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A STUDY INTO THE VALUE PLACED ON NUMERACY AS SYMBOLIC CAPITAL WITHIN THE JOURNALISTIC FIELD

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ABSTRACT

Journalists need a clear understanding of numbers and to be comfortable communicating them if they are to perform their role of informing the public and holding power to account. That is because numbers are at the heart of almost every topic of public interest: from health, wellbeing and politics to sport, the economy and business. Yet the popular image of the journalist is that of a barely-numerate wordsmith, at home with prose but bewildered by percentages. If true, that is damaging to public discourse, both in terms of what is and is not reported, and how effectively it is communicated. This research project proceeds from the observation that journalists have a "numeracy deficit" when it comes to writing with and about numbers, and it analyses this deficit in an original manner by drawing on Bourdieu's concepts of the journalistic field, symbolic capital and habitus, employing these as the basis for a fresh understanding of the topic. By comparing journalism students with statistics students, the role of habitus and cultural capital is invoked to theorise how the development of journalism students' numeracy skills is inhibited. A numeracy audit of UK newspapers illustrates common errors when reporting on stories which involve quantitative data, and it is argued these arise in large part because numeracy is not valued within the journalistic field to the extent that literacy is. Case studies were critically analysed to explore the practical consequences of an inadequate level of numeracy on the quality of journalism. The findings have been supplemented by interviews with authoritative figures within the profession. By placing this topic for the first time within the context of field theory, it is argued that a solution to journalism's numeracy deficit does not lie in training alone, as traditionally argued, but requires a transformation of the journalistic field itself.

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CHAPTER ONE: INTRODUCTION

Research motivation

The motivation for the present dissertation arose during the three decades the researcher spent working as a journalist from the late 1980s to 2010. Unusually for the profession, the researcher had an active interest in mathematics and completed a BSc in the subject during this period, and so tended to take an interest in news stories which involved numbers and data. It was noticeable that this was not the case with most colleagues. In fact, each year a supplement was produced for the *Liverpool Echo* and the *Liverpool Daily Post* which analysed school examination results and sorted them into a series of league tables for publication as a pull-out supplement within the newspaper (this was prior to the introduction of State-authorised tables). There were only two journalists among the 25-strong editorial staff who knew how to do this, and great care was taken to ensure they were available to work on the supplement, as otherwise it is doubtful it could have been produced. While the work involved a degree of expertise with Excel, no advanced mathematical skills were required in its compilation.

On another occasion, a colleague was unable to translate retail prices from the 1940s into contemporary values in order to show how current food costs were a lower percentage of family income than they had been during and after World War II. On this and similar occasions, the present researcher was called on to perform what were quite elementary numerical calculations. The business risk inherent on relying on a limited number of editorial staff to produce such important stories/supplements is one reason why Reach (at the time called Trinity Mirror) established a stand-alone Data Unit based in Manchester to service its regional news organisations. David Ottewell, head of the unit, explained that its origins went back to 2013, when he and a colleague who worked in Cardiff at the time were tasked with doing “interesting things with data” (Ottewell, 2018). Both were “journalists first and data journalists second”, and by 2018 the team had expanded to 12 and included coders, graphic designers and a videographer. Ottewell makes the point that “there are (still) too few journalists … with the skills to analyse the huge amount of data that is available” (op. cit.). Rival publishing group Newsquest has recently established a similar Data Investigations Unit staffed by two full-time journalists and a team of 11 part-time reporters with the aim of

providing editors “with a dedicated potential splash each week generated by the team” (Prolific North, 2019).

On the surface, then, it would appear that journalists are unable or unwilling to engage with quantitative thinking to the extent that the exalted nature of their calling demands; in particular, doing justice to journalism’s duty to reflect “the increasingly mathematical complexity of our society in its many quantitative, probabilistic, and dynamic facets” (Paulos, 1996: 3). The issue is not merely of parochial interest to journalist educators and the authors of theses on numeracy and journalism; reporting on numbers can lead to significant interventions in public policy. Cohn and Cope (2012: 4) make the point that “the very way in which we journalists tell our readers and viewers about a … controversy can affect the outcome. We have in effect become part of the regulatory apparatus”. In his analysis of how U.S. news media reported on homelessness in the 1980s, Christopher Hewitt (1996: 445) observes that: “Much of today’s political and social agenda is built on statistics that are unreliable or exaggerated, presented as though they were the product of careful scientific investigation … it might appear that neither the media nor policymakers are able to distinguish rubbish from real research”.

It seemed remarkable to the present author that otherwise capable and confident journalists baulked at the thought of handling numbers. Indeed, in the present author’s experience, numeracy was not treated as something to be proud of in the same way that writing copy to tight deadlines or having an impressive contacts list was. If anything, innumeracy (or at least, lack of interest in numeracy) was often treated as a badge of honour, so that the phrase “I’m really bad at maths” was more a boast than a confession. At the time, this state of affairs struck the current writer as curious, and even more so after his move to academia. Several questions presented themselves: What was behind the aversion to numeracy? Had it always been like this? What impact did this have on the quality of reporting? What should or could be done to improve matters? It was reflection on these and related questions which led to the current research project. It seemed improbable that the observed levels of inadequate numeracy were confined to the region of the UK where the author was based, or that this was the only generation of journalists who were number-phobic. That led to the view that there was a more general and widespread factor which affected journalism as a whole and which tended to reproduce a culture which was dismissive of quantitative reasoning. As will later be

suggested, that explanatory principle is to be found in the notion of the *journalistic field* as developed by Pierre Bourdieu.

Two remarks about the production environment of news organisations are in order here, to provide context and avoid misunderstanding. First, when referring to *journalists*, two distinctions may be drawn. On one hand, there is the distinction between the reporting, management and production roles; on the other, there are distinctions within the reporting function, primarily that between specialist and generalist reporters. The reporting role involves identifying and interviewing sources, carrying out research, and the eventual writing-up of the news story in the form of "copy". The news management role (such as news and features editors, the editor and executive editor) identifies and assigns stories, and determines the editorial direction of the organisation (which types of stories to cover and how they are to be covered). The production function is carried out by sub-editors, who check and process the copy in line with the news organisation's values and material practices (formalised as a *style guide*). While there has been an elision of these roles in the past 15 years (partly driven by the economic and technological impact of the internet) - so that reporters may carry out their own sub-editing, for example - the functions themselves remain largely unchanged. (The above remarks relate to print news organisations but can readily be applied to broadcast and online media). The second point is that within the reporting function, there has always been a degree of specialisation and while that, again, has diminished (few regional newspapers still have dedicated education, lobby or health correspondents, for example), areas such as finance and sport still tend to be covered by dedicated staff. The current research is centred around the general as opposed to the specialist reporter, as the latter by definition have atypical qualities and characteristics. In terms of the journalistic field, we can identify specialist reporting as a series of sub-fields, which interact in different ways with various different fields (the economic, the educational, the political), and which favour a habitus quite distinct from that of the general news field.

The process of news production is typically that story ideas or leads flow to the news desk, where news editors filter the stories in accordance with their organisation's news values (the process is often termed "gatekeeping") and then assign them to a reporter(s). Even where the story idea is generated by a reporter, it would normally pass through the news desk for validation and modification ("Take this angle ...", "Speak to this source …", "Make sure you use this intro …"). The completed news story is sent to the news desk for checking. If

unsatisfactory, it may be returned to the reporter for additional work (this process may happen more than once), until it is passed by the news desk to the sub-editors. Further checks are carried out at this stage and the story is brought into conformity with the news organisation's practices before being published or broadcast. The process is described from the UK and US perspective in the first volume of Harold Evans's classic series on newspaper editing and design, and even though his account was penned 40 years ago, it is telling that in its essential features it remains unchanged today (Evans, 1979: 1-13); indeed, the basic production flow is unaltered from that charted by Willard Bleyer in 1913 (reproduced in Nerone, 2015: 130).

Already from this simplified picture, we can see that a news story is rarely the product of a single author and goes through several production steps before seeing the light of day. This blurring or smearing out of the "author function" (a term proposed by Foucault, 1977) within news writing led George Bernard Shaw to issue a characteristically impish proposition that all articles should carry two signatures – one of the person who wrote it and the second of the editor who inspired it because Shaw understood that "the signature is by definition out of place in the newspaper because it is produced by arrangers … rather than creators who control their own language" (DaRosa, 1997: 830). The fact that news articles are often collaborations rather than the product of a single hand is further reason for carrying out this analysis at the level of the journalistic field rather than that of individual journalists.

By way of analogy, we can draw comparisons between the journalistic field's bias against numeracy and its bias against signed articles in news publications from the seventeenth to the early twentieth century. Most journalists and commentators of the early Victorian period took it for granted that journalism should be anonymous, in the same way as it is taken for granted today that journalists are not usually good with numbers: "An inheritance from the eighteenth century, anonymity was the rule in periodical writing during the eighteen-twenties" (Maurer, 1948: 2); in fact, weekly and daily newspaper news stories were not routinely bylined until the 1920s. That this state of affairs was entirely contingent is made clear by the fact that the situation in France over the same period was quite the opposite – signature was the norm rather than the exception. It was not simply a matter of different legislative regimes between the two countries. In 1850, for example, the French Assembly had passed an act requiring French journalists to sign newspaper and periodical articles; in England, a battery of laws and regulations sought the same goal but "authorial anonymity in England was, essentially, an

officially tolerated form of sanctuary" (Griffin, 2003: 5). The difference lay in the relationship between the journalistic and the political fields. In France, journalists more readily made the transition from writing to politics, and so signing their articles was a way of demonstrating their *bona fides*. In England, journalism was a far less savoury endeavour and was considered a hindrance to a political career: "Established professionals consider signed journalism *infra dig*, and younger ones would therefore avoid it from fear of damaging their careers" (Liddle, 1997: 53).

The point of the above analogy is that analysing the issue of journalistic anonymity at the level of the individual journalist or journal, or even at the level of national regulation, is inadequate to understand the differences between England and France. It is the (invisible) relations between the (invisible) fields of politics and journalism which allows us to grasp the form these differences take ("one can truly understand these things only through an analysis of the invisible structures that are fields and … through an analysis of some particularly invisible structures, namely the relations between … fields" (Bourdieu, 2005: 30)). Similarly, the way in which numeracy is side-lined or under-appreciated by journalists can be explained most clearly when it is framed in terms of the field. The field developed in such a way as to place literary prowess at its cultural pole, even though, as John Gore, that chronicler of journalism's epicentre Fleet Street, put it: "Literature and Journalism are not derived from the same seed" (Gore, 1928: 13). And just as the changing understanding of what constituted news affected the use of bylines, so we can foresee changes to the journalistic field leading to a revaluation of the centrality of numeracy to news-gathering and news-telling. This is a reversal of the conventional approach, which argues that to change journalism one must change journalists, through training, education and skill-building; rather, this project proposes we should also aim to change journalists by changing journalism.

Bourdieu indicates how this can occur, albeit in a different context, when he discusses transformations in the French educational field. He notes that schools (like, it may be noted, journalism schools) "constitute a field which … tends to reproduce itself" (Bourdieu, 1990a: 42) because agents have control over their own reproduction; but nevertheless, the field is not isolated from external pressures. One of the most powerful causes of transformation of that field is "what Durkheimians call morphological effects" (ibid.), namely the influx of numerous and socially diverse clienteles. As an example, Bourdieu mentions the vast number of students who entered academia in the mid-1960s attracted by the subversive disciplines of

sociology, semiology and linguistics – subversive, that is, of the order underpinned by the traditional academic disciplines of classics, literary studies, philosophy and so on. This increase in student numbers entailed an increase in the number of lecturers and senior lecturers in these disciplines, creating divisions within institutions which were a contributory factor to the Paris uprisings of May 1968. Bourdieu sums this up as demonstrating how struggles internal to the field become effective when

> the internal demands of the lower clergy (the junior lecturers) … come up against the external demands of the laity (the students), demands which are often themselves linked, in the case of the educational system, with … an 'overproduction' of graduates (op. cit., 43).

None of this is to argue that transformation of the journalistic field is inevitable given an increase in journalism student from STEM backgrounds, nor that training or development courses are unnecessary or undesirable. In fact, a consequence of adopting the student recruitment changes proposed in the conclusion to this research project will be to increase the number of such training courses. This is simply because deficiencies in numeracy currently form a vicious circle within journalism – as one field theorist put it, "the social and educational attributes of new journalists serve primarily to reproduce the field" (Benson, 2005: 101). Many journalism educators share much in common with journalists, and this includes a lack of passion for numeracy - although the more bureaucratic environment in which they work makes avoiding charts, tables and data sets more of a challenge.

As indicated at the outset of this chapter, a major observation upon which this thesis is based is that journalists and their institutions often do not value numeracy as an important professional skill, and this in turn can lead to problems with the quality of reporting (such as a lack of accurate reporting; journalists missing or under-reporting potentially important data-driven stories; a less-than-rigorous approach to precision and providing context). Such problems are explored more systematically via an audit of two UK newspapers, an analysis of historical data, and the use of case studies and numeracy tests. This research project then appeals to Bourdieu's related concepts of habitus and cultural capital within the journalistic field as the philosophical basis to theorise the reasons for the observed systemic devaluing of numeracy. What is at stake is not merely an improvement in the training of individual journalists but a change in the nature of the field itself; some research has been carried out

previously into numeracy and journalism (mainly in the context of the US), but none has related their findings to field theory.

At heart, this is a journalistic research project rather than a sociological one. However, it is to the analytical tools of sociology – and in particular the reflexive sociology practised by Bourdieu – that this project turns. The acceptance within this project of Bourdieu's philosophical work is not an uncritical one, and the lens of reflexive sociology is turned on itself to critique Bourdieu's theoretical apparatus, wherein an attempt is made to examine the histiographical basis of "field". However, Bourdieu's attitude to journalism is not uncritical, either, as he appears to hold it in low regard - as when, for example, discussing what he regards as the insubstantiality of Roland Barthes' essays, he disparagingly refers to way in which Barthes is "condemned, in order to exist, or subsist, to float with the tides … notably through journalism" (Bourdieu, 1998b: xxii). In other passages in this work of Bourdieu, too, journalism is afforded no great respect, being disparaged as a "middlebrow" form of culture offering an ersatz shortcut to recognition and renown ("symbolic capital" – see, for example, Bourdieu, 1998b: 113). As detailed later in this work, the notion of "symbolic capital" is central to Bourdieu's thinking, by which he means a power or value which has significance within a particular field, an example being the possession of degrees or diplomas in the academic field. Outside a particular field, that power may be minimal, or even negative; for example, the current author recalls the suspicion with which graduates were regarded among journalists in the early to mid-1980s; that was because within the journalism field at that time, possession of degrees and diplomas, far from conferring a sense of prestige, implied lack of worldliness or lack of that "rat-like cunning" which *Sunday Times* journalist Nicholas Tomalin held to be essential to success in the profession[1]. Attitudes had not shifted much since Hugh Cudlipp, recollecting his apprentice years in the 1930s, remarked that working as a district reporter in Blackpool was "more instructive than a year at a university" (Cudlipp, 1976: 45); Cudlipp also recalled how the young Cecil King was distrusted within the higher echelons of the Daily Mirror empire because of his university background (op. cit., 52). While this has changed since – partly owing to the development of undergraduate degree courses in journalism – it remains the case that numeracy for its own sake (in its widest sense

[1] "The only qualities for real success in journalism are ratlike cunning, a plausible manner and a little literary ability", cited in Randall, 2016: 1. The necessity of literary ability will be discussed later in this thesis.

of quantitative literacy, or QL – see Chapter Two) is not a highly-regarded quality in journalists, even among editors and senior staff.

