrangements of small pieces of calcite in a physics laboratory, and the mathematics that informs these arrangements, have little meaning for most people. They are difficult to relate to. Journalists therefore want to know about applications; how will a piece of scientific research impact on the wider society? As I will discuss below, more realistic future applications are also mentioned in the news coverage of invisibility cloaks, but it is the fictional applications that are most readily imagined – more real than the real world for having been already realised on page and screen. Thus, by aligning laboratory experiments with concepts familiar from popular novels and films, the reference to fiction makes the necessary connection with the news audience.

It is worth noting that the reality effect of fiction also applies for scientists themselves. David Kirby has argued that scientists who act as consultants for Hollywood films are able to test speculative ideas and recruit supporters through the visual creations of a movie.[9] Scientists also sometimes appeal to fiction in their technical accounts of the science.[10] Already in 2006, one research paper in the field of transformation optics referred to 'cloaks of invisibility'[11] and from the start, research in this area has been oriented around efforts to render objects invisible, despite multiple other potential applications. Research papers talk explicitly of turning fiction into 'scientific reality' and of aiming to satisfy 'a layman's definition of an invisibility cloak'.[12] The fictional framing of the news reports is therefore not entirely the imposition of the journalist. Rather, scientists, public relations officers, journalists and editors all contribute to the distillation of a piece of scientific research into a newsworthy story that conforms to standard news values.

As the example of invisibility cloaks illustrates, news values can be invoked in science journalism as they are in other journalistic beats. Thanks to news values, a team of British scientists inventing an invisibility cloak is news, but a Chinese post-doc demonstrating the validity of a ray tracing calculation is not, despite this being the same event. Indeed, it is something of an article of faith amongst both working journalists and academics studying science journalism that the same news values pertain in science journalism as in any other area. Both groups insist, rightly, that science journalism is journalism just like any other beat. Although one recent study has suggested that general news values need to be adapted and extended to apply to science news, the proposed extensions regarding story content are essentially a more generous interpretation of the classical values; for instance, eliteness is taken to apply to elite scientific figures as well as elite political or cultural figures. And as these authors also note, the general news values, even when narrowly interpreted, are still relevant in the case of science news.[13]

Indeed, the prevalence in British science journalism of news about research conducted in British universities (especially Russell Group universities), research just published in peer-review journals (especially a small number of the most prestigious journals such as *Nature*, *The British Medical Journal* and *The Lancet*), and medical research rather than other scientific disciplines, all confirm the importance of standard news values in routine science journalism.[14] As a recent overview of science journalism put it: 'Science journalism is just journalism, after all.'[15]

Despite being an intuitive and often unarticulated aspect of journalistic practice, news values are worth examining because they remind us that news is constructed; it is something crafted by journalists, not something that exists prior to the act of mediation. In particular, news values mean that events systematically get construed in a particular way. However, as an analytical tool, news values have their limitations. For instance, news values are likely to vary between countries and cultures, between local and national news outlets and popular and elite outlets, between different media, and over time. In an attempt to address the latter point, Tony Harcup and Deirdre O'Neill reformulate Galtung and Ruge's original news values to include, among other things, celebrity and entertainment. This contemporary drive for entertaining news stories, contra the traditional focus on bad news, controversy and conflict, further helps capture the emphasis on fictional concepts found in the reporting of transformation optics.[16]

Yet even modified news values cannot fully account for why a story enters the news. Sociological factors, from what staff are available to the political affiliation of the outlet, will also affect what is covered and how it is covered, as will newsroom factors such as what other newsworthy stories are unfolding that day. Again, the invisibility cloak coverage illustrates these limitations. Although the majority of reports make reference to fiction, a minority do not, despite the apparent newsworthiness of this framing. Similarly, where *The Sun* stressed that the scientists who conducted the calcite experiment were British (even though not all of them were), *The Guardian*'s only mention of location was via the names of the scientists' institutions. Furthermore, although all UK national newspapers have reported on invisibility cloaks over the last decade, on no occasion have all the newspapers reported on any one particular story. A newspaper can cover the topic in near-identical reports a few

months apart, and then ignore it altogether the next time there is a story that other newspapers choose to cover.

