Numeracy
Advancing Education in Quantitative Literacy

Volume 14 | Issue 2 Article 2

2021

Journalism and Numeracy in Context: Four Case Studies

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Recommended Citation

Harrison, Steven. "Journalism and Numeracy in Context: Four Case Studies." *Numeracy* 14, Iss. 2 (2021): Article 2. DOI: https://doi.org/10.5038/1936-4660.14.2.1371

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Abstract

Although research into the relationship between quantitative literacy (QL) and news reporting is sparse, the consensus among researchers is that journalists tend not to place QL very highly among their professional values and that journalism suffers as a consequence. This paper is an attempt to provide concrete examples of the ways in which news reports systemically misinterpret, misrepresent, or misuse numerical data as part of the reporting process. Drawing on scenarios ranging from elections and healthcare to the mundane world of food preparation, it shows how a lack of rigour in the fields of reporting and news production can lead to a diminution in the quality of journalism presented to the public. It is argued that while the effect of this can sometimes be trivial, on occasion it is literally a matter of life and death.

Keywords

quantitative literacy, journalism, news reporting, elections, health reporting, numeracy

Introduction

Previous studies into journalists' levels of numeracy (Hewitt 1996; Maier 2002; Maier 2005; Harrison 2016) have concluded that while news reports get things right much of the time, there nevertheless remain needless errors in articles involving quantitative literacy (QL). The purpose of the present paper is to explore some case studies that illustrate how lack of a "feel for numbers" can lead to impoverished or downright incorrect reporting. The first two case studies are political in nature and look at the reporting surrounding the 2016 US presidential election and the 2015 UK general election. The third study concerns risk reporting within the health field and focuses on a perennial scare story concerning the risks associated with eating processed meat such as bacon. The final case study appears to be less weighty, as it centres on a story about preparing the perfect roast potato, but as the analysis shows, it nevertheless raises several points of wider significance concerning the confusion which can arise when journalists fail to understand the numbers on which they report. The aim here is flesh out the practical consequences of some of the shortcomings in journalists' levels of quantitative literacy. It is a truism that to err is a consequence of being human, but it is also true that being aware of the sources of common errors is a way to minimise them.

This paper is part of an effort to raise the profile of QL within journalism so that greater emphasis is placed on getting the numbers right and more care is taken over news articles which employ facts and figures. There are many reasons why reporters and production journalists get things wrong, including time pressure, overwork, and lack of knowledge. Not all these causes of mistakes can be mitigated, but QL is an area where raised awareness and training can have a positive impact. Recent research has fruitfully focused on the implications of reporting the COVID-19 pandemic, among them Ancker's discussion of quantitative shortcomings, such as the failure to put numbers in context and the misleading use of raw numbers (Ancker 2020), and Irwin's analysis of how failings in the media coverage of Sweden's strategy for dealing with the outbreak meant the country's officials were "forced to put significant energy into combating misinformation, rather than dealing with domestic challenges" (Irwin 2020). In both cases, the argument was made that strengthening journalists' QL competencies would lead to more accurate reporting and a more socially-responsible journalism.

The issue of how news reports handle quantitative information is not new; numbers have appeared in newspapers or their forerunners since the early days of print, most commonly in the form of reports of military activity and battle. Shaaber notes that "narratives of battles, campaigns, and other developments" formed one of the three main divisions of foreign news printed in translation in the UK in the 1590s (Shaaber 1966, 172). Fast forward 50 years and the newsbooks from the time of the English Civil Wars abound with reports of troop numbers: "His Majesty in a

warlike manner with 1500 horse came thither"; "about three hundred Souldiers to Guard the same"; "he sends from Colebrooke to Sion 8. Regiments of his foote, sixe pieces of Ordnance and 20. Troopes of Horse" (Raymond 1993, 66, 68, 78). Numbers also appeared regularly in the form of bills of mortality and commodity prices—the London Chronicle dated April 3–5 1770, for example, lists under "Stocks done this Day": "Ditto New Ann.—3 per Cent. Bank Annuities … 3 per Cent. Conf. 86 1/8 a ¼," while the Chester Weekly Journal of February 15, 1727 gives the numerical strength of forces in Vienna and the Hague, devotes a column to a list of goods for sale by the East India Company, and on the back page gives the tabulated bills of mortality for London (when six died of "mortification" and one of "flux"). However, such news reports simply list numbers without manipulating them, so there is little or no need for numeracy skills. The numbers were provided by public bodies, merchants' agents, or correspondents and set by the printer without editorial intervention (an early example of what today is branded as "churnalism," the re-packaging of PR and agency material—see Cole and Harcup 2010, 194).