In terms of field theory, symbolic capital occupies one of the two axes which structure the field, the other being economic capital. Broadcast media dominate the field in terms of economic capital: for example, in 2017, Sky, BBC and ITV were listed at third, fifth and eighth spot respectively in the Deloitte Media Metrics report, with the highest ranked print media business being the Daily Mail Trust in ninth, with revenues at just under £2bn compared with nearly £12bn for Sky (Deloitte, 2017: 8). The Guardian Media Group (GMG), publisher of the highly-respected *Guardian* newspaper and website, sits towards the higher-end of the symbolic pole, and has made substantial losses over recent years – it suffered an operating loss of around £57m in 2016, for instance (*Guardian*, 2018b) - and only broke even "for the first time in recent history" in April 2019 (*Guardian*, 2019b). The *Guardian* is ultimately owned by the not-for-profit Scott Trust. Although the *Times* – another news organisation rich in symbolic capital - is now profitable, it took years of cost-cutting after its takeover by Rupert Murdoch in 1981 before it hit the black, and before that years of investment by Roy Thomson. Indeed, Thomson wrote in his memoirs:

> I was going to lose a lot of money before *The Times* became viable again, and if it ever did become a profitable concern it would very likely never replay the big sums, the millions, we would have to invest in it. We knew that, my son and I, yet we were prepared to devote a large amount of our private fortune to that end. (Thomson, in Grigg, 1993:5).

In terms of audience demographic, the *Financial Times, Guardian* and *Times* are among the "quality" end of the readership spectrum with high symbolic capital, as opposed to the downmarket press (*Sun, Daily Mirror, Daily Star*) or broadcasters (ITV, Sky) with higher economic capital. A measure of symbolic capital is the winning of prestigious awards, such as the British Journalism awards. In 2018, journalists from the *Financial Times, Guardian* and the *Times* were the main winners (the *Daily Mail*, BBC and Channel 4 News were also among the awards); in 2014, the US arm of the *Guardian* won the Pulitzer Prize; over the past 15 years, the title of National Newspaper of the Year has been shared between the *Guardian*, the *Financial Times*, *Daily Mail/Mail on Sunday* and the *Times*. Hence symbolic capital is held by those with a smaller but more upmarket readership and who are less impervious to commercial pressures.

Views from the experts

The research areas as outlined above have been supplemented by preliminary conversations with leading figures in the field to provide a wider perspective on the issues raised. Those who have been consulted are:

- Prof John Allen Paulos, author of award-winning books on the media and numeracy, including *A Mathematician Reads the Newspaper*, *Numeracy* and *Beyond Numeracy*.
- Scott Kier, Head of education and statistical literacy at the Royal Statistical Society.
- Kevin McConway, Emeritus Professor of Applied Statistics, The Open University (OU), and a co-author of the OU textbook *Elements of Statistics*.
- Alex Bellos, a journalist and author whose recent publications include *Alex's Adventures in Numberland*, a *Sunday Times* bestseller which was shortlisted for the BBC Samuel Johnson Prize.

In addition, original information has been gathered for this research project from Prof John Curtice, president of the British Polling Council, and Alastair Machray MBE, editor-in-chief of Reach's (formerly Trinity Mirror) regional newspapers in the north west and north Wales. Finally, an original contribution to knowledge is also made regarding the composition of an early (1687) text by the writer and polemicist Henry Care based on internal evidence previously overlooked.

In order to flesh out some of the themes around journalism and numeracy, the author began by speaking to Machray, whose stable of titles includes the *Liverpool Echo*, about the capabilities he looked for in an aspiring news reporter. While he acknowledged the importance of numeracy, what he also valued highly in a news reporter was the ability to analyse reader/user data, such as page impressions or social media engagement (the discipline known as "web analytics"). Being able to spot trends in news consumption among website viewers was regarded as just as valuable a skill in a reporter as the ability to "sniff out" a story from a jumble of numbers. If anything, numeracy is less prestigious within the journalistic field than ever before, as the establishment of data units – such as the *Guardian's* DataBlog or Trinity Mirror (now Reach) Regionals' Data Hub – centralises production of content which is heavily data-reliant. In consequence, general news reporters get to handle fewer such stories. Further, one effect of the economic pressures caused by the emergence of disruptive competitors from the turn of the 21st century (such as Google, Facebook,

Amazon[2]) has been to squeeze the cost base in most newsrooms, leading to fewer journalists producing a greater number of stories. The story of decline is a familiar one, most recently summarised by the media editor of the *Guardian*: "The majority [of regional news publishers] coasted with enormous profit margins that subsidised public interest journalism, with many of the big groups racking up enormous debts through acquisition sprees and failing to invest, only to see the entire business model collapse as eyeballs – and advertising cash – switched to Facebook and Google" (Waterson, 2019). This, in turn, has led to a decline in the number of specialist reporters, particularly in the regional press. Over time, as those number-indifferent reporters become promoted to desk editors and sub editors, the residual pool of numeracy within the newsroom tends to evaporate, leaving pockets of expertise concentrated within datahubs, project groups or external contributors.

In addition to the talk with Machray, conversations were conducted with authoritative figures closely connected to both journalism and numeracy. The purpose was to identify common conceptions and concerns, rather than to produce a fully representative survey of industry figures. Those spoken to were John Allen Paulos, Kevin McConway, Alex Bellos and Scott Kier. Paulos, author of several influential books on journalism and quantitative reason including *Numeracy*, lent credence to the view that general news reporters rarely valued numeracy highly when he remarked: "Science and business journalists are usually quite numerate, but I haven't noticed a big change among general beat reporters. The same sorts of errors and omissions of context occur constantly in news stories" (email correspondence – see Appendix Two for full text).

The experts were asked whether they were satisfied with the level of numeracy displayed by journalists. Kier replied: "Classically, journalists are not very numerate. Language is the area of expertise for journalists. We need a culture in journalism where having numerical 'nous' is important. Most journalists have not had a course of statistics. You can tell better stories by improving your understanding of statistics. That enables you to spike [i.e. reject] the bad but also get exclusives." He added: "I've seen some very good examples of journalists digging into the numbers and asking good questions." He pointed to a story by a reporter who had

[2] Amazon was founded in 1994, Google in 1998, and Facebook in 2004. It became a truism among news executives from the early 2000s onwards that these upstarts were "eating our lunch" (Edwards, 2016) by creaming off lucrative advertising revenues – Edwards (2016) specifically mentions newspapers as among those industries most susceptible to "disruptor" rivals.

worked out that a pledge in the Conservatives' 2017 election manifesto to spend £60m on free school breakfasts corresponded to an outlay of just under 7p per meal per pupil[3]. That compared with a cost of 25p per pupil on average for a bowl of porridge, or about 85p per portion for a more substantial cooked breakfast. On the other hand, a story being worked on talked about employment rising by 60,000 yet the confidence interval of the figures (the range within which the truth probably lies) was 79,000, so the journalist realised there was actually no story to be told, and it was accordingly dropped.

Fact-checking was an area which Kier believed was becoming more important: "Holding statistics to account is a role journalists can do." The RSS, he said, worked to encourage good practice rather than by censuring bad practice. "If you want to get people on side, you have to do it in a positive way," he said. "We're living in the world of data. Bacon-eating stories still appear [stories about food health safety – c.f. Chapter Six below]. The role of journalism is complex. We want to encourage them to tell stories better." In the medium to long term, it was important to encourage journalists to understand statistics and to present them in appropriate ways: "The ecosystem needs to be changed – journalists, graphic artists, subs – all need to be able to ensure across the story cycle, that numerical angles are handled properly." In this respect, Kier is in agreement with one of this project's observations, that it is the culture of journalism (its ecosystem) that requires change, not just individual journalists. While proposing that journalism degree courses ought to do more to help students improve their numerical skills, and that numeracy skills should be compulsory in school up to the age of 18, it was ultimately "all about being able to ask questions, and we want to encourage that. There are still questions that can't be asked without doing the maths".

The writer Alex Bellos began his journalistic career at the *Brighton Argus* after leaving Oxford with a degree in mathematics and philosophy. It was, he wrote, "a decision, at least superficially, to abandon [science] and embrace [the liberal arts]" (Bellos, 2011: 9). While mathematics had been his best subject at school, he said that at university "my largest social group was all around newspapers. I went on the milk-round of traineeships and got on the *Brighton Argus*, then freelanced in London" (interview with author). That is, it was the culture in which he felt most at home, rather than his academic interest, which prompted his

[3] https://schoolsweek.co.uk/conservatives-free-breakfast-pledge-costed-at-just-7p-per-meal/ (accessed 12.8.2017).

move into journalism. The fact that a move into journalism was the career trajectory which felt most comfortable is an illustration of Bourdieu's conception of the habitus as doing that which comes naturally (habitus ensures agents "merely need to be what they are in order to be what they have to be", Bourdieu, 1990a: 11; habitus is "the law of the social body converted into the law of the body", Bourdieu, 2000: 179). While Bellos's interest in mathematics was not a topic he regularly discussed with journalist colleagues ("You never really talked about it"), it did crop up at work indirectly "because I was more of a mathematician than a writer; maths is all about structure. Maths is really just a structure." There was no sign, Bellos believed, that journalists' numeracy skills were improving and that was because newspapers do not have the resources these days to provide training in statistics and numeracy to their journalists: "Newspapers don't have any money so the reporters are not being trained and that means there's a lack of sound statistical background." However, lack of knowledge was not always to blame: "It is easy to misuse statistics. Too often, the *Daily Mail* deliberately misinterprets things."

The mathematician and author John Allen Paulos was also asked whether journalists were sufficiently numerate to carry out their jobs effectively, and his reply was that in general they were not: "Of course, that depends on the kind of story being covered, but for many numerically-flavored stories (and other kinds), the answer is No." He added: "Innumeracy is certainly still a problem, but it is compounded by political/cultural constraints as well, and it is sometimes hard to separate innumeracy from the latter. Gullibility and a lack of critical perspective further exacerbate journalists' innumeracy." Again in line with the thrust of the current research project, cultural reasons are pinpointed as one factor for failings when it comes to correctly writing about stories involving numbers. While specialist reporters, such as science writers, were as a rule quite numerate, Paulos had not noticed an improvement in general news reporters' handling of figures. "I haven't noticed a big change among general beat reporters. The same sorts of errors and omissions of context occur constantly in news stories," he said.

Paulos was asked what he thought could be done to improve the numeracy of journalists. He replied that he had been brought in by the Columbia School of Journalism in the mid-1990s to teach a course in quantitative literacy. 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." This further highlights the cultural aspect of the journalism students' experience; while Paulos's students were intelligent and motivated, they did not take easily to a course of study involving numbers because this was not the world they felt at home in. Paulos regretted that Columbia did not continue the course, and added: "I think such a course should be offered at schools of journalism and, for those students who don't pass a numeracy pre-test, it should be required."

McConway agreed that journalism courses ought to encourage more students with a science background as one way of addressing what he accepted to be "the problem of low numeracy skills", although he made the point that some of the best journalists he knew when it came to writing about number were not from a science background at all (he gave the example of Michael Blastland, the co-devisor and first producer of the BBC Radio 4 programme *More or Less*, who is an English graduate). However, he did acknowledge that many journalists from a traditional arts background "just run away from [numbers] in fear, as seems to happen too often". McConway made the point that many people engaged in data journalism are from non-arts backgrounds (computer science, librarianship, statistics); and he expressed concern that while such entrants generally gather and analyse data very well, they may be at a disadvantage when it comes to telling stories – that is, presenting data in an informative and engaging way that compels attention, which is one definition of what journalism is about. He said: "Many science graduates are really not very good at that sort of thing [telling stories], so you would have to start at a lower base in training them in writing aspects." Whether it is more of a challenge to teach writing skills to science students than numeracy skills to art students remains an open question, and one which will be taken up in the Conclusion to this research project. The final point which McConway made was that not everyone with a science background has particularly well-developed numerical skills:

> Many people that I speak to, even if they are working as research scientists, tell me how difficult they found statistics when they studied it as an undergraduate, and say that there are still important aspects that they don't get. That's particularly true of people who studied some biological sciences (McConway, 2019).

However, he added that at least such students know what they don't know, and "their level of not understanding is doubtless considerably higher than that of a typical English graduate".

Three themes emerge from these conversations. First, there is unanimity that numeracy levels among journalists leave much to be desired, even if there are differences about why this is the case. The fact that compulsory maths education at school in England and Wales ends at 16, the lack of on-the-job training and a shortage of numeracy courses at degree level were all mentioned; these are all interventions at the level of the agent. Second, all the experts made reference to the underlying culture as either a contributing factor or something which needed to be addressed; this involves an intervention at the level of the field. There was no sense among the experts that the situation in respect of numeracy was improving, nor was there confidence that improvements were on the horizon. The third theme was that there was no pressure on newspapers themselves to act in a numerately-responsible manner; indeed, some news organisations were accused of wilfully misrepresenting data, such as the *Daily Mail*'s reporting before and during the Brexit referendum, a view supported by research carried out into the newspaper's reporting:

> By setting the agenda and framing the news coverage on immigration, the *Daily Mail* can be said to have acted in a manner that does not align with objective journalistic standards. Instead, using negative rhetoric with reference to immigration, the *Daily Mail* created frames that engendered negative associations with immigration (Sogelola, 2018: 12)

Although it is the case that the experts expressed concern at the current state of numeracy among journalists, there was no consensus about what ought to be done about it; indeed, McConway admitted that, apart from encouraging more entrants with a science background into journalism, he was not sure what else would reliably work, while Paulos regretted the discontinuation of the Columbia course in quantitative literacy on which he had taught. Although the experts all agreed that education was a key factor, there was no consensus as to when numeracy education should be delivered (at school, in higher or further education, or in the workplace), nor what precise form it should take. This is by no means an original or recent observation; when the distinguished journalist Geoffrey Crowther delivered his report on the state of education in UK schools in 1959 on behalf of the Central Advisory Council for Education, he noted that:

> The literacy of the scientist and the numeracy of the arts specialist are clearly complementary needs … The difficulty in the way of making all science specialists literate is not one of ignorance about how to do it, but of the will to see that it is done thoroughly and effectively. There seems to us to be no way of making the arts

> specialist numerate except by providing a special Sixth Form course for this purpose (Crowther, 1959).