There is also some reason to suspect that science journalism is different from general news journalism, notwithstanding the similarity in news values. Even more so than other beats, science journalism is highly reliant on pre-mediated material from press releases and press conferences.[17] These are largely controlled by the communications departments of the top peer-review journals, along with press relations offices at universities. As long ago as the 1980s, sociologist Dorothy Nelkin, in her landmark study of American science journalism, concluded that science reporting was frequently promotional and uncritical: 'Unaggressive in their reporting and relying on official sources, science journalists present a narrow range of coverage. Many journalists, are, in effect, retailing science and technology more than investigating them, identifying with their sources more than challenging them.'[18] As I will discuss in the remainder of this chapter, this lack of a critical stance leads to several significant absences in the reporting of science news.

To illustrate these absences I will draw on two sets of data. The first is a sample of news reports about scientific studies of invisibility printed in the UK national newspapers from August 2003 to 2013.[19] The sample consists of news articles with invisibility as the main focus rather than a passing reference. A database search yielded a sample of 66 unique news articles reporting on 28 separate stories.[20] These include the reports of transformation optics referred to above, but also a few other stories about invisibility cloaks based on projection methods whereby an object is covered with screens which mimic in real-time the environment around the object.

The second set of data was compiled for a content analysis commissioned by the BBC Trust to inform a review of the impartiality of the BBC's science coverage. The sample drawn on here is of the BBC's news coverage of science on television, radio and online in alternate weeks over the summers of 2009 and 2010, giving a total of eight weeks of output. This sample covers all items which refer to science, not just one particular field or topic.[21]

A lack of transparency

The first absence I will examine concerns the funding of science. To a large extent, the progress and direction of modern science is determined by access to funding. Clearly some funding sources are oriented towards the public interest or have philanthropic motivations, but the source of funding can also indicate a vested interest in an area of science yielding new technologies or other applications that might be of benefit to the funding organisation. A number of studies have shown that who funds research can affect its interpretation and outcomes. Most of these studies look at the funding of medical research and find that research sponsored by the pharmaceutical industry is more likely to report results favourable to the industry than is other research. Several meta-analyses have confirmed these findings.[22]

There has been little work looking at funding bias in other sectors, but it would be surprising if biomedical science were uniquely predisposed to these sort of influences. It seems reasonable to assume that wherever large commercial or national interests are

at stake and are involved in funding scientific research – agricultural biotech, the energy sector, the defence and security industries – it is possible that similar influences will be at work. Peer-review journals implicitly acknowledge this possibility through the now-standard practice of requiring authors to declare the source of their funding and any other potential conflicts of interests.

Thus the academic community recognises that funding can influence research outcomes and the way these are reported, and it also recognises that knowledge about funding sources helps other researchers assess the validity of a study. In a report on science and the corporate agenda, Chris Langley and Stuart Parkinson of the campaign group Scientists for Global Responsibility go further and argue that disclosure of funding should also be the default for groups engaged in public debate about science so the public can make up their own minds about possible bias: 'Advocacy groups on all sides of debates in science and technology (including professional institutions) should publicly disclose funding sources, to allow the public to decide potential sources of bias.'[23]

Yet despite the potential for funding bias, the sources of funding are not mentioned in the majority of news reports about science. In the case of the invisibility cloak articles, 61% did not mention the funder. For the sub-set of articles reporting on newly published research results (i.e., those articles where a funder may be most relevant), the proportion not mentioning the funding source rises to 81%. Surprisingly, even two reports about the award of a new grant failed to mention which organisation had awarded the grant, even though this sort of factual detail is the mainstay of news reporting as indicated by Bell's 'facticity' news value.

This failure to mention funding sources is not correlated to the type of newspaper – tabloids are no less likely to mention funding than are the quality papers. Similarly, there is little correlation between the length of the article and the inclusion of funding details.