Although journalistic numeracy skills did not feature in their production, news reports containing numbers were very common from the late sixteenth century onwards, a feature which accelerated with the rise of the financial press in the second half of the nineteenth century (the Financial News was founded in 1884 and the London Financial Guide, precursor of the Financial Times, was first published in January 1888). The financial press contained extensive tabulated market and commodity data, as one would expect, yet here again, as with news reports, there is little requirement for numeracy on the part of journalists since the information is provided by an external agency and printed without further editorial processing. A description of the role of the City Editor, penned in 1897, lists the various attributes he requires (including business acumen, writing ability, objectivity, and impartiality)—numeracy is not among them (Duguid 1897, 160). The increasing prevalence of sports journalism in the nineteenth century, too, led to more statistics appearing in newspapers, again rarely requiring numeracy skills on the part of the journalist. At the turn of the twentieth century, then, the newspaper reading public was accustomed not only to seeing numbers in their papers, but numbers presented as such—columns of market stock and share prices, sporting league tables and match statistics, and tabulated election results. The casual browser of a copy of the Times from the 1860s onwards would find lists of numbers on nearly every page but relatively few calculations. Election results, for instance, gave totals for each party, but numerical manipulation, such as the calculation of swing, was lacking. (It was the 1950s before the concept of election swing was developed.) But even this passive reproduction of numbers consolidated the newspaper's transition from an organ of opinion into a repository of facts, what one study describes as the movement from the "partisan" to the "Victorian" press (Barnhurst and Nerone

2001). In large part owing to the prevalence of numbers and statistics in their pages, the form of the Victorian newspaper took on the rigour of a scientific paper rather than the partisanship of a manifesto.

When it comes to identifying what counts as a mistake in a news report, the author seconds Maier's assertion that the literature is "essentially silent on what constitutes mathematical error" (Maier 2002, 510). Maier, for example, considered an article about gains in prosperity made by African-Americans as erroneous (it fell into his category of "Naked Numbers") because it lacked "the human dimension": there was no discussion by African-Americans themselves about how the new-found prosperity affected their lives, even though the data was reported correctly (ibid., 516). It is highly debatable whether this constitutes a shortcoming, as it is much more a matter of editorial judgement (and perhaps reflects on the resources available to the editors) than of mathematical shortcomings. It may be the case that interviews with affected individuals were slated to be published in a follow-up article, or the news desk realised interviews were desirable but no reporters were available, or the pressure of deadline meant there was no time to conduct interviews. Conversely, other researchers may disagree with the inclusion in this paper of the reporting of incorrect statements made by politicians. There is a line of thought that it is the function of news media to report in unvarnished form statements made by public figures; in this light, reporters are a neutral conduit for the transmission of politicians' claims. The assumption of supporters of this view is that the reader, being fully informed and having the time and means to verify the claims of public figures, is then at liberty to make up their own mind as to the veracity of the claims. It is not a view to which the present author subscribes. It would divert us too far from the purpose of this paper to lay out the detailed case for a form of reporting which acts to challenge those in power, but my position is essentially summarised by a riff on the maxim attributed to (among others) Northcliffe: news is what someone somewhere wants to go unchallenged; all the rest is public relations. A consequence of this position is the belief that reporters ought to have sufficient QL skills to know when a statement is false or misleading and to respond appropriately, such as by asking the interviewee for clarification or qualification during an interview; in the case of published statements, by subsequently pointing out discrepancies. Insofar as reporters are incapable of responding because they are insufficiently numerate, then this constitutes a shortcoming for the purposes of this paper.