Teaching science students how to write well, then, was seen not as an impossibility but a matter of priorities – given the will and the resources, it could be achieved. This research project argues that training and continuing education is indeed a necessary condition to bolster numeracy within the profession, but not a sufficient one.

News media and trust

Turning now to the significance of this research project, it is evident that the lack of care over numeracy within news reporting strikes right at the heart of the link between journalism and trust. At a time when presidents charge journalists with being traitors to their country and decry "fake news", it may seem odd to claim news media are trusted; but the fact is that traditional news media (newspapers, TV and radio) remain more trusted than social media, blogs, or corporate websites when it comes to obtaining information about the wider world, albeit that trust is lower than in the past. Recent reports may appear to contradict this – for instance, the industry website What's New in Publishing summarised a major Knight Foundation/Gallup media survey with the words: "Most American say they have lost trust in the news media in recent years" (Bhattacharjee, 2019), before qualifying that statement by noting the results of a survey conducted by Brand Keys and Media Post's Research Intelligencer which found that "traditional American newspapers are currently enjoying a very high level of trust" (op. cit.). The apparent contradiction is explained by the fact that trust varies considerable with medium and it is primarily social media which generates the highest levels of mistrust. A third survey, by the Pew Research Center, also cited by Bhattacharjee, found two-thirds of Americans got their news from social media, although over half (57%) expect it to be inaccurate (Pew Research Center, 2018)[4]; this suggests a triumph of convenience over credibility.

Similarly, research for the Guardian YouGov-Cambridge Globalism Project found more than four in every five Britons distrusted news on social media, while a majority of Britons placed their trust in national TV news channels (61%) and local news organisations (54%)

[4] In keeping with this project's own recommendations, it should be noted the margin of error in the Gallup survey is 4% at the 95% confidence interval (Knight Foundation, 2018) and that for the Pew Research Center is 2.5% (Pew Research Center, 2018).

(*Guardian*, 2019a). According to this survey, only 12% trusted news on social media compared with 83% who had little or no trust. In terms of usage, 24% of UK respondents said they had used Facebook as a source of news in the previous month and 14% had used Twitter[5]. While many people now access news via social media, very little news is generated directly by the social media platforms, which rely primarily on traditional news media as sources for their information. All this indicates newspapers still play a key role in public discourse, a fact which bolsters the significance of the current research project. If newspapers were irrelevant to the lives and views of most citizens, it would not really matter how well they reported on data-related news stories. But because journalism continues to inform an active citizenry, it is crucial that reporting is accurate and based on a full understanding of its raw material, whether or not that involved numbers. Journalists who are poorly equipped to undertake this role are therefore doing democracy a disservice, and steps to rectify such failings are to be welcomed.

Numbers and statistical data lend newspapers authority and objectivity, which is a powerful reason why errors in numeracy are potentially so damaging to public trust in news media, a point which researchers have confirmed. For example, one research paper examined the public's response to the accumulation of minor errors in articles and concluded: "Even seemingly small errors feed public skepticism about a newspaper's credibility. Each misspelled word, bad apostrophe, garbled grammatical construction, weird cutline and mislabeled map erodes public confidence in a newspaper's ability to get anything right" (Urban, 1999: 11, cited in Maier, 2005). Maier went on to emphasise the wider implications of such mistrust: "When the public distrusts what they read and see on the news, the media not only lose customers but, research suggests, community and democracy wither as the public becomes increasingly disengaged" (Maier, 2005: 546). Thus in terms of its significance, one of the observations this research project makes is this: journalists who undervalue numeracy skills are more likely to make errors when it comes to reporting stories which require such skills, and public trust becomes eroded as a result. By encouraging a greater degree of numerical awareness and responsibility among journalists, the ambition is that mistakes will become less common and trust, if not restored, will at least not be further undermined.

[5] No data on margin of error is provided for this survey.

Yet “ignorance of mathematics has attained the status of a social grace”, as the mathematician and educationalist Morris Kline wryly observed in his landmark account of the cultural import of the subject on Western culture (Kline, 1982: 16). It is a central tenet of this thesis that, far from being divorced from or even irrelevant to the quotidian world, numbers and numeracy play a foundational role; indeed, as one recent historian of the field somewhat dramatically put it: “We can say that mathematics and hence numbers hold the key to the future destiny of mankind. This is nothing new. Numbers have always played an essential role in shaping the evolution of society” (Flegg, 1984: iii). Ours is a world shot through with numbers; they are the threads which weave together political discourse, public debate and social policy. Veteran newspaperman David Randall observed that: “If you don’t know enough to question data, then you really are impotent as a journalist” (Randall, 2007). The doyen of quantitative reporting Philip Meyer echoed the sentiment when he wrote that journalists “write with words, but we must learn to read in numbers” (Meyer, 2002: 145). Yet the journalists who report on and interpret this world are rarely drawn from the ranks of the mathematically-inclined; there is anecdotal evidence that many entrants into the profession do so expressly to avoid tangling with numbers[6] (Mencher, 1995; cited in Maier, 2002). Maier draws the conclusion that: “Innumeracy in professional practice apparently has roots in journalism education, as the discipline tends to attract students who lack the skills and the motivation to use numbers effectively” (Maier, 2002). Ranney et al (2008) add that: “Some journalists are avowedly ‘number-phobic’ – trying to ‘write around the numbers,’ thus yielding pieces insufficient in rich, memorable, or accurate information”.

As will be demonstrated in the next chapter, the emphasis for journalism entrants has traditionally been on a liberal arts education - one respected commentator has gone so far as to declare that “the natural academic home of journalism is among the humanities and the humanistic social sciences” (Carey, 2000). Until relatively recently, this type of education was unsuited to delivering numeracy as a core element within its curriculum: “Classical education in the US and Europe did not focus on competencies such as numeracy until the latter part of the twentieth century when numeracy became a concern in the United Kingdom and in the US” (Madison and Steen, 2008). This makes it all the more crucial that journalists

[6] Mencher’s anecdote concerns students at Columbia University’s Graduate School of Journalism. On being asked why they performed so poorly in a maths test, the unanimous reply was: “We chose journalism because we don’t have to deal with numbers” (cited in Maier, 2002: 508).

and journalism students are confident and capable when working with numbers. Of course, it is widely recognised that facility with numbers is a trait desirable in all graduates, not just those studying journalism. For example, in his report into the future of higher education, numeracy was described by Lord Dearing as one of the four basic skills which are "key to the future success of graduates whatever they intend to do in later life" (Dearing Report, 1997: 133). Yet a survey by the Organisation for Economic Co-operation and Development (OECD, 2013) showed that England's 16-24 year olds languished 21st in a list of 24 countries for numeracy.

The centrality of numbers to our understanding of the world and our place in it emphasises the significance of the present research project. Regardless of how people receive their news – whether from traditional or online channels – most news is still generated by journalists[7]. The way in which journalists deal with numbers can therefore determine how people grasp the world around them, or at least validate that understanding. As one set of commentators somewhat plaintively asked: "Can we trust media reports of reality? Just how solid is the research that we use increasingly to guide our personal lives as well as our public policy?" (Murray et al., 2001: xv). Sociologists of the media have argued that the primary way in which the media affects the public is not by influencing them on a particular issue but by legitimising the social importance of that issue – news is a form of "public knowledge" (Schudson, 1996); journalists "control, in effect, public existence" (Bourdieu, 1998a: 46). The role of higher education in preparing entrants into the profession is well-attested: a UK study carried out on behalf of the Reuters Institute found that "journalism is now fully 'academised'. Of those journalists who began their careers in 2013, 2014, and 2015, 98% have a bachelor's degree and 36% a master's" (Thurman et al., 2016). Similarly, the Poynter Institute in the US found that over half (53%) of journalism educators "believed a journalism degree is very to extremely important to getting a job. Forty-one percent of professionals share that belief" (Poynter, 2013). In the present author's own experience, the provincial press are particularly likely to recruit journalism graduates, since in addition to having a degree, such candidates also have a grounding in newspaper law and in shorthand. This removes the financial burden of having to pay for training in these areas, as no editor would wish to risk running into serious legal issues such as contempt of court or defamation by

[7] "Original reporting and writing are the two industry roles largely left to news organizations" (Poynter, 2016).

employing reporters unversed in media law. It also means reporters with a journalism degree can be set to work immediately on complex stories, without having to wait for their training to be completed (this can take several months). Shorthand, too, remains a key skill, despite the rise of digital recording, as there are occasions when digital recordings are forbidden (such as during court cases) or impracticable (such as when a digital device runs out of power or it disrupts the flow of an interview). Consequently it is the case that journalism students frequently go on to become journalists; this is why the focus of this project is on both current journalism practitioners and journalism students, as the practitioners of the future.

Further, the project confines itself to print journalism rather than broadcast journalism, for two reasons. First, the current researcher specialised in print for over 25 years and hence has extensive knowledge of this aspect of the profession. Second, stories concerning numbers and numerical data tend to be reported in greater depth in print and online than on TV or radio, whose format makes presentation of complex data more challenging. This view is supported by the study by Cushion and Lewis (2018), which found that about one in five news stories published or broadcast by the BBC featured a statistical reference, albeit that "most references … were fairly vague" and that online news (as opposed to TV or radio) "used statistics more often and with more context and clarity" (Cushion and Lewis, 2018: 34). It is not just Bourdieu (1998a) who argues that broadcast media's obsession with speed and the visually stimulating tends to discourage detailed reporting of complex issues - see also, for example, Rosenberg and Feldman, 2008; Chapman and Nuttall, 2011: 282-4. Print as opposed to broadcast new media is where tables and lists, market reports and share prices, election returns and detailed statistics, sit most comfortably.

As a final, timely reminder of the significance of this research project, recent events on the international stage – including Brexit, the Trump presidency, "fake news", and the Scottish referendum – have placed the act of reporting under the spotlight, if not in the dock. Far from being a transparent act of transmission, reporting is increasingly viewed as a site of contestation, where facts are alternative, interests are vested, and phones are hacked. This renewed attention ("re-newed" because distrust of news media is cyclical) does have welcome aspects, since it demands a critical self-appraisal of journalism which in turn foregrounds practices which routinely go unexamined; which is not to deny the destructive force such attention can muster, of course. In the course of such an appraisal, the way in which numbers and statistics are reported becomes an object of examination, too. This leads

to the question with which this research project originated: do journalists value numeracy sufficiently highly? It must be said that already we're faced with terminological imprecision here: "media", "news", "journalism", "reporting" and even "numeracy" each proffers a smorgasbord of meaning which can smother crucial differences and elide distinctions. Differences in style, presentation and approach within sections of the same newspaper (never mind differences between newspapers; between newspapers and news websites, and then between broadcast and print media) make a mockery of treating "the media" as an homogenous entity with a unified purpose. The difference in role between a reporter, columnist, sub-editor and news editor is erased when the single word "journalist" is used to describe them all[8]. This tendency to blur divisions serves to muddle the arguments about news journalism, leading to claims the media are agents of the State, or of the liberal elite, or of right-wing press barons. The truth, as always, is more complex and more interesting. One historian of the early press pithily summarises this distinction by writing: "News is less than journalism, which is all writing for the public prints on matters of current interest … News is primarily matter of fact, data, particulars which tell a story" (Shaaber, 1966). The focus of the current research project, then, is primarily on general news reporters and sub-editors within the context of print newspapers.

Why is this important? It is because the relationship between numeracy and journalism is a key aspect of how society functions (in terms of public policy or political priorities, for example) and how society then reflects on that functioning (such as during elections or in the value it places on institutions). Yet very little research has been carried out into this relationship. To what extent do journalists and journalism students value numeracy and how does their grasp of numeracy develop? What effect does the level of their numeracy have on the news? What, if anything, could improve the situation? Such questions are rarely posed, particularly in the UK. When they are asked, the issue is usually reduced to that of skills – what is diagnosed is a lack of skill, and so what is prescribed is a skill supplement. The current project takes instead a field-based approach, drawing on the philosophical framework developed by Bourdieu, to argue that what is at stake is not just a lack of skills by individual

[8] "Journalistic culture varies across different departments of a paper, across different media, across different news organisations" (Schudson, 1996: 16). Schudson goes on to explain that one reason the phrase "the media" gained ground in the 1970s was because it was consciously favoured by the anti-press Nixon administration – "it sounded unpleasant, manipulative, a much less favorable term than 'the press'." (op. cit., 156).

journalists but a structural tendency to select for innumeracy: journalism generates innumerate journalists. Allowing for the gross over-simplification, the point is that skills training, while important and to be encouraged, is not by itself sufficient to tackle the "numeracy deficit" which this study will argue afflicts the profession, and which is an effect of the journalistic field. We now turn to the way in which journalism is organised as a professional practice, since this partially determines the structure of the journalistic field, which is the theoretical keystone of this thesis.

The business of news

The form and structure of newspaper ownership and business practice partially determine the journalistic field, so the way in which newspapers operate is of immediate relevance to this project. Hence this section will survey the economic structures of news production, and examine the impact of technological developments on the newspaper business environment. It did not need the intervention of Bourdieu to realise that the economic environment within which newspapers operate has significantly deteriorated over the past 50 years. When Roy (later Lord) Thomson was building his publishing empire in the 1940s onwards, he bought up local and provincial newspapers because he could see how to make them highly profitable (it was the business-like Thomson who (in)famously defined editorial content as "the stuff you separate the ads with" (Braddon, 1965: 127), and Braddon later quotes him as describing the broadcaster STV as "a licence to print money" (op. cit., 240)). Thomson's model of creating monopolistic newspapers operating to rigid budgets worked because of the inefficiencies inherent in the small, often family-run, businesses then prevalent in Canada and the UK. This golden age[9] of profitability lost its lustre in the closing decades of the 20th century before the arrival of new, unanticipated rivals destroyed the monopolies upon which businesses such as Thomson's were predicated – Craigslist, Google and Facebook gobbled up advertising spend while digital-only news outlets faced none of the barriers to entry which had long protected newspapers from competition.