As noted above, the majority of science news is prompted by the distribution of a press release, either by the journal in which the study is published or by the researchers' universities. I was able to locate press releases for half of the invisibility stories, which together account for three quarters of the sample of newspaper articles.[24] Over half of the press releases included information about funders, but only half of the news reports based on these press releases reproduced this information.

As this suggests, the under-reporting of funding sources is unlikely to be due to the information being difficult to unearth. Furthermore, in most cases the information is readily available from a journal paper even if it is not included in the press release. Almost three quarters of the sample of newspaper articles about invisibility cloaks reported on studies newly published in a peer-reviewed journal. All but two of these journal papers included funding information. Yet just a fifth of the newspaper articles based on journal papers that gave details of funders also included this information. To put this a different way, no news article based on a journal paper mentioned the funder of the research unless this was mentioned in the press release and even then, journalists were as likely to omit this information as they were to include it.

Despite this under-reporting, the coverage of the invisibility story is unusual for the number of times the funder *is* mentioned. In news reporting of other areas of science, funders are even less visible. For instance, Emma Weitkamp and Torill Eidsvaag have found that in the coverage of superfoods only 14% of news articles in British national newspapers mentioned the funding source, despite this information being available in 74% of the research papers and in 60.5% of the press releases for the studies being reported.[25]

The sample of general science news gathered for the BBC impartiality review shows an even greater absence of funding information. Whilst 14% of BBC online news reports about new research mentioned the source of funding, a mere 3% of the broadcast news items did so. Furthermore, in a few cases, representatives of the funding organisation were interviewed without making it clear that their organisation had funded the research.

I was able to trace press releases for 29 of the stories arising from journal publications covered in the BBC television and radio news sample. As with the invisibility story, the funder was mentioned in about half of these press releases and funding details were given in all but two of the journal papers. However, only one of the 99 broadcast news items based on these 29 stories mentioned the funder of the research. The pattern is the same for newspapers covering this same set of stories. Of 142 reports in the national press, just four gave funder details – and even one of these included the name of the funding body as part of the name of the research group rather than spelling out that this charity was funding the research. Thus, across broadcast and press, just 2% of news reports covering new research publications identify the funder.

Of course, much scientific research is publicly funded – almost all of the set of 29 stories in the BBC sample were funded either by public organisations or by charitable foundations. Yet without being told that this is the case, the audience is not to know that funding bias is unlikely to be an issue. For instance, one of the stories concerned research that showed that adding caffeine to the drinking water of mice with Alzheimer's disease led to an improvement in their symptoms. The media hailed the study as a good news story, or, as the headline in *The Daily Mail* put it: 'Forget the health fascists, coffee is good for you!'[26] If the audience thought the study could have been funded by a coffee manufacturer or retailer, they may have been sceptical about the findings. However, none of the news reports informed the audience that this research was publicly funded. Similarly, in another story about a study that had found that poor dental hygiene was associated with an elevated risk of heart disease, there was no mention across all the news coverage that the study had public funding rather than being funded by, say, a toothpaste manufacturer.

However, even where commercial interests are present, this information is often not reported. For instance, one story concerned a study that found that changing levels of physical activity had no impact on the amount of body fat in children, with the conclusion that exercise regimes are unlikely to have an effect on childhood obesity. The study had been partially funded by pharmaceutical companies, though none of the funding organisations had a role in the study design, analysis or write up. This was noted in the journal paper but not in the news reports. Transparency about funding was thought to be important for the audience of scientists and medics reading the journal paper, but not for members of the public reading the newspaper.

The case of the disappearing tanks

As noted above, despite the majority of newspaper reports about invisibility cloaks not including funder details, these articles were more likely to include this information than science news generally is. For 38% of the articles, the funder was a defence or security organisation and in 16 of the 20 news reports where the source of funding was identified, the funder was either the military or a defence company. In some cases, these reports concerned experiments in the field testing projection systems which generate a perfect camouflage. Although the press reports did not explicitly mention funding, they all named the companies – BAE Systems and QinetiQ – which were carrying out this research.