Case Study 1: Forecast of the 2016 US Presidential Election

In a series of articles reflecting on the way in which the 2016 US election polls were reported, Nate Silver—editor-in-chief of polling aggregate website

FiveThirtyEight—remarked that "there are real shortcomings in how American politics are covered, including . . . a lack of analytical rigor" (Silver 2017a). The problem, he concluded, was not with the presidential election polls (which were within 2% of the final result, an historically better-than-average performance) but with the way in which they were reported, in part due to the innumeracy of some reporters. In short: "The media's demand for certainty—and its lack of statistical rigor—is a bad match for our complex world" (Silver 2017b). Against the widespread view following Donald Trump's victory that the polls had got it wildly wrong, Silver counters: "While many things about the 2016 election were surprising, the fact that Trump narrowly won when polls had him narrowly trailing was an utterly routine and unremarkable occurrence" (ibid.). The shock expressed by many newspapers after Trump's election implied the polls were wrong. In fact, Silver remarks, they were about right: Trump was a narrow underdog and he narrowly won.

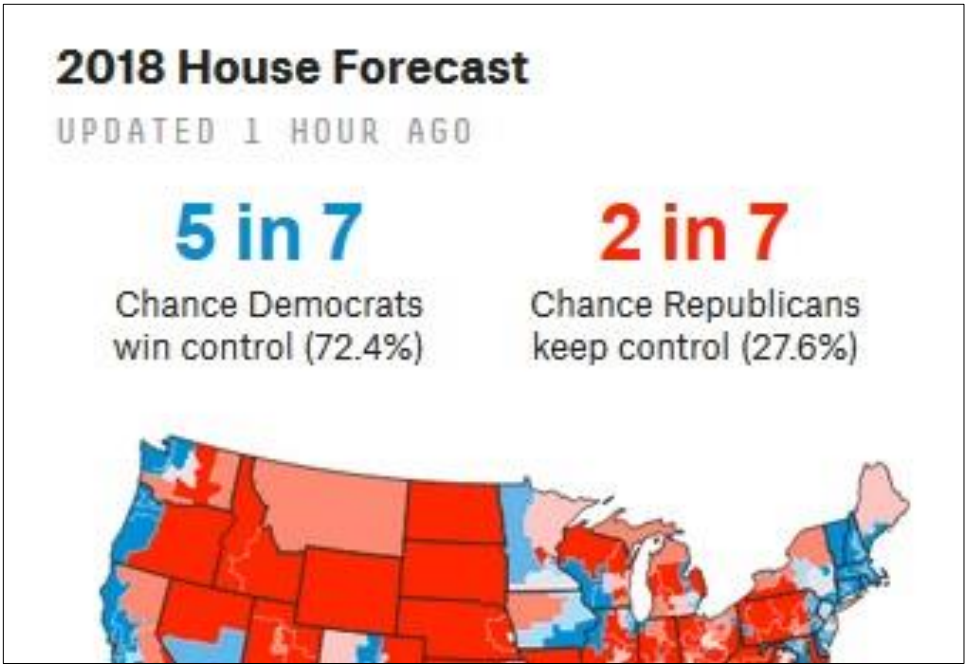

Figure 1. FiveThirtyEight expressed its US mid-term poll prediction in ratios.

Part of the problem with media coverage, Silver argued, was its failure to interpret and report correctly the outcome of a probabilistic election forecast. Silver singled out as an example of erroneous reporting the post-election analysis by Jim Rutenberg of the *New York Times*. Rutenberg criticised news organisations (including his own) for projecting "a relatively easy victory for Hillary Clinton with all the certainty of a calculus solution" (Rutenberg 2017). In point of fact, the *New*

York Times's prediction was headlined "Hillary Clinton has an 85% chance to win" (Katz 2016) and opened with the assertion that a victory by Trump remained possible. Rutenberg's characterisation of the *New York Times*'s prediction was, Silver tartly observed, "pretty much **exactly the wrong way** to describe such a forecast" (2017b) because a probabilistic forecast is an expression of uncertainty. After castigating Rutenberg for his innumeracy, Silver observed the way the data were presented was potentially confusing, since probabilities and polls are both routinely expressed as percentages. It is worth noting that during the 2018 US mid-term elections, the FiveThirtyEight website chose to present its headline poll predictions in terms of ratios, with percentages playing second fiddle (see Fig. 1).