The consequences for this on the quality of journalism is the shrinking of resources and of ambition which accompanies retrenchment and cut-backs. While it is true that resources in previous generations could depend on the whim of a capricious owner, the fact that well-run newspaper businesses were guaranteed to be profitable led to regular investment and

[9] "Retrospectively there are some reasons for seeing the 1960s as a golden age" (Tunstall, 1996: 31).

adequately staffed newsrooms, for those businesses which survived the mergers and take-overs. The net result was that journalists had time to work on stories, develop contacts and time to check their copy. The current author's own experience in the mid-1980s corresponds to this situation, first working in the branch office of a weekly newspaper staffed by three reporters, an editor and two staff photographers, plus two administrative staff; and later on a regional morning newspaper with 20-odd journalists and extensive support staff (including copy-takers, proof-readers and two librarians). That much has changed in the intervening years is evidenced by the fact that both titles have since been shut down. As argued elsewhere in this thesis, the increased pressure on margins for all UK news publishers has tended to lead to fewer staff, an increased workload for those who remain, and less time for training despite the need for a wide range of skills (video production, data analytics, social media promotion, podcasting, and mobile journalism, to list but a few). While it is difficult to prove this has led to even less emphasis being placed on numeracy skills, it certainly cannot have helped. Hence time-scarcity has become a barrier to on-the-job training for journalists; the days when reporters were afforded the afternoon off work to learn shorthand, as was the case with the current author, are long gone. This may appear to militate against one of the thrusts of this research project, namely that training should be one element of the efforts to improve numeracy skills. However, this need not be the case if the requisite training is delivered at pre-entry stage, either as part of a degree programme or on a further education course - as already happens with media law, for example.

In terms of technology, the journalism landscape has changed immensely over the past 20 years, with the rise of social media being the latest development in a technological shift which began with the advent of computerised page make-up in the 1980s and which accelerated thanks to the invention of the world wide web a decade later. Technicians and computer specialists strode the floors of Murdoch's Wapping, and subsequently appeared in newsrooms across the country, as so-called "new technology" entered the heart of newspapers' editorial operations. The current researcher recalls the period well, as the introduction of digital page make-up technology coincided with his first weeks of employment at the Liverpool Daily Post and Echo in the mid-1980s, and he went on to oversee the newspapers' tentative presence on the web starting in 1998. However, there remained a divide between the technicians and the journalists – a literal divide in the case of the Liverpool Daily Post and Echo, where technical staff were confined to a glass-walled pod incongruously set down on the news floor like a fish bowl. Although there was proximity

between journalists and technicians, there was no interaction. The situation is analogous to the present day, whereby news organisations have established datahubs within their operations; numerical expertise is isolated from the general reporters in the same way that technical staff were separated from journalists 20 years ago. The point is that the availability of people with numeracy skills inside a news organisation is in itself no guarantee that that know-how will become widely disseminated or even valued, yet this transfer of skills is precisely what training sessions or the introduction of "super users" seeks to achieve. Such an approach is by itself of limited effect. By way of contrast, this research project proposes a field-wide approach to supplement skills-building and professional development.

The internet and social media have made one important contribution to improving journalists' capabilities, and that is the way in which they have eased access to expert knowledge, including access to experts on numeracy and data. Much has been made of social media as a publishing platform, yet one of the main ways in which journalists use Twitter on a daily basis (and this applies to a lesser extent to other social media sites, including LinkedIn, Instagram and Facebook) is for making and maintaining contacts. Similarly, all news organisations have established websites as a means of distributing their content, but journalists primarily use the web to check information and leads, by using fact-checking sites, for instance. This means the ability to tap into all forms of expertise, including experts on statistics and numeracy, has never been easier. However, the existence of expertise in itself is of little use unless journalists know when they need to call on it and what to ask. By definition, a numerate person is aware of the limits of their own numeracy knowledge, whereas someone whose thinking about number is muddled may falsely believe they know the answer to a problem, or fail to spot there is a problem in the first place. These may include stories based on unscientific polls, flawed data or unwarranted assumptions, instances of which are identified in Chapter Four. In addition, Appendix One draws attention to a type of counter-intuitive problem where the unwary can easily come unstuck, making the point that it is only a clear understanding of numeracy that enables one to realise its limits and ask for assistance. Having knowledgeable experts at one's fingertips is beneficial only when one knows when to call on them and why.

To assess the significance of a research question, we could pose the question: why bother? What does it matter whether journalists are numerate or not, and why should we attempt to improve the situation? For a long time, this was a reasonably accurate summary of

journalism's own estimation of itself – a view that is supported by anecdotal evidence, personal accounts, training manuals, biographies and histories of the profession, all of which combine to show that numeracy has been largely ignored. As will be argued later, this disregard of numeracy is an effect of the field and has largely gone unnoticed, which is why it has persisted so long. But by taking steps to address the culture of journalism, through encouraging applicants with a STEM background into the profession, as well as continuing to train and develop existing journalists, it is possible to transform the field and elevate numeracy to a loftier perch within journalism: to increase its value as cultural capital, in fact. This is always possible since what is at stake in any field is precisely the stakes of the field: as Bourdieu reminds us, every field is "the locus of a struggle … to determine which properties are pertinent, effective and liable to function as capital so as to generate the specific profits guaranteed by the field" (Bourdieu, 1998b: 11). As to why it matters whether journalists are numerate – that is what the remainder of this project sets out to explain.

Structure of the thesis

Following this Introduction, the current research project goes on to set out the historical and cultural context of journalism's roots, which is important for two reasons. First, a critique of where we have arrived at must include an explanation of where we started from. Secondly, field theory lays particular emphasis on the origins of any given field. Practices and conventions exert a residual pull – a cultural inertia, as it were - on future developments of the field. Hence Chapter Two examines the early stages of the journalistic field in order that its current configuration can be better understood and efforts to transform it made more effective. Since there is nothing inevitable about the way in which the journalistic field is presently constituted, its transformation is possible. Chapter Two traces the way in which writers who did not conceive themselves as journalists constructed a space in which to communicate ideas and interpretations in a fresh way, sometimes under the aegis of a patron but often working on their own behalf. The chapter goes on to detail the way in which numeracy has historically been incorporated into the training of journalists, specifically those from the UK, although the UK is by no means unique in this regard; studies from the US, Europe and elsewhere tell a similar story (Williams, 1929; Genis, 2001; Terzis, 2009). Despite the occasional and isolated focus on numeracy, journalism training has largely neglected numeracy, and has favoured the subordination of numeracy to literacy, so that familiarity with Shakespeare or the St James Bible has been recommended to the budding

journalist while getting to grips with estimation, margins of error or relative risk has not. Chapter Two concludes with a consideration of some recent key works in the field and identifies a shortfall in the existing literature which the present thesis aims to remedy.

The theoretical approach of Bourdieu, which forms the philosophical heart of this thesis, has already been referred to and is more systematically analysed in Chapter Three. This chapter aims to justify the use of Bourdieu's work as the philosophical framework for the current thesis while subjecting his work to critical analysis. It also discusses developments in field theory in relation to journalism, some of which occurred after Bourdieu's death in 2002, and surveys some of the main objections raised against his thought before subjecting it to a critical reflection based around an original reading of Bourdieu's polemic against the political thought of Martin Heidegger. The significance of this chapter is that for the first time the issue of numeracy in journalism is analysed using a field theoretical approach and this contributes to the originality of this project's findings.

Chapter Four contains an audit of one UK national and one UK regional daily newspaper, discussing examples of numeracy skills in news and business news articles. The audit was based on a sample of approximately 2,700 articles spanning three decades. The errors are categorised and some of the most common error types are analysed. Parallels are drawn with a similar study carried out in the US. The purpose of this chapter is to determine what types of errors occur and their relative frequency. Given the morphological similarities between UK and US journalism, it is expected that errors types and their relative frequency will largely match those of the earlier study.

In Chapter Five, 72 students from journalism and statistical courses took part in a numeracy test to evaluate their relative numeracy capabilities, employing Bourdieu's notions of symbolic capital and especially that of habitus in order to discuss and interpret the results. The work and career of proto-journalist Henry Care is discussed in some detail in this chapter, as it reinforces the point that the current configuration of the journalistic field, in which numeracy is under-valued, is by no means inevitable but is, rather, the work of historical practice. While Bourdieu argued that fields tend to reproduce themselves (Benson and Nevue, 2005: pp4-5), new entrants can effect a transformation of the field; in the case of this thesis, the argument runs that a field can be transformed in such a way that numeracy and quantitative reasoning become more highly prized as professional attributes.

Chapter Six draws on real-world print media examples to present and analyse recent case studies, and discusses the ways in which misunderstanding or misapplication of numbers can affect the quality of news reporting. While some examples are relatively trivial, such as a formula for producing the perfect roast potato, they illustrate the general point that failure to communicate numerical data correctly can damage a news organisation's credibility and, in the case of the more serious stories, can act to confuse or mislead readers. By going back to the original research papers which were the source for some of these news reports, the present author indicates how misinterpretations or errors arose and how deeper engagement with the source material could have resulted in richer journalism. Some of the case studies provide fodder for Appendix One, the *Journalists' Guide to Writing with Numbers*.

The concluding Chapter Seven draws together the various thematic strands raised by this research project, summarises the main points of the project, and expresses ambitions for the future development of the profession. It also discusses other research methods which could have been employed in this thesis but which were rejected. This chapter also puts into practice the theoretical imperative for self-reflection which lies at the heart of Bourdieu's sociology, despite the fact that such self-reflection does not normally feature as part of an academic research project. Finally, this chapter returns to the thesis's starting point and considers how a more numerically-centric approach to journalism could improve the quality of news reporting in an era when statistics, numerical data and quantitative literacy have become ever-more central to the way restrictions about our daily lives are made (for example, in the politicians' mantra to "follow the science"). The acceptance or rejection of these restrictions have had, and continue to have, life-changing consequences for us all.

Two sections of this thesis have previously been published in a modified form. They are parts of Chapter Two, which were published in the journal *Numeracy* 7:2 (Harrison, 2014), and parts of Chapter Five, which were also published in *Numeracy* (Harrison, 2016). An earlier version of part of Chapter Five was presented at a Higher Education Authority-sponsored conference hosted by the University of Sheffield, "Statistics in journalism practice and education: a cross-Atlantic comparison of best practices and approaches" in early 2014. Thanks are due to the organisers of the Sheffield conference, Jairo Lugo-Ocando and An Nguyen. Some of the examples in the *Guide to Working with Numbers* which forms Appendix One have previously been published in a different form on the Journalism.co.uk

website (Harrison, 2009a; Harrison, 2009b) and on the present author's latterly-neglected blog *News Numeracy* (Harrison, n.d.).

CHAPTER TWO: HISTORICAL TRAJECTORY OF NUMERACY IN BRITISH JOURNALISM EDUCATION AND TRAINING

If the history of journalism education has been a footnote to accounts of the profession's development, then the history of numeracy training for journalists must be considered a footnote to a footnote. Despite the universally acknowledged centrality of numbers to a clear understanding of the world, many journalism students and entrants are proudly number-phobic; it is even suggested that an aversion to maths is a reason why some choose journalism as a career[10]. This chapter traces the development of numeracy education within journalism and it does so by first outlining the way numbers have historically been reported in newspapers before turning to the way journalism training addressed, or failed to address, the issue. It is only with the incipient professionalisation of journalism from the mid-19th century that numeracy becomes problematic, partly because of the rise of mass education in the 1870s and partly because of the changing nature of news. Yet drawing on manuals, biographies and personal accounts, it turns out it was as late as the 1940s before any systematic plan to counter the prevailing literary leanings of journalists was proposed, and a further 30 years before this took root in the academy. The picture today is mixed, with professional and accreditation bodies, industry-sponsored initiatives, non-journalism organisations and academic institutions all playing a part. The lack of a coherent approach to numeracy training, or even agreement as to what it should comprise, exposes a critical weakness in journalism's mission to explain.

History of Numbers in Newspapers

The issue of how news reports handle quantitative information is not a new one; 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

[10] Several colleagues have made this point to the current researcher over the past decade.

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, nevertheless 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. So much, then, for how numbers have become familiar and frequent features of every newspaper; we turn now to reflect on the development of the role of the journalist as a distinct profession.

Setting the scene

The reason this section looks backwards to early news-gathering practices is two-fold: first, by examining a period prior to the establishment of modern categories and compartments, it is possible to see how the choices made shaped current practice; and second, the prism of the past throws the present into sharper relief, illuminating what appear at first to be timeless structures. As one prominent media theorist puts it: "Both the practices and literary conventions of journalism are historical precipitates" (Schudson, 1996: 15). Early news-writers in the UK were a mixed lot: scriveners, secretaries, soldiers, clergymen and even the odd tailor and ironmonger were among its first constituents (Andrews, 1859; *Times*, 1912: 13). This should come as no surprise. The manuscript news-writer of the 1620s sent out regular handwritten reports on a near-industrial scale[11], consolidating the cottage industry of mid-Elizabethan times when private letters of intelligence were circulated to a select few powerful figures. By the 1640s, when tensions between King and parliament were boiling over, interest in affairs of State reached fever-pitch and a role had developed for collators of intelligences who delivered up their reports in the form of semi-regular printed public newsbooks, authorised or not. As yet, there was no clearly-defined career path for a journalist, and those who undertook the task did so more as a diversion than a destination; as late as the mid-19th century, the distinguished writer and editor Frederick Greenwood declared he had gone into journalism "as a makeshift" ("like many another aspirant", notes his biographer Robertson Scott) and jokingly labelled his career a "perversion" (Robertson Scott, 1950: 121). The point is well-made by Shaaber that early news writers had a variety of motives:

[11] Jonson's "Factor" (scribe) in *News from the New World* claims to pen up to 1,200 newsletters a week (Jonson, 1620), although a more realistic figure is more likely to be a few score (Frank, 1961: 20).

> It is not surprising that men wrote and published news from many motives, of which the disinterested desire to serve the public interest that prompts the modern journalist is only one. Consequently much news was written by men who were moved by an ulterior purpose – the inculcation of godliness, for example, or the glorification of the English nation. (Shaaber, 1966: 7).

In the 17th century, then, it was not taken for granted that news reporters were necessarily number-adverse. Indeed, as will be detailed in Chapter Five, one such early figure by the name of Henry Care published a self-help manual which included a section on what we would today term basic numeracy. It is later chroniclers who fostered the image of the journalist as fluent in the arts but hesitant with figures; Escott, for instance, anachronistically notes of Defoe that his education, as well as featuring Latin, Greek, French and Italian, had "even [been] grounded in mathematics", as though the fact were an aberration (Escott, 1911: 54). The notion of the number-phobic news reporter, this current study argues, is an historically-determined one which grew up alongside the "literatisation" of journalism in the latter half of the 19th century (the writers around *Pall Mall Gazette* editor Frederick Greenwood in the 1860s championed "the claim of journalism to be considered a branch of literature", Escott, 1911: 251). This was partly a result of journalism's professionalisation: "It was only in the late nineteenth century that professional ambitions progressively captured the imaginations of journalists" (Waisbord, 2013: 22).