However, research in transformation optics has also been supported by defence organisations. Many of the foundational studies, including the first mathematical design of an invisibility device, were funded by the US defence agency DARPA.[27] As early as 1995, John Pendry, one of the founders of the field, was involved in research supported by the UK's then Defence Research Agency.[28] In addition to DARPA, US agencies supporting the studies and researchers reported in the UK press include the Army Research Office, the Office of Naval Research, the Air Force Office of Scientific Research and the Intelligence Community Postdoctoral Research Fellowship. In 2009, the Army Research Office awarded $6.25m to establish a Multi-University Research Initiative on transformation optics, to be led by Duke University and involving Imperial College in the UK and another three universities in the US.

That news reports sometimes note that research into invisibility cloaks is funded by defence agencies suggests that this information is potentially newsworthy. However, despite this, two thirds of the articles referring to research funded by defence or intelligence agencies did not include this information, though three of these articles did include some other general reference to 'the military'. Furthermore, of the 16 articles covering the two widely-reported 2006 studies, whose authors included a researcher funded by the Intelligence Community Postdoctoral Research Fellowship, only one mentioned this source of support and this article did not point out that the fellowship is administered and funded by the CIA.

The possibility that work on invisibility cloaks may have military applications receives some coverage, with half the articles mentioning this. As one headline put it: 'Invisibility cloak could make a tank disappear.'[29] By contrast, only a quarter of the articles mention possible civilian applications of the new metamaterials, such as use in microscopes, protecting equipment that is sensitive to electromagnetic waves, or as surgical aids.

Yet, the newsworthiness of military applications notwithstanding, 39% of articles make no reference at all to the military interest in this field. Where military applications are mentioned, the implication is always that it will be US and UK tanks that are hidden from the enemy, not the other way round. In no articles are any concerns or ethical considerations raised about the purported development of a technology of invisibility, nor about who might have control of this technology and the ends to which it could be put. Nor are these issues explored in feature articles even

though feature articles do appear which describe the fictional backdrop to the concept of invisibility. The closest any newspaper came to questioning defence applications was when *The Observer* quoted a scientist saying: 'I think governments could make a lot of use out of a cloak that can hide objects on the seabed, although I won't speculate on exactly what they may want to hide.'[30]

The likelihood of a newspaper mentioning the military funding of invisibility research does not appear to correlate with its political stance. The left-leaning *Guardian* and its Sunday sister publication *The Observer*, are the outlets one might assume to be most sceptical about military ties. As quality papers they are also more likely to explore topics in some depth and *The Guardian*, in particular, is known for its commitment to the coverage of science. However, none of the 14 news articles carried by these two papers included any reference to the funding source and half made no reference to military or security applications.

As discussed above, the news values of relevance and consonance ensure that the majority of news reports about invisibility research refer to fictional representations of invisibility cloaks. Four fifths of articles reporting newly published studies of invisibility make some reference to fiction, yet exactly the same proportion fail to mention where the funding of the research has come from and only half make any mention of the defence context of this work. One way of conceptualising this situation is to suppose that, just as news values influence what is included in news reports, other factors work equally strongly in the opposite direction, leading to the systematic exclusion of details about vested interests from news reports about science.

Limited limitations

Another essential feature of science is also frequently excluded from the routine news coverage of science – reference to the limitations of the research. The experiments on invisibility cloaks all, inevitably, fall a long way short of rendering objects invisible in the commonsense (and fictional) meaning of the term. The early experiments dealt with wavelengths longer than visible light, such as microwaves, and only worked on a small scale. Later experiments shielded larger objects and, as with the calcite experiment, could work with visible wavelengths, but these too were effective only for a narrow bandwidth of light. In addition, loss of light within the device can make it visible even at the specified wavelength.

For a device to be able to render an everyday object invisible to the human eye, it would be necessary to be able to shield objects metres across for the full range of visible wavelengths and from all directions. Yet the very properties that allow light of one wavelength to be guided through a metamaterial rather than scattered off it, lead to light of other wavelengths being more strongly scattered.[31] Furthermore, even if it were possible to create a device able to function at all visible wavelengths and large enough to hide a human, it would not be possible for someone hidden within the cloak to see out.