It is reasonable to ask, then, how could the presidential polling have been reported more accurately? In terms of news headlines, a form of words which reflected the probabilistic nature of the data would have helped. For example, the FiveThirtyEight website headlined its own polling articles during the 2020 presidential election using the word "favored," so that the phrase "Biden slightly favored to win" was employed when the candidate's chance of victory was over 50%; this changed to "clearly favored to win" whenever his chance increased to above 90%. Headlines are no place for subtlety, of course, and it is in the main body of a news report that appropriate context and caveats should appear. At the very least, reporters should refrain from describing an event as a near-certainty (in the case of 2016, victory for Clinton) when the polling data suggested Trump had a one-in-six chance of success. Reporters should point out that while a Trump victory was unlikely, unlikely things nevertheless happen, as did FiveThirtyEight in 2020: it explained that at one-in-ten, Trump's chances of victory were "roughly the same as the odds that it's raining in downtown Los Angeles" today, which it does approximately 36 days a year (FiveThirtyEight 2020).

Case Study 2: Run-up to the 2015 UK General Election

Throughout the 2015 UK general election, fact-checking charity Full Fact ran a rapid-response service from 6 a.m. to midnight, seven days a week for the six weeks preceding the May 7 poll date. Full Fact provided support to newspapers from all political quarters, and the organisation noted they received a large number of media requests from journalists "displaying varying degrees of statistical literacy" (Arnold 2017, 217–8). An example of the charity's work was the erroneous reporting of a press release from the Trussell Trust, the UK's largest provider of foodbanks. The release was inaccurately reported as claiming 1 million people were using food banks, whereas the figure related to uses rather than users; the true number of users was nearer to 500,000. Full Fact encouraged the Trust to issue a clarification to avoid such mis-reporting, and helped a *Guardian* journalist word a

correction to a published article which had been based on a misinterpretation of the Trussell Trust's figures (ibid., 219). The extent to which Full Fact helped news organisations make corrections is indexical of the errors and oversights which necessitated these corrections; had the news reports been entirely accurate, there would have been no need to call on Full Fact's services.

The errors identified by Full Fact can be split into two broad categories: a lack of clarity over what is being measured (examples 1 and 2 below), and claims about the change in growth of a quantity which may simply reflect a growth in the population (example 3). These are both areas which numerate journalists ought to be able to identify and challenge, so it is significant that Full Fact's assistance was required. The examples:

1. Labour leader Ed Miliband claimed three times as many people were on zero-hours contracts compared to 2010 (a zero-hours contract is one in which the employer does not guarantee any specific hours of work, and generally applies to casual employment). Full Fact issued a release pointing out that the Office for National Statistics (ONS), whose survey provided the figures about zero-hours contract working, made clear that such comparisons over time are not reliable since an increase in the number of people who report they are on zero-hours contracts may be a consequence of a greater awareness of what type of contract they are on. "Nobody knows how much of the increase really reflects more people on zero-hours contracts, and how much is increased awareness" (Arnold 2017, 222). The *Financial Times*' Chris Giles tweeted about the release, and it was reported in newspapers including the *Daily Mirror, Sun, Daily Mail, Independent,* and *Guardian*. Although Labour continued to campaign on employment security, they dropped their specific claims about zero-hours contracts.
2. Then-prime minister David Cameron said, "We have created two million jobs," during a party leaders TV debate when he meant two million more people were in work. There can be a big difference between the number of jobs and the number of people in work—some people have more than one job, and one job can be shared. In fact, although at the time of the election there were 33.5 million jobs, there were 31 million people in employment. Cameron later changed his wording to "two million more people in work." (ibid. 223) One would expect a number-savvy journalist to be able to challenge unclear use of statistics.
3. Both the Conservatives and Liberal Democrats claimed UK employment was at a record high. This is nothing to be surprised about since the rise in population practically guarantees record employment year after year, except in periods of economic decline. A more pertinent baseline is employment rate (the proportion of working-age adults in employment), which by 2015 was above the previous high of 73% recorded in 2008 and was therefore a more meaningful record. The wider point made by Full Fact was "The UK's population is rising. Many claims we hear about record numbers of people boil down to that simple fact" (ibid., 225).

Full Fact concluded that journalists continued to exhibit a poor grasp of numbers. For example, references by a party spokesperson to one of various poverty trends went unchallenged by the reporter. The charity also believed that news organisations' commitment to balance (which is a statutory requirement for broadcast media in the UK) may have led journalists to include "inaccurate or

unsubstantiated quotes . . . without challenging them or offering further analysis" (ibid., 226).