As the role of the journalist crystallised, so did the qualities and characteristics expected of a journalist. It became a stereotype - in Walter Lippmann's sense of the word (Lippmann, 1922) - that to be a journalist was to be immersed in the world of literature and the literary imagination. In consequence, numeracy barely figured at all, unless in a negative sense as something to be avoided, downplayed or ignored. Escott goes as far as to remark, approvingly, that Leigh Hunt's *Examiner*, launched in 1808, was a newspaper which "abhorred statistics" (op. cit., 142). Disregard of numeracy became one of the characteristics of the journalistic field to the extent that, as we shall see, journalism students on occasion declared they had elected to study journalism precisely because they wished to wash their hands of maths. There were exceptions, of course; a Parliamentary writer for the London weekly *Leader* in 1853 makes a maths-based pun when he censures Lord Aberdeen's coalition government for acting in a petty-minded way: "When we accept a Coalition Government, we must expect an average liberalism – a 'mean' result, in fact" (Whitty, 1906: 153); where "mean" takes the sense both of an act of ill-will and a species of average (the arithmetic mean).

Turning now to the terminology surrounding this issue, we note that the term "numeracy" has many definitions: the American Quantitative Literacy Design Team listed four different meanings in its 2001 report, before going on to frame its own (Steen, 2001). In the US, "numeracy" is a relatively new entry into the academic lexicon, its acceptance having been hastened by the popularity of John Allen Paulos's antonymous best-seller *Innumeracy* (Paulos, 1989). This thesis understands "numeracy" in the broad sense of the term "quantitative literacy", which has been described as:

> the ability to adequately use elementary mathematical tools to interpret and manipulate quantitative data and ideas that arise in individuals' private, civic and work lives (Gillman, 2006: vii).

That is, "numeracy" and "quantitative literary" are taken to be ontological terms designating a stance towards the world, rather than epistemological terms delimiting a sphere of knowledge or competency. Hence any training which aims to bolster the ability to reason with number is considered in this chapter, not merely training which is explicitly labelled "numeracy" or "mathematical". While numeracy or quantitative literacy are not synonymous with mathematics (Steen, 2001: 37), the two are clearly related. In particular, an aim of numeracy training for journalists should be to address the trepidation surrounding mathematics which can erode the confidence to think critically about numbers. Reinforcing the deep relationship between quantitative literacy and journalism, Ganter (in Gillman, op cit: 13) gives three examples of different levels of quantitative literacy, two of which are drawn from the sphere of journalism: 'citizens reading the newspaper' and 'reporters interpreting data'. Clearly, there is more than a superficial connection between numeracy and journalism. Paulos further drives home the point when he observes that among the roles which newspapers play in society is that of "knowledgeably reflecting the increasing mathematical complexity of our society in its many quantitative, probabilistic and dynamic facets" (Paulos, 1996: 3). Many studies have identified the specifically journalistic shortcomings caused by an inadequate degree of numeracy, including Paulos, 1996; Maier, 2002; and Genis, 2001. In his Final Report for the Royal Statistical Society, Frank Swain, National Coordinator for Science Training for Journalists, pointed out that "an understanding of numbers and statistics are key to many of the common errors in reporting science" (Swain, 2012: 2). So perhaps surprisingly, little attention has been paid to the issue of whether, how and when journalists are trained in numeracy, and its history is often overlooked. It is true that the history of quantitative literary and numeracy is receiving increased attention, particularly in the US (eg,

Steen, 2001; Gillman, 2006; Madison and Steen, 2008), but this takes a broad view and rarely focuses on journalism as a discipline. On the other hand, research into numeracy training for journalists is often equally unforthcoming on the topic's history (eg, Genis, 2001; Ranney et al, 2008), so consideration of the history and development of numeracy in the context of journalism education is long overdue.

The rise of journalism education

Journalism education itself emerged as a discipline in the UK only in the second half of the 20th century, and it was a further 30 years before the history of this training attracted serious academic interest. But even today, little or no attention has been paid to the specific area of the history of numeracy training for journalists, despite the opt-repeated acknowledgment that numbers are the language of public discourse and the recent incursion of numeracy into traditionally unrelated domains, such as that of politics (e.g., Meyerson, 2002) – a worldview opened up by Morris Kline's examination of the role of mathematics plays in wider cultural development (Kline, 1982).

As mentioned above, "journalists" - as opposed to printers, booksellers or essayists - began to appear towards the end of the 18th century, although it was the middle of the 19th before the profession existed in a form which we would recognise today[12]. Technical works on shorthand and some autobiographical accounts aside, it was only from around 1869 with the publication of T. A. Reed's *The Reporter's Guide* that any attention seems to have been paid to training, and a further 60 years before this was formalised with the establishment of the National Council for the Training of Journalists (NCTJ). In the profession's infancy (roughly from the 1640s to the early 19th century), the only schooling was that delivered through experience. That specialist breed, the parliamentary reporter, generally learnt shorthand, although even here there were exceptions - Dr Johnson famously invented the MPs' speeches he wrote up for *Gentleman's Magazine*, much to their improvement (Griffiths, 2006: 39), and manuals devoted to the art of stenography (shorthand) had been published since 1602. But prior to the mid-19th century, there was no sense of a shared need to train new entrants, since there was no sense of journalism as a profession. Experience was all the training required ("...

[12] Martin Conboy (2011: 1) identifies 1833 as the year the word 'journalism' entered the language, although 'journalist' had already appeared in *Spectator* 322 in 1711/12 (Addison & Steele, 1837: 5:6). Mansfield (1944: 1) cites 'jurnalists' as being used in 1693 but gives no source.

in the 17th C., experience was the best school of journalism" (Frank, 1961: 187)), with it being taken for granted that any gentleman with a liberal education was admirably qualified to be a journalist. Indeed, lack of education was no bar from the outset. Samuel Pecke, who first began circulating manuscripts of parliamentary news in 1628, was

> an interesting model for the early journalist not least because he was relatively uneducated. There are few classical references in his work … he was an artisan as much as a writer and aspired to neither literary fame or political influence. He was simply doing his job (Raymond, 1999: 24).

Raymond also makes the point that John Dillingham, editor of *The Parliament Scout*, was the object of ridicule because of his lowly social status and lack of formal education, originally being a tailor (op cit: 29), and Raymond further makes the point that "many editors [of early newsbooks] were not learned men" (op cit: 129). Hence the development of any form of training for journalists is inexorably linked to the establishment of journalism as a profession, with its own codes, standards and practices. This was a gradual process and, indeed, some argue journalism neither has nor should be considered a profession ("newspaper reporting is a craft or trade, like undertaking, which it sometimes resembles" (Alsop, 1958: 4)), while F. J. Mansfield in 1944 pointedly dedicated his *The Complete Journalist* to his 'fellow craftsmen' – although we ought to be wary of assuming that 'craft' and 'profession' are always mutually exclusive. Even as late as 1869, the *Spectator*'s review of Reed's *Guide* hesitantly refers to "the profession of 'reporting'", the use of quotation marks suggesting a reluctance to apply the term unreservedly (*Spectator*, 1869). There is no doubt, however, that as the 19th century progressed, so did the general social level of journalists: Smith points out that as early as 1810, no fewer than 18 of the 23 journalists working in Parliament had university degrees (Smith, 1979: 100), and Westmancoat adds that by the end of the century "the Grub Street hack of the 1750s was socially acceptable" (Westmancoat, 1985: 27).

From the 1860s onwards, a number of factors combined to enable newspapers (then the dominant form of journalism) to reach mass markets, and hence to expand considerably the need for trained journalists. Among these factors were the abolition of stamp duty (the 'tax on

knowledge') in 1855; the rise of an educated mass audience eager to read; and advances in printing technology and distribution[13].

> Till after the middle of the last [19th] century … staffs were very small … [After] the repeal of the 'taxes on knowledge' in the 'fifties and 'sixties there was no reserve of experienced editors and reporters on which these could draw (Kemsley, 1950: 226).

The growing interest in journalism as a profession is evident from the comment in the *Spectator*'s review of Reed's *Guide* in 1869 that "the number of those who do want such an account is not inconsiderable" (*Spectator*, 1869). Frederick Higginbottom, a journalist whose account *The Vivid Life* details a career which began in 1875, observed that the ideal foundation for an aspiring reporter was "a liberal secondary education, which should include a knowledge of Latin and at least one modern language, and an acquaintance with physical science and English classics", along with "a knowledge of the practical details of newspaper production" (Higginbottom, 1934)[14]. Here, Higginbottom is echoing Reed's advice that "properly to fulfil the duties of a reporter requires good natural abilities, and, to say the least, a tolerably good education" - which includes knowledge of Latin and Greek - as well as "the names at least of the principal authors in the various departments of science and literature" (Reed, 1869). W. L. Courtney's journalistic career began on the *Daily Telegraph* in 1889; a career for which he was "marked out by education and inclination", wrote his wife in her biographical account (Green, 1930). That education was reading Classics at Oxford.

So by the late Victorian period, it was taken for granted that the foundation for a career in journalism was a liberal, arts-based education, alongside a passing acquaintance with science (or at least the names of key scientific writers). This is not to say that newspapers prior to the 20th century shied away from using numbers when reporting. The first edition of the *Manchester Guardian* in May 1821 published a table of school sizes in the Manchester area which had been 'leaked' by a credible source to show that official estimates of the number of children receiving free education were in error over the true figure by a factor of three (*Manchester Guardian*, 1821). However, there appears to be no journalistic intervention in either the compilation or interpretation of this data – it was submitted by an external source

[13] The *Times* was first produced by steam press on November 29 1814, printing around 1,100 impressions per hour.

[14] Not everyone was an admirer of the book – the journalist Collin Brooks declared it to be "the second-dullest book of our time" (Brooks, 1950: 38). Brooks did not reveal which tome eclipsed it.

and printed without comment. In spite of sporadic attempts to inject elements of professionalism into journalism ("As far back as 1890 the Royal Charter of the Institute of Journalists spoke of examinations or tests in theory and practice to establish journalistic proficiency." (Hamilton, 1989: 69)), in the first decades of the 20th century, the situation for would-be journalists had not significantly changed since Higginbottom's time. Arthur Christiansen, pioneering editor of the *Daily Express* in its post-war pomp, boasted rather than bemoaned the fact that, upon leaving school in 1920, "of maths I knew nothing and cared less" (Christiansen, 1961: 11) while *Daily Mirror* editorial director Hugh Cudlipp noted that: "Anything I did not learn as a reporter in Blackpool ... I learned by ear on the *Sunday Pictorial*" (Cudlipp, 1962). Peter Cole records how his career began on a London evening newspaper with no training, and he had to rely on his editor for pointers and encouragement: "By example and helpful reference to my own writing and reporting mistakes, he developed my journalism … Newspaper law … I had to acquire for myself" (Franklin and Murphy, 1998: 67). *Sunday Times* journalist Leonard Ross, in his contribution to *Modern Journalism*, advised: "A good education, with the command of a couple of modern languages, makes an excellent foundation on which the beginner can build stone by stone, as he enlarges his experience not only of literature but of the world around him" (Carr and Stevens, 1946: 216).

Rise of the training scheme

The first real steps in the gradual professionalisation of journalism came with the establishment of the UK's first academic qualification, the Diploma in Journalism offered by the University of London between 1919 and the outbreak of World War II. The curriculum was focused on journalism practice, with optional courses in politics, criticism, literature, history or modern languages – again, biased towards the liberal arts. One course was entitled 'General history and development of science', but was not compulsory (Carr and Stevens, 1946: 10). Lecture courses were also given by London Polytechnic and the Institute of Journalists, but overall the authors of *Modern Journalism* concluded: "So far journalism in this country has not become a subject of highly academic interest" (op cit: 12). The perspective of F. J. Mansfield – author of *The Complete Journalist*, first published in 1935 - is doubly valuable, since he was not only a *Times* journalist for 20 years and former president of the NUJ, but he also lectured in 'Practical Journalism' at the University of London from 1925-34. He stresses literacy rather than numeracy as journalism's defining characteristic: "Though journalism is not in itself literature in the complete sense, it has claimed the service

of most distinguished literary men" (Mansfield, 1944: 12). As Frost observes: "The immediate post-war period … lacked almost any kind of formal training or education for journalists in the UK" (Frost, 2011: 6), a point reinforced by Briggs' and Burke's survey of the period: "Between 1919 and 1939 the only University Diploma for Journalism in Britain was offered at London University" (Briggs and Burke, 2005: 165). The void was filled by an editorial training scheme launched in 1949 by Kemsley Newspapers, at the time the largest newspaper group in the country (Camrose, 1947: 65) and which included the *Sunday Times*, *Daily Graphic* and *Daily Record* among its portfolio of eight morning, nine evening and six Sunday titles, along with regional weeklies. Owner Viscount Kemsley's right-hand man at the time was Denis Hamilton, later editor-in-chief of the *Sunday Times*, who explained that political rather than professional motives lay behind the scheme's inception. Hamilton was aware that the Royal Commission on the Press, set up in 1947, could be damaging to the group's interests. The Labour government, and particularly home secretary Herbert Morrison, were hostile to the right-wing press barons – Kemsley and Beaverbrook heading the list - and one of the aims of the Royal Commission was to investigate political bias in the press. Kemsley himself observed that: "The decision in 1946 to set up a Royal Commission on the Press seemed to be inspired by political animus against newspapers" (Kemsley, 1950: vi). Determined to bolster his employer's reputation, Hamilton hit upon the idea of launching the Kemsley Editorial Training Plan, which by 1950 had the desired effect of transforming Kemsley into "the standard-bearer of his profession" (Hamilton, 1989: 67), alongside the more far-reaching consequence of giving "a new professional status to the industry" (op cit: 70). The significance of the Kemsley initiative lies in the fact that it was a deliberate attempt to pre-empt the recommendations of the Royal Commission, which asserted that journalists ought to be better educated than the public they served. Yet there is virtually nothing in the 424-page Kemsley tome concerning numeracy or quantitative literacy, apart from a passing reference to economics in a short (three-page) chapter on the role of the City editor. When it comes to recommended reading for trainee journalists, it is to the Bible, Shakespeare and Macaulay that the manual directs the aspiring reporter (Kemsley, 1950: 398). But the author of that section (the journalist and historian Robert Ensor) does end with two 'special pleas' – one being for the history of science. "The journalist cannot be expected to know the sciences," he breezily asserts, "but he badly needs to know something of the history of scientific development" (op cit.: 402). His second 'special plea' was for poetry.

However, a breakthrough of sorts had occurred the year before the Royal Commission was established, in 1946. At a special delegate meeting, the National Union of Journalists (NUJ) had put forward their own training scheme, the academic components of which included English, geography and modern history (Kenyon, 1948: 75). But significantly, this three-year curriculum also included "finance and statistics for journalists" – this topic is then singled out for extended treatment, since "**the profession attracts men and women with a literary bias** and many of them meet difficulties (which they do not always overcome) in handling figures" (emphasis added because this illustrates Bourdieu's concept of the interaction between habitus and the field). The eight sub-headings into which the topic is broken down include elementary mathematics, finance, and social and economic statistics. It is explicitly observed that this part of the curriculum is not intended solely for those who intend to specialise in financial or business reporting, but aimed at the general reporter, since the modern world "cannot be reported by journalists who do not understand figures" (op cit: 76). The point is reinforced in his introduction by Ernest Jay, then NUJ president, who in listing the qualities of the ideal 'journalist of the future' pronounced: "Statistics, which to most people appear to be dry, meaningless tables of figures, must be to him alive with interest and possibility. He must be able to take them and translate them into vivid, factual commentaries on Life." (op cit: 8).