However, despite the news value of negativity, *not* being able to do something does not make the news. Studies highlighting the difficulties of achieving invisibility are not reported. Rather, experiments that have demonstrated limited invisibility are

reported and the limitations of such experiments are downplayed or ignored. Thus, over half of the sample of news articles reporting on newly-published invisibility research made no mention of the limitations of the studies. Where limitations were mentioned this rarely extended beyond a sentence or two. In almost all cases, this mention was either relegated to the final paragraph or it was downplayed. For instance, a short report in *The Sun* about one early proposal notes that: 'Although only a plan, the idea is said not to violate any laws of physics.'[32] The scare quotes in the headline – 'Invisibility "a reality"' – further indicate some caution, but the claim made is a positive one and the improbability of achieving full invisibility is never raised.

To some extent, the reporting of limitations is a result of the length of the news article. The shortest articles are least likely to mention limitations and the longest are most likely to detail several specific shortcomings. However, even very short articles can foreground the challenges. Thus one 128-word article in *The Observer* begins by stating that 'true invisibility cloaks may remain forever a dream' and goes on to note that 'total invisibility would require the value of some of the cloak's key electrical and magnetic properties to be infinitely large, something that is impossible.' Even this article, however, concludes that new calculations show that a cloak can 'render someone entirely invisible'.[33] By contrast, some long articles make little or no mention of limitations. For instance, one 639-word report in *The Times* had space to include a list of fictional treatments of invisibility and discusses the scientific research in some detail, but in a way that implies all difficulties have been overcome: 'The scientists were reassured that little of the light was lost during the process of bending, meaning that high definition would be maintained. This would be important for the development of an invisibility cloak because a fuzzy appearance to a landscape would give away to an observer that something was being hidden.'[34]

Similarly, the possible applications of the technology are reported in certain terms. For instance, the same *Times* article reports that: 'scientists expect to be able to make tanks, buildings and even individual infantrymen disappear from view' and that the technology could be used to merchandise Harry Potter's invisibility cloak. News reports also uncritically reproduce scientists' claims that functional devices may be just a few years off. *The Times* article concludes with the claim, attributed to John Pendry, that: 'in the short to medium term the most likely application of a cloaking device would be to hide objects such as aircraft and tanks from radar.' Whilst the potential for metamaterials to enhance existing stealth technologies explains defence interest in the field, to go from highly constrained table-top experiments to deployment in the field will require considerable development. Even more inflated claims also appear. For instance, in 2008 *The Daily Telegraph* reported that: 'An invisibility cloak like the one in which Harry Potter wanders Hogwarts unseen may be a reality within five years, scientists believe.'[35]

Expressions of uncertainty are rare. Whilst almost three quarters of articles quote a scientist, less than a quarter included a quote that expressed any caution about the claims being made. Where such a comment was included, it was usually wrapped around with a more positive comment, as with this 2006 quote from John Pendry:

> This cloaking device is just a demonstration showing that you can get radiation where you want it to be. There's still some development to do,

> but in five years you could be seeing some sort of practical realisation of this technology. It's probably too heavy for aircraft, and making objects as big as buildings disappear might be difficult. But it would be ideal for hiding a tank.[36]

As with the under-reporting of funding sources, the under-reporting of limitations and uncertainty are common in science journalism, notwithstanding concerns that journalists over-report uncertainty in the case of climate science.[37] In the sample of BBC news reports, about two thirds of news items reporting on new research findings included no expression of uncertainty about the science. Similarly, only about a fifth of the interviewees in broadcast news items, and about a quarter of interviewees in online news, expressed cautionary comments such as noting the limitations of research findings or questioning the claimed applications of the research. Hardly any interviewees – just 7% in broadcast news and 4% in online news – made deeper criticisms, and where such comments were made, they usually did not come from scientists but from others challenging the ethics of the science.