Full Fact (2018) went on to respond to the BBC Trust's 2016 impartiality review of the BBC's reporting of statistics (BBC Trust 2016) concluding "the BBC needs to be braver in challenging statistical assertions if it is to be a useful public service" (Hawkins and Arnold 2016). As an example, Full Fact wants BBC guidelines to insist that when the UK Statistics Authority declares a claim to be false, then journalists should point this out when interviewees try to make that claim. The Statistics Authority showed the claim of a £350 million-a-week "Brexit bonus" to be spent on the NHS was wrong, although an Ipsis Mori poll found around half the public thought the claim was correct. Full Fact believed that had the statistic been challenged on BBC platforms, then voters would have gone to the referendum polls "with a more accurate view of our relationship to the EU—regardless of the outcome" (ibid.).

It is true that in all three of the above cases, journalists had accurately reported (erroneous) claims made by politicians, so it could be argued these are not examples of journalistic failings. However, the point made by Full Fact is one with which the present author concurs. A reporter with a keen nose for numeracy (in the same way journalists pride themselves on having a nose for news) should have responded to the claims with the same degree of healthy scepticism they would greet any other piece of information by asking: Does it hold water? Is it accurate? Could it mislead our readers? It seems reasonable to suggest that if the politicians' claims rang alarm bells for those working for Full Fact and other fact-checking organisations, then they ought to have rung alarm bells for those working for news media organisations also. For a journalist to point out that a claim made by a politician is misleading or mistaken is not to overstep the role of journalist; it is to present a more complete picture to the reader, and hence to fulfil the role of journalist. The better-armed the journalist is to sniff out numerical mishaps and the stronger their nose for numbers, then the better will be their quality of news reporting. As one theorist of the media puts it, after noting that journalists prior to the mid-19th century "had sought to simply collect and transmit the flow of information": "Objectivity came from the disciplined attempt to reconcile conflicting versions of real situation and events by not just gathering information but by actively evaluating it" (Nerone 2015, 141).

Case Study 3: Dying for a Bacon Sandwich

People have been dying for bacon sandwiches for years in the UK, according to media reports, but journalists have been providing insufficient information—and continue to do so—despite their failings being highlighted time and again. This particular example is instructive, as it concerns a story which crops up regularly, and yet the level of reporting has not improved over the years. It forms one of the

chapters in Blastland and Dilnot's 2008 study of how the media report stories involving numbers. They look at a report published the previous year by the World Cancer Research Fund (WCRF) which advised people to avoid processed meat, but as the authors point out, "nothing we have said so far gives you the single most essential piece of information, namely, what the risk actually is" (Blastland and Dilnot 2008). When they calculate the risk, it turns out that typically 5 men in every 100 get colorectal cancer over the course of their life; if they all ate an extra couple of rashers a day for life, that figure would go up to about 6 in every 100. This way of describing risk as a number of people out of every 100 (or every 1,000, or whatever is the most convenient number) is known as a natural frequency, and Blastland and Dilnot recommend that reporters use natural frequencies rather than percentages. Blastland and Dilnot were also concerned that the confidence interval/level was inadequately explained; this is the level at which researchers have confidence in the results of their research. It is often set at the 95% level, which means there is only one chance in 20 that the research findings were due to chance (ibid.). Their advice that confidence levels should always be reported is echoed in a handbook aimed at journalists, because it gives the readers a chance to assess the results themselves (Wickham 2003, 75).

Bearing in mind these two key exhortations to journalists—to express risk as natural frequencies and to include the confidence interval in their articles—how was a more recent instance of the "bacon causes cancer" story reported? In 2019, the *Guardian* carried a story under the headline "Even moderate intake of red meat raises cancer risk, study finds," based on a report which used data on nearly half a million adults (Boseley 2019). The third paragraph of the article states that "eating on average 76g of red or processed meat per day, had a 20% increased risk of bowel cancer compared with those who averaged 21g a day" (ibid.) So once again, relative risk is prominently reported, but given previous criticisms of this type of story as detailed above, surely the absolute risk was also given? It was not mentioned at all. Despite the news report's relative length (740 words) and the fact that three experts (including the research paper's lead author) were interviewed, no mention is made of the level of absolute risk, the confidence intervals involved, or natural frequencies. The tone of the headline combined with the "20%" claim is alarming. So, is this alarm borne out by the evidence? The *Guardian* article helpfully linked to the research paper on which it was based (Bradbury et al. 2019). This paper tabulates incidence of cancer alongside foodstuff consumption. In the case of red and processed meat, there were 274 cases of cancer among the 68,359 participants who ate the foodstuffs less than twice a week (around 21g per day), which is a natural frequency of about 40 people in 10,000. For those who ate red and processed meat two or three times a week (about 52g a day), this went up to 52 people in 10,000, and for the maximal group who ate red and processed meat four or more times a week (around 76g a day), the cancer rate was about 63 people in 10,000.