This appears to be the earliest explicit reference by a leading figure within the profession to the difficulties those with a literary bent had in dealing with facts and figures, although even then it was clearly not a new problem. One possible reason for this shift in focus was the experience of World War II, which had demonstrated the value of planning and training:

> During the War ... thousands of conscripted leaders had to be trained and troops prepared to meet the most efficient soldiers in the West, the Germans. It was achieved by a brilliant system of training potential leaders ... if the army succeeded, why shouldn't journalism, too? (Hamilton, 1989: 67)

Contrast this with the attitude prevalent prior to the war, when guide books such as 1931's *Modern Journalism*[15] sniffily observed: "It remains true, whatever the schools of journalism may claim, that there is no training like the school of practical journalism which exists in every properly-organized newspaper" (Carr & Stevens, 1946: 22). But while the NUJ's 1946 scheme appears to be the earliest acknowledgment of the significance of understanding the

[15] The book was reprinted exclusively for the use of H. M. Forces in 1946, when journalism was a career option for the soon-to-be demobbed.

world through figures, it was not built upon. The manual which Denis Hamilton produced in 1950 to accompany the Kemsley scheme reverts to the 19th century model; again, the pre-eminent qualification for the aspiring journalist is a liberal arts education: "Nor can he [the would-be reporter] have much success without a minimum standard of qualifications: accurate English, a liking for literature and history, a lively interest in passing events … he is also fortunate if he has done much essay writing" (Kemsley, 1950: 228). Numeracy, numerical reasoning or the ability to understand and interpret figures is only mentioned once, in a dismissive account of the 'statistical sub-editor', whose role "may be despised as uncreative" since it "calls, perhaps, for no great imagination" (op cit: 77). Similarly, the curriculum for the diploma course offered at Cardiff Technical College is described (op cit: 396-7). Despite English literature featuring in three courses (Drama and Novel, Poetry, and Shakespeare) and English composition once, mathematical or statistical training is notable by its absence. The syllabus of the three-year basic training course proposed by the NCTJ's precursor, the National Advisory Council for the Training and Education of Junior Journalists[16], was handily summarised in a 1951 'Teach Yourself' textbook aimed at aspiring journalists (Candlin, 1955: 35-40). The emphasis is again on English, which appears across all three years of the curriculum – optional subjects are limited to "a modern language or an approved subject in social studies … The term social studies is taken to include history, geography, economics, etc". It is acknowledged that those with "a scientific bent" may choose to specialise in science reporting, but the topic receives no more attention than reporting on the countryside (and less than that devoted to sports reporting or book reviewing) – and no specific training is recommended.

In 1963, the NCTJ in association with the NUJ produced a training guide of its own in the shape of *The Practice of Journalism*. The chapter dedicated to reporting was written by veteran correspondent Maurice Fagence, once a rising star on Northcliffe's fledgling *Daily Mail*. Doubtless to the satisfaction of the training body publishing his work, Fagence cautioned: "Do not accept the nonsense that good journalists are born and not made. The best of them may have been born with a predisposition to journalism, but that is all" (Fagence, 1963). He makes the point that pressure to introduce formal training came from below, as well

[16] The NCTJ was originally set up under the name of the National Advisory Council for the Training and Education of Junior Journalists in November 1951, and changed its name to the National Council for the Training of Journalists in 1955. Hamilton (op cit: 69) gives the date as 1952 but this is presumably a mis-recollection.

as above: “It was they [the older generation of journalists] who fought for a higher educational standard among entrants and a proper training scheme for the junior” (Fagence, op cit: 43). But again, what is stressed as the core competency is facility with English composition. Indeed, there is a subsequent chapter on ‘Good English’; but there is no mention of numbers or numeracy.

The landmark publication came, not from the UK, but from across the Atlantic in 1973 when Philip Meyer published his *Precision Journalism* - now into its fourth edition (Meyer, 2002) - and popularised the concept of what was known as the time as computer-assisted reporting (CAR)[17]. The advent of cheap computing power and the free availability of enormous government data-sets meant reporters were able to source stories by analysing and interpreting databases. Indeed, Meyer asserted that: “A journalist has to be a database manager, a data processor, and a data analyst” (Meyer, 2002: 1). The significance of Meyer’s work was not so much that UK universities rushed to set up courses in data-driven journalism (by and large, they did not) but that numeracy rose higher on the agenda of journalism educators. The focus on numeracy training is evidenced by the fact that today a journalism textbook aimed at the general reporter devotes a substantial chapter to working with numbers (Grundy et al, 2012: Chapter 4: “Facts and Figures: The Story has to Add Up”, pp95-111), which contains the admonition: “If you thought getting into journalism was a good career choice because you hated doing maths at school, think again” (op. cit.: 96).

Until the late 1980s, it remained true that most UK journalists were trained by their employers (typically the regional press) as part of the proprietors’ obligations under the national agreement between the Newspaper Society and the NUJ (Gopsill and Neale, cited in Frost, 2011). As Mansfield explained: “The vast majority of journalists begin their training on the weeklies” (Mansfield, 1944: 25). However, the ending of the national agreement in 1987 meant cost-conscious employers closed their training schemes, with the result that only “a small number of training courses are now run by newspaper groups, mixing basic journalism training with company induction” (Frost, 2011: 11). The current picture remains mixed; while educators are far more conscious of numeracy as a core journalistic skill and some research is

[17] Meyer notes that in an age when computers were exciting and esoteric, newspapers loved to refer to ‘computer-assisted reporting’; but now that we live in a “world where almost everything is computer assisted, that no longer means a lot” (op cit: 79) – although he does go on to point out that the phrase was in use as late as 2001.

being carried out (e.g. Genis, 2001), delivery via the undergraduate curriculum tends to rely on occasional lectures, workshops or master classes rather than being consistently woven into the degree programme. For instance, UCAS listed 82 providers offering 443 undergraduate courses in journalism for 2014. While many undergraduate journalism programmes include elements of numeracy training, it appears that only one institution, the University of Hertfordshire, offered a joint programme in mathematics and journalism (it has subsequently been withdrawn).

The three main accreditation bodies for journalism are the NCTJ, the Broadcast Journalism Training Council (BJTC) and the Periodicals Training Council (PTC). The NCTJ's qualification specification for its Diploma in Journalism lists 22 learning outcomes for its News Reporting unit, but there are no references to numeracy or numerical skills (NCTJ, 2013). Numeracy does feature as one of the 18 key tasks the NCTJ requires for its Reporter's Logbook (part of the body's National Certificate examination): "Submissions should demonstrate basic numeracy - the ability to handle figures, understand tables or interpret statistics, for example" (NCTJ, 2011) - even here, however, evidence of numeracy is only one of nine marking criteria for this task. Most recently, in 2019, the NCTJ has proposed adding a Data Journalism module to the suite of elective programmes of study which comprise the National Qualification in Journalism. Details of the module had not been published at the time of writing, but because it is an elective rather than a core module, it appears to be aimed at those intending to specialise in data journalism – perhaps those seeking a career within the data hubs which have sprung up across the industry – rather than at the general news reporter based within the newsroom.

The Broadcast Journalism Training Council (BJTC) lists within its accreditation schema 13 "essential elements" of journalism skills and although these include accuracy and clarity, there is again no specific mention of numeracy (BJTC, 2013). The PTC's magazine MagScene is aimed at budding magazine journalists ("This guide hopes to give you a taste of the variety of job opportunities available to you within consumer and business media"). Among the advice is a reply to the question, what skills other than writing are required to be a good journalist?

> You need to be enthusiastic, determined, have great ideas and you need to be able to get things done. Incredibly talented writers simply don't make it if they can't meet their deadlines. In an age of multi-media journalism you also need to be skilled across

> a range of platforms, as well as be the face of your magazine at various events and networking functions. All round communicators are in strong demand (MagScene, 2013: 30).

Sound as this advice is, numeracy does not rate a mention. The Society of Editors, which as its name suggests represents senior editorial executives within the press and broadcast sector, give advice for aspiring journalists on its website. It lists, not surprisingly, public administration, shorthand and ethics are core requirements, followed by "news sense, general knowledge, interviewing ability and news writing" (SoE, 2013) - but not numeracy.

Creative Skillset, the licensed Sector Skills Council for journalism, aims to support the industry's productivity by, among other things, "developing skills, training and education policy". It published an extensive 66-page suite of industry standards for journalism, designed to "provide a clear, up to date description of what an individual needs to be able do in order to perform a job successfully" (Skillset, 2010). The Skillset standards identify three core capabilities which all employers demand, regardless of changes in technology or working practice. These are "the ability to write with clarity, accuracy and flair; curiosity and a broad general knowledge; the skills to communicate effectively with a wide range of different people" (Skillset, 2010: 5). The only reference to handling quantitative information comes in a section on measuring the effectiveness of editorial content (op cit: 52).

The key role of universities in training journalists was made clear in evidence submitted to the Leveson Inquiry. The Association for Journalism Education (AJE), which represents approximately 60 higher education institutions in the UK and Ireland, pointed out that the industry has largely withdrawn from the provision of training, leaving it primarily to higher education institutions. A major factor behind this withdrawal is undoubtedly cost. Sue Ryan of the *Daily Mail* explained to Leveson: "The trainee scheme costs the *Mail* well over half a million pounds a year. I know of no other newspaper group that spends anything like this sum training its journalists" (Ryan, 2012: 5). This suggests that provision of numeracy training for journalism students - at undergraduate level, at least – is ad hoc and patchy. As a report produced for the Royal Statistical Society put it: "There is little statistics or science content in most general journalism courses, although most journalism trainees do not have a numerical or scientific background" (Swain, 2012: 42) - and while statistics or science content is not synonymous with numeracy, there is a considerable degree of overlap, particularly as the RSS

report identified a key area of concern as that of reporters “feeling comfortable with numbers” (Swain, op. cit.).

Beyond the Academy

Training (and education - to which it is inescapably if not unproblematic ally linked), like numeracy, is neither ideologically pure nor institutionally neutral. Just as numbers are embedded in political, philosophical and bureaucratic systems (Alonso and Starr, 1987), so too is academic instruction - lecturers teach what they have been taught to teach. So while the debate concerning quantitative literacy has moved centre stage in the US - with a raft of initiatives aimed at plugging the ‘QL gap’ among liberal arts students (Gillman, 2006) - discussion in the UK is less well-developed. A more recent intervention was the task force chaired by Carol Vorderman, commissioned by the Conservative party while in opposition, promoting a ‘world-class mathematics education for all our young people’ (Vorderman et al, 2011). Although the task force’s focus was mathematics as opposed to numeracy, the recommendation that maths teaching should be spread across the curriculum rather than being confined to one lesson is echoed in US proposals to embed quantitative literacy throughout college teaching. This approach has clear pedagogical implications for the future of numeracy training for journalists, as discussed in the Conclusion to this current research project.

Not all numeracy training initiatives have originated from within academia or the journalism profession. A training programme was launched by the Royal Statistical Society (RSS) with the aim of “helping trainee and practising journalists to develop a better grasp of the basic principles and methods of statistics” (RSS Stats Life, n.d.). This followed the publication of the report of the expert group Science and the Media (2010), under the auspices of the Department for Business, Innovation and Skills (BIS), and subsequently updated (Science and the Media, 2012). The specific goal of the RSS project was to improve science reporting, but it was acknowledged that in order to achieve this, the objective should be on fostering “greater scientific literacy in the whole journalistic community” (Science and the Media, 2010). As the Final Report on the project noted:

> This project has focused on basic training for non-specialist reporters and journalism students, and has identified that an understanding of numbers and statistics are key to many of the common errors in reporting science (as well as other subjects). (Swain, 2012).

Hence the ground covered by the RSS project meets the definition of numeracy detailed at the start of this chapter. Other outcomes identified by the BIS expert group have included the development of resources on the BBC College of Journalism website, and similar websites created by the Online Media Group for Science (now defunct) and the Royal Statistical Society's mini website "Stats Life" (RSS, n.d.). Valuable though they may be, online resources by themselves do not constitute training, and the issue remains of who delivers this training and within what context(s): "In general, it has been difficult to identify places where journalists go for on-the-job training and where science/stats training could be institutionalised" (Swain, op. cit.).

While this primary focus of this research project is the training of the general news journalist, it should not be forgotten that specialist reporters dealing with business, commodities and shipping have been in existence since at least the 18th century (*Lloyd's List*, for example, has been published since at least 1734 and had predecessors). The *Financial News* was established in 1884, later to merge with its younger rival the *Financial Times*, and specialised in reporting of the financial, commodity and exchange markets. This meant reporters had to be specialised, too: "Business reporting involves many beats, and journalists who cover business tend to be specialists" (Thompson, 2001: xi). By the final quarter of the nineteenth century, business and financial journalism was flourishing not just in specialist titles but across a range of non-specialist newspapers as merchants, manufacturers and political elites sought information that could have an impact on their wealth or prestige (Score, 2020: 486-6). But even here, the lack of quantitative competency can still be felt. "Since many of us who studied journalism or selected it as a profession did so to avoid mathematics, a 'math phobia' permeates the field" (op cit: xii). Although one might anticipate that financial and city reporters would have a firm grounding in dealing with figures, this has not always been so. A case in point is the career of Collin Brooks, one-time confidante of the first Lord Rothermere. His role as an influential city journalist, beginning on the *Financial News* in 1928, was not hampered by his having had a "limited formal education" – indeed, it was his "interest in literature that enhanced his journalist career" (Crowson, 1998: 10). On this point, the Kemsley manual concurs. While a degree in economics was to be welcomed in a City editor, "there is, indeed, much to be said for a more liberal education" (Kemsley, 1950: 272).

Even a modern-day advocate of journalism as an intellectual discipline (as opposed to a form of vocational training) insists on the primacy of the literary over the numerical; summarising

the primary value of a degree in journalism, de Burgh observes that "the overall objective is that which Hough gives for what he calls 'a literary education'" (de Burgh, 2003: 97). De Burgh adds weight to the present project's contention that the journalistic field (journalism culture) needs to be addressed when considering the issue of numeracy in his remark that "the good [journalism] courses select (or are selected by) applicants who already have the appropriate orientation" (op. cit., 109) – in Bourdeusian terms, journalism course are populated by those students whose habitus is already attuned to the journalistic field, and that includes a propensity to undervalue numeracy.