Exceptions do occur, showing that, for some journalists at least, the inclusion of expressions of uncertainty and caution do not necessarily deflate the news value of the story. For instance, one story in the BBC sample concerned a study in which researchers, led by a biologist at Newcastle University, converted human stem cells *in vitro* into sperm-like cells with tails. The researchers presented their work as helping develop a treatment for infertility. The study was published in the journal *Stem Cells and Development*,[38] and was accompanied by a press release from Newcastle University and by a media briefing from the Science Media Centre. It was widely reported across the BBC and the national press, attracting the most media coverage of the set of 29 stories extracted from the BBC sample. The PR activity helped make the story easy for journalists to cover, but it was also highly newsworthy, allowing reference to sex and scope for humour in rehashing old debates about the comparative roles of men and women.

Unusually, most of the news articles included comments questioning whether the sperm-like cells were actually functional sperm. Three scientists contacted by the Science Media Centre for their press briefing, none of whom had been involved with the research, all questioned the claims being made for these cells and journalists hedged their reports with some reference to these criticisms. The implied confrontation between the researchers and these other scientists invoked the news value of conflict even whilst the criticisms could be interpreted as detracting from the unambiguity of the story.

However, despite the high newsworthiness of the sperm story, even here there were limits to how far the critical approach would go. When, a few weeks after its original publication, the journal withdrew the paper because two paragraphs had been plagiarised from another paper,[39] only two newspapers – *The Mirror* and *The Sun* – covered the story in their print editions, generating less than a tenth of the copy than had been produced in response to the original story. That two papers did cover the retraction showed that it could hit the required news values – there was conflict and negativity on an issue of relevance to the public – but something else persuaded editors at other papers that the story should be ignored. Other retractions are also reported infrequently. For instance, in recent years high-profile journals have retracted

a number of papers about stem cell research. This has attracted some media commentary, yet this makes up a very small proportion of the overall coverage of the field. As a rough indication of how small, in the two years 2013 and 2014 almost 800 articles in the UK national press mentioned stem cells, but only eight referred to the retraction of research. [40] Of these eight, three reported on the suicide of the co-author of two retracted papers, but even this extreme outcome was not reported in the majority of newspapers.[41]

I suggest that such omissions point to a set of 'non-news values' that serve to suppress stories that reveal the flaws and shortcomings of science. This is not a form of intentional censorship but rather editors and journalists, as well as invoking an implicit set of values about what news looks like, also invoke an implicit set of values about what science news does not look like.

Conclusion

Most journalists – or at least those working on 'serious' beats like politics or economics – see part of their role as holding the agencies of power to account. One might expect science journalists to share this ideal of scrutinising the claims made by news sources. And, in theory, they seem to. Thus the title of the 2013 World Conference of Science Journalists was 'Science Journalism: Critical Questioning in the Public Sphere'. Yet, as the examples discussed here illustrate, this is not what British science journalists tend to do in practice.

There are, of course, exceptions to the lack of scrutiny – the sperm story is one such example – but these exceptions usually revolve around public controversies with policy implications and such stories are often covered by environmental reporters or general news or politics correspondents rather than by science journalists. In routine science reporting, such as the reporting of transformation optics, news coverage is largely uncritical, typically failing to explore the interests vested in a particular line of research or to probe the claims made for the application of the science.

Nelkin attributed the uncritical stance of science journalism to scientists' efforts to control news coverage by pre-packaging their research for media consumption. Today we'd call this 'churnalism' – the churning of press releases into news stories. Yet science journalists' dependence on press release material does not entirely explain the lack of scrutiny in science news. As noted above, many press releases, and nearly all journal papers, record who funded the research. They also give details about the experimental design – the sample size, whether there was a control group, whether an animal model was used for a human disease, and so on – and this is essentially an indication of the limitations of the findings.

In routine science news, then, questions of funding, limitations and misconduct emerge as consistent, persistent, absences, despite this information being readily available to journalists. News values, as currently understood in journalism studies, can't account for this. News values suggest why some stories are selected for news coverage – we can see why the sperm story or the stories about invisibility were deemed newsworthy – and news values show why certain features of a story are likely to be repeatedly emphasised (the implications for health, the entertainment angle, and

so on). But they do not explain those features of science stories that are systematically overlooked. As the few reports that do mention the funders or the limitations of research show, such statements do not necessarily undermine the newsworthiness of a story. Indeed, mention of public funding or well-respected charities would help reinforce the news value of authoritative attribution, and stating the limitations of experiments could help emphasise the novelty of the research, could enhance the facticity of the report, and potentially could be used to frame a story in terms of conflict.