When the researchers weighted for lifestyle factors, the increase in risk was indeed 20 percent as reported in the *Guardian*, but expressed in terms of natural frequency, the increased risk corresponded to an additional eight people per 10,000. While that is an appreciable number, it is far less alarming than the headline statistic of 20 percent and is likely to have quite a different impact on people's eating habits. In addition, the *Guardian* also failed to report the confidence interval, which varied from 4 percent to 37 percent at the 95 percent level. The omission of the uncertainty regarding the research findings makes for more dramatic copy but at the expense of accurate and balanced reporting.

Case Study 4: How to Cut the Perfect Roasties

Not all examples of reports involving maths are so serious, although the reporting should be equally rigorous. One example which threw up several interesting points was a light-hearted article about the best way to cut a potato so as to create the perfect roast potato ("roastie") by maximising its internal surface area. The research was carried out by students at the Edge Hotel School, University of Essex, and the Samuel Whitbread academy in Shefford, Bedfordshire. It follows in a long tradition of applying mathematical formula to foodstuffs, such as how to create the perfect pancake (Clay 2014), pizza (Medina 2013), or even cheese on toast (*Inside the Factory*, BBC2, March 26, 2019). The roast potato research was picked up by a wide range of news outlets, including the *Sun*, *Daily Mail*, *Independent*, BBC Three, and the *The Times*, complete in the case of the *Times* with a graphic (*The Times*, Monday January 22, 2018, 14) supplied by Edge Hotel School (although not credited as such by the *Times*) (see Fig. 2).

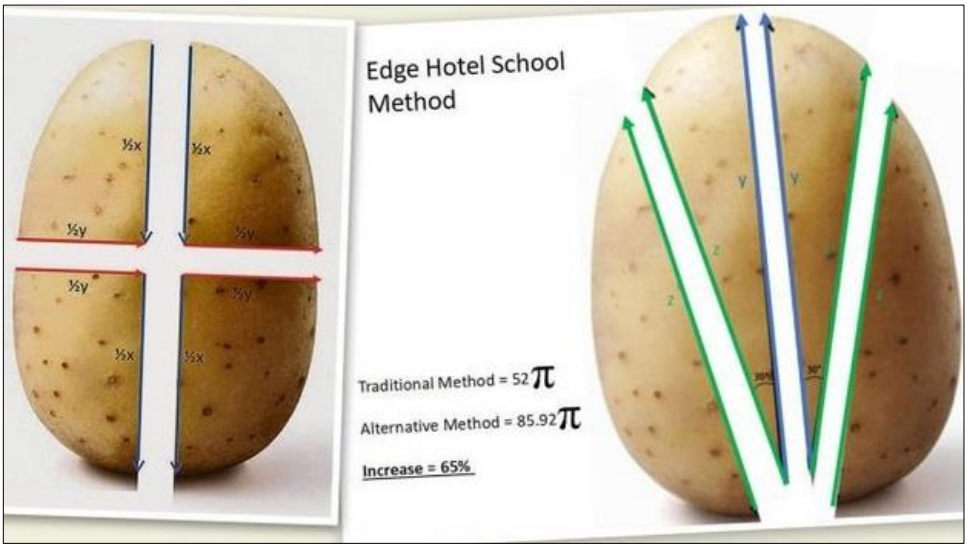

Figure 2. Graphic as used in the *Times*

Unfortunately, the *Times* had edited the original image (Figure 3) so as to remove the dimensions of the potato, which gives the impression that the internal surface area of **any** potato cut traditionally is 52π—clearly nonsense, since 52π is a constant (just over 163), whereas the size of a potato can vary.