The current state of numeracy within journalism has been admirably surveyed in a collection edited by Nguyen (2018) in which he puts forward the view – with which this research project concurs - that "beginning journalism students have no less ability to deal with numbers than those in other disciplines – including those in the natural sciences" (Nguyen, 2018: 6); although a few sentences earlier, Nguyen had quoted Aron Pilhofer, at the time the *Guardian*'s executive director for digital, as saying: "Journalism is one of the few professions that not only tolerates general innumeracy but celebrates it" (op. cit., 5). (On a side note, it is worth noting that the thesis presented in this research project squares the apparent contradiction between these two statements – the innumeracy observed by Pilhofer is a consequence of field effects and is largely independent of the individual qualities of entrants into the field, who may well be **capable** of quantitative thinking but who do not **culturally value** it). Nguyen proposes that "all that is needed is the right statistical training approaches": namely, having confidence in the ability of journalism students to handle statistical data, and ensuring they have the knowledge and skills to analyse and communicate those data (ibid). What Nguyen does not address is the question as to why journalism is still generally perceived as a profession lacking in numeracy skills despite over 100 years of journalism training and education, at least some of which has delivered precisely the "right statistical training approaches" (as attested to by Paulos in the introduction to this research project, above). While the present research project concurs that Nguyen's approach is a necessary one, it does not agree that it is a sufficient one: training certainly is needed, but it is not "all" that is needed. The reason, as outlined above and set out in more detail below, is the tendency of the journalistic field to reproduce itself; that is, for the field to shape as well as being shaped by the habitus of the actors who operate within it, and therefore any effective remedy for number-deficiency must include a field-wide transformation. Interestingly, the same study which concludes that statistical training is all that is required also approvingly evokes the

figure of Walter Lippmann to assert, as paraphrased by Stuart Allan, something which sounds remarkably like a call for transformative action and which therefore echoes the thrust of the current research project:

> More than a question of journalism training being compelled to improve the teaching and learning of numeracy skills, as welcome as this would be, he [Lippmann] believed it would necessarily entail a critical reorientation of journalism's routine, everyday engagements in the mediation of statistical data (Allan, 2018).

Despite its universally acknowledged importance, there has been no sustained, consistent approach to the provision of numeracy training for UK journalists or journalism students. While some important work has been done on how a quantitative approach can best be engendered among a group who traditionally shy away from thinking with figures (eg, Gillman, 2006; Ranney et al, 2008), the institutional and organisational aspects remain ill-defined. This is not helped by a lack of emphasis from training and skills bodies on quantitative literary as a way of interpreting the world. Since journalism educators are themselves generally drawn from the ranks of the profession, the inadequacies which flow from quantitative illiteracy will continue to be perpetuated as the field reproduces itself.

CHAPTER THREE: CONCEPTUALISING THE FIELD: THEORETICAL PERSPECTIVES ON NUMERACY IN JOURNALISM

The historical review in the preceding chapter has shown that, while uncommon, discussion of journalism and numeracy is not unheard of; indeed, the major collection of essays *News, Numbers and Public Opinion in a Data-driven World* was published less than 18 months ago (Nguyen, ed., 2018). What the present study aims to do, however, is to propose a theoretical basis for such discussions by drawing in an entirely original way on Bourdieu's field theory, itself arising from the concepts of habitus, symbolic capital and symbolic violence which have been fundamental to Bourdieu's thought since the early 1960s. The theoretical framework analysed and critiqued in this chapter informs the way in which this research project understands the relationship between "practice", "agent" and "profession" and hence fundamentally shapes the terms of this project's discourse.

Evolution of theoretical model

This project has undergone a gestation of elephantine proportions, which accounts for a shift in its theoretical perspective. It started by considering the "two cultures" of C. P. Snow, and this formed the original point of departure for the subsequent theoretical elaborations of this thesis. Snow noted, in his "two cultures" *New Statesman* article (Snow, 1956) and as later developed in lectures and books, that increased specialisation within the arts and sciences had by the inter-war period led to mutual incomprehension between artists and scientists; while mixing at Cambridge with scientists in the day and writers and literary colleagues at night, he felt:

> I was moving among two groups—comparable in intelligence, identical in race, not grossly different in social origin, earning about the same incomes, who had almost ceased to communicate at all, who in intellectual, moral and psychological climate had so little in common that instead of going from Burlington House or South Kensington to Chelsea, one might have crossed an ocean (Snow, 1959: 1).

This captured something salient about the breach between arts (journalism) and science (statistics) students exposed by the numeracy test described later in Chapter Five of this project. It was, claimed Snow, as if "the intellectual life of the whole of western society is increasingly being split into two polar groups" (op. cit., p2). He would later modify this

characterisation to suggest this separation involved a degree of animosity: “Between these two groups – the scientists and the literary intellectuals – there is little communication and, instead of fellow-feeling, something like hostility” (Snow, 1963: 61). Further, Snow specifically linked culture to habit and to learning, two of the themes which will subsequently become prominent in this research project. One meaning of the term “culture”, Snow explained, was “to denote a group of persons living in the same environment, linked by common habits, common assumptions, a common way of life” (op. cit., 64), and gives as a “non-controversial” example the belief among academics that research is the primary function of a university: “This attitude is automatic; it is part of their culture” (ibid). The fact that other writers were independently formulating the same thought suggests that Snow was tapping into a widely-held set of attitudes – in 1957, for example, the American political scientist Merle Kling published an article which also lamented the chasm between the literary (in his words, “the intellectual”) and scientific worlds; the intellectuals’ world vision was, wrote Kling, “blocked by a massive wall of technology, science, mathematics and expertness which he is unable to penetrate” (Kling, 1957: 15). The extent to which Snow’s framing of the issue permeated the popular consciousness is demonstrated by the casual way it was referenced in newspapers. For example, the editor’s welcome message in the launch edition of the *Sunday Telegraph* of February 1961 pointed out the new paper’s aim was to bridge the gulf between the quality and popular press, rather than to tackle what the editor dubbed Snow’s “notorious division between the scientists and the rest of us” (cited in Smith, 1974: 45). Note in passing, the way in which scientists have become separated from those of a literary inclination; no longer are there two tribes, of equal but distinct stature: Now there is only “them” and “the rest of us”.

This idea that a transformation of culture was required in order to address journalism’s shortcomings was reinforced by the findings of two veteran journalists with ample experience of how well the media handles stories involving numbers and statistics. Michael Blastland and Andrew Dilnot were for many years responsible for BBC Radio 4’s programme *More or Less*, whose mission is to “explain - and sometimes debunk - the numbers and statistics used in political debate, the news and everyday life” (*More or Less*, n.d.). They reviewed news articles across a range of topics, from crime and politics to health and immigration, and found the public were often let down by the quality of the journalism involved. In stark terms, they declared:

> A culture that respected data, that … valued statistics as a route to understanding, and took pains to find out what was said by the numbers we have already got, … a culture like this would, in our view, be the most valuable improvement to the conduct of government and setting of policy Britain could achieve (Blastland and Dilnot, 2008: 163).

Useful as Snow's observations proved as a mean of orientating this project, they lacked any philosophical cohesion, and his conclusion that the two cultures needed to come together for the moral health of the country was a pious ambition but one which hardly constituted a research programme. Hence this researcher's attention turned to Bourdieu's theory of habitus, symbolic - and particularly cultural – capital, and finally to the generalised notion of 'field'. The fruitful application of field theory to other areas of journalism, in the work of researchers such as Marlière (1998), Lingard and Rawolle (2004), Benson (2006), Marchetti (2009), Vos et al. (2012), and the various contributors to Benson and Neveu (2005), attests to field theory's appropriateness to the current study.

Bourdieu: Symbolic Capital, Habitus and the Field

The notions of "cultural/symbolic capital" and "habitus" were incorporated by Bourdieu into his theory of the field, which has been fruitfully applied to journalism by Bourdieu himself and subsequent researchers (for examples, see Benson and Neveu, 2005). This section will give an overview of some of his key philosophical ideas as they relate to journalism in general and specifically to this research project, and address common criticisms of his thought.

The term "habitus" derives from the ancient Greek thinkers via Scholasticism, although Bourdieu is at pains to point out his radical departure from earlier usage (it was "a concept which I completely rethought"), and is characterised as "a system of acquired dispositions" which have generative capacities (Bourdieu, 1990a: 10, 13). It can be understood "as a way of escaping from the choice between a structuralism without subject and the philosophy of the subject" (ibid., 10) in that it functions analogously to muscle memory in a sportsperson, making a way of being that is "necessitated without […] being necessary" (ibid., 15). Elsewhere, Bourdieu describes habitus as a "socialised subjectivity" (Bourdieu and Wacquant, 1992: 126), marking his difference from the notion of "bounded rationality" associated with Herbert Simon and his followers. Often, habitus is described as "having a feel for the game", that seemingly natural ease with which sportspeople take up precisely the optimum position in the field of play without having to think about it first. It allows Bourdieu

to account for the effects of agency without invoking a metaphysical subject (elsewhere Bourdieu is at pains to point out his research conceptualises "socialised agents", not "rational subjects" (Bourdieu, 1998b: 150)), and the link between habitus and capital is made explicit when Bourdieu describes habitus as "incorporated capital" (Bourdieu, 1998b: 53). It is important to note, however, the Bourdieu cautions against viewing habitus as either mechanically deterministic ("Habitus is not destiny": Bourdieu, 2000: 180) or as synonymous with the unconscious (op. cit., 220).

"Capital" in Bourdieu's philosophy generalises the economic meaning of the term to refer to a quality or substance which has value in relation to a specific field, although he is clear this is no way commits him to a naïve Marxist economic determinism. As one of his editors puts it: "Bourdieu's use of economic terminology does not imply any sort of economism or economic reductionism. In fact, he sees the economic field per se as simply one field among others" (Johnson, 1993). Capital is that which embodies value within a field, such as higher degrees among academics, or Pulitzer prizes among journalists. Different forms of capital may be exchanged, as when the award of a Pulitzer may allow a journalist to obtain a better-paid job. In any event, capital only functions within a specific field: "A capital does not exist and function except in relation to a field" (Bourdieu and Wacquant, 1992: 101). Symbolic capital is "a form which is assumed by different kinds of capital when they are perceived and recognised as legitimate" (Bourdieu, 1990a: 128). Wacquant goes so far as to remark that symbolic capital is one of Bourdieu's most complex notions "and his whole work may be read as a hunt for its varied forms and effects" (Bourdieu and Wacquant, 1992: 119 n.73); poignantly, "Symbolic Capital" is the title of the final section of one of the last works Bourdieu published in his lifetime (Bourdieu, 2000: 240).

The underpinning principles of the theory of cultural capital originated in the re-examination of subjectivity beginning in the mid-17th century, whose starting point can be identified as the 1637 publication of Descartes' *Discourse on Method* (Devlin, 1997). In its modern form, the concept of cultural capital took shape in Bourdieu's influential essay *Symbolic Power*, originally published in 1977 and translated two years later. It is most immediately indebted to Max Weber (Weber, 2013) and Ernst Cassirer (Cassirer, 1955). Bourdieu writes:

> The dominant fractions, whose power is based on economic and political capital, seek to impose the legitimacy of their domination either through their own symbolic production (discourse, writings, etc.) ... The dominated fraction always tends to set

> cultural capital—to which it owes its position—at the top of the hierarchy of the principles of hierarchization (Bourdieu, 1979: 81).

Hence cultural capital plays a role structurally analogous in the symbolic realm to that played by economic capital in the material realm. "Capital" in both senses can be put to work by elites to produce surplus value—a form of "wealth" based on currency or prestige which accrues from occupying a dominant position in the economic structure or symbolic superstructure. For instance, DiMaggio's study into the impact of cultural capital on one group within society (U.S. high school students) found that "cultural capital has an impact on high school grades that is highly significant" (DiMaggio, 1982: 199).

In their review of the ways in which the notion of cultural capital has mutated and been transformed since Bourdieu's characterisation, Lamont and Lareau (1988: 156) coin their own definition: cultural capital, they aver, constitutes "institutionalized … high status cultural signals (attitudes, preferences, formal knowledge, behaviors, goods and credentials) used for social and cultural exclusion." But it is noteworthy that what is lost in this modification of Bourdieu's formulation is precisely the link with Marx's analysis of "capital", without which the material effects generated by cultural capital become inexplicable. Where lies the power to delimit the "inside" and the "outside"—to include or exclude—if not from a position of structural mastery? It is not clear how the basis for such power could be understood once divorced from the material conditions of symbolic reproduction—what Lamont and Lareau (op. cit.: 161) dismissively characterise as "the French context" of cultural capital. Nevertheless, Lamont and Lareau (op. cit.: 158) make the valuable point that acquisition and display of cultural capital is not in the main a conscious activity: "Bourdieu thinks that most signals are sent **unconsciously** because they are learned through family socialization, and incorporated as dispositions, or *habitus*, or are the unintended classificatory results of cultural codes" (emphasis in original; and in point of fact, Bourdieu claims these signals are sent non-consciously rather than unconsciously). Hence the display of cultural capital is not an act of deliberate one-upmanship or showing off, in spite of Veblen's view to the contrary (Veblen, 1912, cited in Lamont and Lareau). Rather, it is "the way things are done," that which comes "naturally" or "goes without saying". When applied to the context of the present study, habitus and cultural capital provide a mechanism for explaining variance in the performance of the two groups of students who agreed to take part in a quantitative literacy test (Chapter Five). For one group, it "goes without saying" that numeracy is nothing more than applied

common sense; for the other group, Orrill's phrase, "quantitatively oblivious," comes to mind (Orrill, 2007: 49).

The materialist implications of the apparently idealist conception of cultural capital is suggested by Cassirer's (1955: 80) observation that: "… the content of the concept of culture cannot be detached from the fundamental forms and direction of human activity"—culture actively shapes, and is shaped by, our activity in the world (labour). Numeracy is an ontological stance grounded in our interaction with the world (a stance towards being), not a species of knowledge. This characterisation suggests that overcoming innumeracy among journalists is a difficult nut to crack, as Curtin and Maier (2001: 722) acknowledge: "How journalists can be trained to avoid math errors and to increase math literacy … remains understudied." While cultural capital may seem an alien concept within numeracy studies, it is related to the more familiar theme of "disposition," which occurs regularly, for instance, in definitions of quantitative literacy (e.g., Madison and Dingman, 2010; Mayes et al., 2013; Wismath and Worrall, 2015). They are related by what Bourdieu calls "habitus," the idea that "individuals' predispositions, assumptions, judgments and behaviors are the result of a long-term process of socialization" (Benson and Neveu, 2005: 3), or, more epigrammatically: "Habitus is that presence of the past in the present which makes possible the presence in the present of the forth-coming" (Bourdieu, 2000: 210). Cultural capital – which is both formed and informed by an individual's habitus - stresses the dynamical nature of socialisation; while a "disposition" may be (statically) embodied or inherited, cultural capital is (dynamically) accumulated, spent and transformed in much the same way as economic capital.