The pattern of exclusion that emerges is as predictive of news content as are news values. News values therefore appear to operate alongside a set of non-news values. Where news values are criteria for inclusion in news reports, non-news values are the criteria for exclusion from news reports. By excluding questions about funding, vested interests, uncertainty, limitations and misconduct, the non-news values construct an image of science as an objective set of facts independent of the process through which they were uncovered. Generalising from the examples examined in this chapter, the non-news values of science journalism might be summed up like this:

> *Provisionality* – assumptions, limitations and shortcomings are un-newsworthy.
> *Contingency* – the preconditions that made the research possible are un-newsworthy.

The failure of many newspapers to report the retractions of high-profile research tentatively points to a third non-news value:

> *Dissonance* – deviant behaviour is un-newsworthy, so if a story departs from the script of objective science carried out by flawless humans of noble intent, its newsworthiness may decrease.

More research is required to demonstrate whether these generalised non-news values do capture the patterns of absence in routine science news and, if they do, how these values become embedded in journalistic practice. However, as with the other examples of absences discussed in this volume, non-news values pose a challenge for the social scientist. One approach in journalism studies has been to use ethnography to examine how journalists enact news values in their newsroom routines. A similar approach to non-news values would require the researcher to attend not only to what is excluded as a result of editorial discussions or to what is to be found in the newsroom waste bins, but also to that which is never even acknowledged in the first place. The challenge, then, is to ensure that ethnographic observation of the here-and-now does not eclipse the not-here.

Research into non-news values also demands a re-signifying of those stories that receive minimal coverage. Typically quantitative content analyses direct our gaze towards content that is widely represented across the sample. To better understand what is systematically excluded, researchers need to shift their gaze instead to content that is *un*-representative as a means of identifying the might-have-beens of journalistic output.[42] Re-focussing on non-news means interpreting the unrepresentative not as an object of uninterest but as a signifier of absence.

In some ways, the non-news values proposed above are the flip side of the standard news values: dissonance is the opposite of the consonance in Allan Bell's list of news values; provisionality and contingency involve the opposite of Bell's unambiguity and superlativeness. Crucially, however, recognising non-news values means shifting attention from patterns of selection to patterns of exclusion. Furthermore, the relationship between the two is dynamic, changing with the context. News values and non-news values can complement each other – for instance, if critical commentary were included in a news report, it could undermine the significance of the story, so following the non-news values by excluding critical commentary can help emphasise the news values. Yet in other cases, the non-news values may contribute to the omission of information that has the potential to be newsworthy.

As with news values, the explanatory power of non-news values may be limited – they highlight textual outcomes rather than explaining the sociological processes that lead to these outcomes. But in the same way that attending to news values can highlight journalistic assumptions that otherwise go unquestioned, attending to non-new values – the non- of science journalism – highlights the naive philosophy of science that journalists implicitly reproduce in their reports. The non-news values of science journalism suggest that journalists routinely draw on, and reproduce, an image of science as unassailable and devoid of vested interests. It is an image that serves us poorly when controversies about scientific findings do enter the public sphere, leaving reporters with limited discursive resources to tackle the uncertainties and nuances that are at the heart of science.

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[20] The Factiva Database was searched for: 'invisibility cloak and (scien* or physic* or boffin* or research*)'. Feature articles, repeated articles and articles which made only a passing reference to research into invisibility were discarded. A period of one day before and two weeks after the dates of the selected reports was then searched again with the less restrictive search term 'invisib*'. Again, only news articles were selected whose main focus was scientific efforts to produce invisibility.
[21] With an eight weeks sample drawn only from the summer months, the overall amount of science output may have been skewed by other news events and by the time of year. However, the content of the science items, which is what is of relevance to the present discussion, should not be affected by this limitation. For full details of the sampling technique see: Mellor *et al.*, *op. cit.* note 14.
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