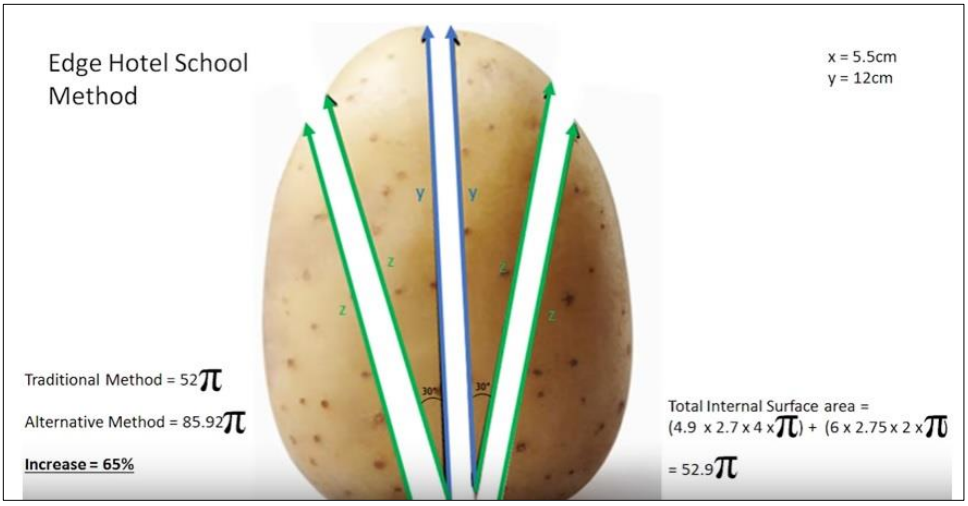

Figure 3. The original graphic produced by Edge Hotel School

As the original image makes clear, the calculations are based on the dimensions of a specific potato, given in the top right corner of Figure 3. Further, the prominent use of the figure 65% to describe the increase is misleading, or at best ambiguous. First, that is only the increase in **internal** surface area. Since the external surface area remains unchanged regardless of which way the potato is divided, the change in total surface area (equal to internal surface area plus external surface area) will be less than 65%. In fact, for the potato of the dimensions given, it is straightforward to work out that the total increase is 12.3%. Second, it is far from clear whether the figure of a 65% increase in internal surface area is true generally or only for the example given. The reason this is important is that if the latter is the case, then it is not intuitively obvious that the Edge Hotel School method will always give a greater surface area (hence tastier roasties).

Of course, such detailed considerations cannot reasonably be covered in a three-sentence caption and add little to the reader's understanding of the article. But the badly-edited graphic, which omits crucial information and hence does not make sense, points to a lack of quantitative literacy. I have argued elsewhere (Harrison 2016) that if quantitative literacy were more highly valued by journalists, then an omission such as this would not have occurred because it would have been questioned somewhere along the production chain; perhaps other details in the caption would have been made clearer, too. Of course, for this particular story it matters not a jot whether the graphic was clear or not because what is at stake is

eminently trivial. But the more general point is that this could have been a story about living standards, voting intention, or health issues, and a similar lack of rigour in this type of story could have far-reaching consequences—if only in undermining readers' trust in the ability of the news organisation to report any story accurately.

As a side note, a numerically-inclined news reporter could have followed the example of the current author and checked the literature for potato-related research. There is surely journalistic mileage to be made out of the fact that volume 48 of the *American Potato Journal* (an area of research in which the UK sadly appears to be lacking since it boasts no comparable national publication) carried a paper with the beguiling title "Calculation of Potato Tuber Surface Area" (Maurer and Eaton 1971). The research, perhaps to the surprise of the casual reader, has an eminently practical application, since agriculture often needs an estimate of potato surface area in order to assess the extent of infections. Maurer and Eaton's paper reviewed previous research and concluded that a modified form of the formula for the surface area of a prolate (pointy) spheroid most closely matched the measured findings. Two such sets of measurements were described, one from 1969 when each potato was peeled and the peelings measured using graph paper, and a project in 1970 when potatoes were covered in honey and had fine glass beads applied to the surface—the beads were later collected and weighed. Maurer and Eaton recalculated the results based on their modified formula but noted further work was required on the 1969 data as the method "was both time-consuming and destructive" (ibid., 83). As far as can be ascertained, no journalist took the trouble to unearth this paper in order to campaign against such wanton potato destruction.

Conclusion

The above case studies illustrate how a lack of rigour in news articles containing numerical data can lead to inaccurate, confusing, or incomplete reports. I have previously made the case that the remedy is a combination of training and a shift in the culture of journalism (Harrison 2016), a shift in what the media theorist Pierre Bourdieu has termed the *journalistic field* (see Benson and Neveu 2005). It does not require a degree in higher mathematics to work with numbers, but it does require applying common sense and the same critical thinking that goes into any other news story. Based on previous research coupled with the case studies discussed above, I believe the following guidelines can help reduce errors and ambiguity in news reports:

- When reporting polls, always give the margin of error and polling method where necessary—if space is at a premium, link to the full analysis and data sources;
- In articles which involve measurement, be clear about what is being measured;
- When reporting medical/health studies, always give the level of confidence, and provide a link to the original article;

- Use natural frequencies to explain risk;
- Put numbers into context using appropriate and relevant analogies;
- Contextualise results or findings ("How big is it?", "What does that mean for me?").

In the longer-term, a key step is to raise the prestige of numeracy within journalism so that QL is more highly valued by reporters and news editors. This will enable news reporters to place stories involving QL within their proper context. Lynn Steen recalled how the reporting on a major mathematical breakthrough he had written about in the late 1970s was distorted because of "writers and editors who did not know enough mathematics to understand the story" (Steen 1989, 5). The issue is not confined to the US and UK: an analysis of mathematical errors in Portuguese newspapers concluded that "low numeracy levels may also justify the way journalists use mathematical information" (Pereira et al. 2016, 16). Training in itself is important and should be encouraged, but various QL training schemes for journalists have been in place for at least the past 30 years; the mathematician and author John Allen Paulos recalled teaching such a course at the Columbia School of Journalism in the mid-1990s. He said: "I thought I'd be able to introduce some new ways to describe numerical data and some non-standard questions that should often be asked. Unfortunately, I had to spend more than half the semester on elementary material ranging from simple percentages to converting units to the basics of probability. The students were smart, articulate, but many of them were not numerically savvy, to put it kindly" (Paulos 2018). If training alone were the solution to improving journalists' QL skills, then mathematical errors in newspapers would have become less prevalent over the decades, which does not seem to be the case.

The need for reporting which contextualises data-sourced news articles in order to assist the public make decisions has never been greater (Yarnall and Ranney 2017). Over the past year, the coronavirus pandemic has changed the world to an extent unprecedented outside wartime. Decisions about life and death are being taken by governments guided by scientific evidence and accepted by populations who can see in the statistics—the daily graphs and charts, the "flattening of the curve," the rates of testing and treatment, the value of the reproduction rate R—concrete proof that their actions are having a beneficial effect. Scholars have explored the QL implications of these public discussions around COVID-19 in recent months; for example, Best concluded that some quantitative arguments have been widely understood even though there is disagreement about what constitutes the facts under discussion (Best 2020, 12). More generally, previous researchers have argued that errors in news reports tend to undermine confidence in the news organisation as a whole. Researchers at the American Society of News Editors (ASNE) made the point that "Even seemingly small errors feed public skepticism about a newspaper's credibility" (Urban 1999, 11). Numerical errors in news reports are especially egregious because numbers and statistical data lend

newspapers authority and objectivity. By encouraging a greater degree of numerical awareness and responsibility among journalists, my hope is that mistakes will become less common and trust in news media, if not restored, will at least not be further eroded.

Expert advice is converted into social action (or not) because the public can see the evidence working; that evidence takes the form of numbers. If public confidence in those numbers were to be shaken (as appears to have been the case in some parts of the US during mid-April 2020), then acceptance of the need for life-saving measures such as lockdowns would start to evaporate with potentially catastrophic consequences. Meredith Conroy, assistant professor of political science at California State University, observed, "Studies have found that conservatives have become increasingly distrustful of science, and that distrust is greatest amongst consumers of conservative media. The consequences of a growing misinformation gap might vary from the immediate, such as a shift in adherence to preventive behaviors like avoiding large gatherings, to the long term—such as a difference in who is believed to be responsible for the economic and public health fallout" (Conroy 2020). The value of using numeracy to inform decisions about our daily lives, acting on the basis of numerical information, has never been greater, and the need to report accurately on stories involving numerical data has never been more pressing. Errors, confusion or sloppiness by journalists when reporting on data relating to the coronavirus outbreak are not simply undesirable or unprofessional; they could be lethal.

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