Bourdieu outlines what he means by journalistic field in one of the few works which explicitly address the media and media power[18], his polemic *On Television*:

> In order to try and grasp the explanatory mechanisms of journalistic practice, I have to introduce a somewhat technical term – the idea of the journalistic field. Journalism is a microcosm with its own laws, defined both by its position in the world at large and by the attractions and repulsions to which it is subject from other such microcosms (Bourdieu, 1998a: 39).

[18] Of course, many of his other writings implicitly invoke the media, such as his studies of the field of cultural production and especially his work on the university field.

He contrasts his field approach with the "half-baked version of materialism" of economic reductionism associated with Marxism, which "ultimately explains nothing" (op. cit.) – we may perceive a slighting reference to Althusser here. In order to grasp what journalists are able to do, one must be aware of both the relative position of the news organisations they work for, and the positions they occupy within this organisation. Hence, "a field is a structured social space, a field of forces, a force field" (ibid., 40). Elsewhere, the field is described as "a separate social universe having its own laws of functioning independent of those of politics and the economy" (Bourdieu, 1993a: 162), which is to say an autonomous sphere embedded within and subject to the forces of wider spheres without being reducible to them.

The field is both a symbolic and a physical arena, which means it is neither a thing nor a concept. The precise status of "the field" is deliberately left indeterminate and this allows Bourdieu to evade the claims of Heideggarian ontology, which is antithetical to Bourdieu's sociological project[19]. As part of the physical world, the field is manifested in people, organisations, institutions and practices. If it were to be introduced as a concept, then like all concepts it could be appropriated by Heidegger's ontological project – a project which Bourdieu is at pains to resist. Ontology claims precedence over all conceptual thought by presenting itself as the foundation of all metaphysics ("why is there something rather than nothing?" is Heidegger's abiding, constant question)[20]. It is precisely because he wishes to challenge the over-weening ambitions of ontology that the opening section of Bourdieu's *Pascalian Meditations* [21]is dedicated to philosophically undermining the shibboleth of philosophical foundations, which are an illusion "supported and encouraged by … hegemonic ambition". Bourdieu is particularly scathing of "the illusion of 'foundation'", which he specifically links to Heidegger's writings on *Das Man* (Bourdieu, 2000: 30-31), and the related problematic of the "origin", whose violent arbitrariness Bourdieu decries (op. cit., 95). Bourdieu focuses his fire on the terms "foundation" and "origin" because the power of

[19] "Heidegger's philosophy … paradigmatically expresses the philosophical attitude of superiority which Bourdieu had to destroy in himself, and perhaps, in France, in order to get rid of his problem [the lowly status of sociology in 1950s French academia]" (Philipse, 2002: 284).

[20] By way of deliberate contradistinction, Bourdieu poses the question of why there should be "action rather than nothing" - "which, unless one supposes a natural propensity for action or work, is not at all self-evident" (Bourdieu, 1990a: 194).

[21] The title is of course a response to and reaction against Husserl's *Cartesian Meditations* (1931). Pascal was known to have been highly critical of Descartes,

Heidegger's move resides in ontology's claim to occupy a foundational role: as the science of Being, it abrogates to itself alone the task of determining the authenticity – the limits and the legitimacy - of knowledge. For example, *Kant and the Problem of Metaphysics* spends an entire section considering not just the foundations of metaphysics, nor even the laying of the foundations of metaphysics, but "the point of departure of the laying of the foundations of metaphysics" (Heidegger, 1972). Far from embracing "foundational" or "primordial" thought, Bourdieu explicitly rejects such a way of thinking – for example, when justifying his choice of Pascal as his philosophical guiding spirit, his cites as one reason Pascal's "refusal of the ambition of foundation" (Bourdieu, 2000: 2).

The claim, so antithetical to Bourdieu, to mastery over thought's very foundations reaches its apogee in Heidegger's monumental *Nietzsche*, in which it often appears that the 20th century philosopher is ventriloquizing his 19th century forbear (Heidegger, 1991). Bourdieu wishes to preserve the field from being appropriated by ontology, in the same way that Harold Bloom's invocation of non-Western kabbalahistic thought (Bloom, 2005) attempted to situate itself beyond the reach of Derridean deconstruction. "Field" deliberately and consciously shuns the philosophical baggage that encumbers concepts such as "capital", "subject", "dialectic" or "symbolic", with their rich and compromised etiology. Bourdieu's strategy is partly philosophical and partly personal, and stems from his intellectual debt to Ernst Cassirer. Cassirer and Heidegger represented two radically opposed schools of Kantian thought, and their differences were not confined to the field of academic discourse. The philosophical and personal antipathy between them reached a symbolic crescendo at their legendary encounter in Davos in the spring of 1929. "Heidegger … was out 'if possible to annihilate' Ernst Cassirer's philosophy" (Safranski, 1999: 186) – the very thing which Bourdieu attempts to do to Heidegger's philosophy some 60 years later in *The Political Ontology of Martin Heidegger*[22]. What was at stake in Davos was nothing less than laying claim to Kant's imprimatur; seizing control, that is, of the very foundations of metaphysics. It is notable that Bourdieu devotes a major section of *The Political Ontology* … to this meeting – the intellectual heir of Cassirer[23] is determined to wrest back the mantle of Kantian orthodoxy

[22] The very title is nothing less than a full-frontal assault on the putative status of ontology as the originary and originating ground of all philosophy.

[23] Bourdieu's admiration for Cassirer is not unconditional – for instance, in a late work he criticises the "false frontiers between artificially separated theoretical universes, for example, the neo-Kantian philosophy of symbolic forms proposed by Cassirer" (Bourdieu, 2000: 175).

from the father of ontology. Bourdieu's development of field theory and the corresponding downplaying of his earlier work on symbolic power[24] can be seen as a strategic move designed to shield his own contribution to thought from ontology's claim to priority over any and all symbolic systems. The very title Bourdieu chooses for this work is deliberately provocative – by shockingly (from a Heideggarian perspective) yoking together the words "political" and "ontology", the supposedly primordial and value-free (because constitutive of all values) science of ontology is instead cast down onto the level of politics, a level which is characterised by partisanship, *realpolitik* and the mundanely contingent. The language of Heidegger was, claimed Maurice Blanchot, the "very language by which, in a great moment of the history of thought, we had been made present at the loftiest questioning, one that could come to us from Being and Time" (Blanchot, 1989: 479); Bourdieu wishes to reduce it to the status of a political pamphlet.

The field, then, is neither completely thing nor symbol – it is variously described as "a field of forces", a "sphere of action", and "a structured set of positions" (Bourdieu, 2005: 30-35; Levi Martin, 2003: 29). Levi Martin goes on to elucidate three overlapping senses in which theorists tend to use the term "field"– as "an analytic area of simplified dimensions"; as an organisation of forces; and as a field of contestation, a "battlefield" (op. cit., 28). Bourdieu invokes the same triumvirate when he described the field of power as "a field of latent, potential forces … but it is also a battlefield which can be seen as a game" (Bourdieu, 1995: 148-150). It is the second formulation which Bourdieu had in mind when he wrote:

> … just as the Newtonian theory of gravitation could only be constructed against Cartesian realism which wanted to recognize no mode of action other than collision, direct contact, the notion of field presupposes a break with the realist representation which leads us to reduce the effect of the environment to the effect of direct action as actualized during an interaction (Bourdieu, 1990a: 192).

Although Neveu cautions that relying on this formulation of the field as a field of force may suggest "a mechanical vision" in which actors are at the mercy of impersonal forces in the same way that iron filings are repositioned by a magnetic field (Neveu, 2007: 339)[25], it is one to which Bourdieu returns, as when he appeals to the gravitational field in order to compare

[24] "The wider framework of symbolic system and symbolic power … was important in Bourdieu's social theory before it became dominated by field theory" (Couldry, 2003: 653).

[25] "Flaubert first offers us a description of the field of power, within which he traces the movements of six young men … who are propelled in it like so many particles in a magnetic field" (Bourdieu, 1995: 148).

market forces to black holes which “deform space” (strictly, “spacetime”). Interestingly, in physics a fundamental field is defined as an “undecomposable unity by itself; it cannot be taken apart materially … . Points … are meaningless when detached from the field” (Auyang, 1995: 48); this notion of the undecomposability of a physical field captures precisely Bourdieu’s sense of the interaction between field and individual, allowing him to describe agency without ascribing it to a subject, and structure without requiring the formal rigidity of structuralism: “Notions like that of habitus …, practical sense, and strategy, are linked to my effort to escape from structuralist objectivism without relapsing into subjectivism” (Bourdieu, 1990a: 61). It is worth bearing in mind here Bourdieu’s cautionary words about metaphors drawn from physics, as they imply “a completely false philosophy of action and a conservative vision of the social world” (Bourdieu, 1998c: 24); social agents, he declares, are neither “particles subject to mechanical forces … , nor are they conscious and knowing subjects” (ibid).

Why talk about the field? Why not simply talk about journalists? Bourdieu is explicit about this: if one focuses on the strengths or failings of individual journalists – that is, centres any analysis around the notion of journalistic responsibility - one fails to identify what is truly at stake. Journalists as visible agents, Bourdieu claims (citing Plato) are “puppets whose strings have to be found” (Bourdieu, 2005: 42). Instead, the object of analysis should be “the structure of the journalistic field and the mechanisms that operate within it”. As an example, Bourdieu highlights the increasing pressure which the search for ratings has had on journalism’s least autonomous sector, that of television (least autonomous because most reliant on the economic power of advertising), which has subsequently become the model for all other branches of journalism: “the model of the most heterogeneous area of the field, that of television, is little by little spreading to the whole field, including its ‘purest’ regions” (op. cit.). The educational field has an impact on journalism’s autonomy via the overproduction of graduates, ensuring precarious employment conditions, owing to which “censorship can be exercised through political or economic control” (ibid., 43). Taking Zola’s “j’accuse” support for Dreyfus as emblematic of journalism’s autonomy, Bourdieu argues the stance of the professors and academics who sided with Zola was in part made possible because of the security of their tenured position, whereas precariousness of employment stifles such autonomy - which explains why those whose employment was less secure failed to rally to the Dreyfus flag with equal vigour. In general, to comprehend what is happening within the journalistic field, it is necessary to determine the degree of autonomy of the field (to what

extent it is able to defend its borders, so to speak), and the degree of autonomy of a media organisation or journalist within the field. Hence the erosion of autonomy signalled by increased commercial pressures leads to the corporate conformity of media products (TV chat shows, news magazines, newspapers), which Bourdieu argues has led to an increasingly undifferentiated and anodyne media in general: “here, as in other areas, rather than automatically generating originality and diversity, competition tends to favour **uniformity**” (Bourdieu, 1998a: 72, emphasis in original).

Bourdieu's work has been subject to much amplification and extension in recent years. Atkinson argues from a phenomenological perspective that habitus and field should be generalised to what he terms "’horizons’ of perception" and "world horizon", allowing for a fresh analysis of, for example, physical space or gender (Atkinson, 2016) – even though Bourdieu does to some extent address the former in *Pascalian Meditations* (Bourdieu, 2000) and the latter in *Masculine Domination* (Bourdieu, 2001). Atkinson identifies what he claims are two major gaps in Bourdieu’s work: its inadequacy in accounting for the full richness of quotidian lived experience, and, second, in understanding “how we each come to be who we are as a whole” (ibid., 6). As a result, Atkinson proposes supplementing Bourdieu’s fields with the notion of “lifeworld” as the intersection of world and habitus (ibid., 24). According to this view, while the journalist experiences an interview differently from his or her subject because of their place in the field, the journalist’s class, employing organisation and family all contribute factors of differing potency to that experience (the tenor and instance) - and this will of course vary with time. Couldry, meanwhile, proposes an extension of the notion of meta-capital to account for the media’s ability to affect a wide range of fields; the media’s position is privileged because it is both a field and potentially an influence on all fields (Couldry, 2003: 653). Meta-capital is attributed to the state because of its range of influence across multiple fields and its ability to set “the rules of the game” for fields (ibid., 667). Couldry proposes that media power should be treated analogously as a form of meta-capital through which the media exercise influence over other forms of power. As an example, Couldry refers to Bourdieu’s observation (Bourdieu, 1998a: 59) that appearing on television can endow an academic with symbolic capital in their own field:

> Television exerts also … an indirect pressure[on the academic field] by distorting the symbolic capital properly at stake in the academic field, creating a new group of academics whose symbolic capital within the academic field rests partly on their appearances on television (Couldry, 2003: 668).

That is, journalism – like the state – has the power to determine what counts as capital in a variety of fields; it is in a position of "**definitional** power across the whole of social space" (ibid., 669). From the perspective of the current study, the interest of Couldry's extended conception of the journalistic field lies in its ability to set the agenda across a range of fields. By underplaying or devaluing the importance of numeracy – by diminishing its capacity to function as symbolic capital - the journalistic field produces effects beyond its own limits, in the field of education or cultural production, for instance. Inadequate or non-existing reporting of stories involving data may engender a wider feeling that such stories are uninteresting or irrelevant; careless or erroneous handling of statistics may lead to the feeling that numbers cannot be relied on to throw light on the truth but instead can be twisted to suit any purpose. In short, the ideal of being a numerate and data-inquisitive member of society could be made to be seen as less desirable because of the effects of the journalistic field on other fields.

The adoption and extension of field theory by journalism researchers in particular indicates the peculiar fruitfulness and suggestiveness of Bourdieu's approach for journalism studies, combining as it does a synthesis of theoretical models alongside an insistence on the specifics of concrete analyses. Bourdieu has often signalled his rejection of grand, over-arching theories in favour of empirical research, and one of his interpreters warns against reducing Bourdieu's thought to that of the field: "In much the same away that Weber offers more than 'rationalization' … , 'field' cannot summarize Bourdieu. This concept must be considered as part and parcel of a toolbox" (Neveu, 2007: 339); field theory is useful precisely insofar as it deepens our understanding of the phenomena under study. Bourdieu describes the journalistic field as emerging from the opposition between sensationalised, populist newspapers of the nineteenth century (an example would be the *Illustrated Police News*, founded in 1864) and the more analytical, serious newspapers such as the *Times* (founded in 1785 but which reached the height of its influence under Delane from c. 1840-1870[26]). The field is therefore a site of struggle between two poles, one of legitimation through peer recognition, delivered by those who have most completely internalised the values specific to the field; and the other through recognition by the public, in terms of sales and profits (for this and what follows, see

[26] See for example the verdict of Martin Conboy that by the mid-nineteenth century, the *Times* had established "a position of absolute dominance in terms of …defining a position for the political role of a newspaper in bourgeois society" (Conboy, 2004: 18).

the section headed “The Power of Journalism” in Bourdieu, 1998a). An essential characteristic of any field is that it has a degree of autonomy, although this will always be constrained by the field within which it is embedded or to which it is related, such as the economic field. The two poles of the journalistic field are therefore (external) market forces and (internal) journalistic integrity. Drawing comparison with the literary field, Bourdieu notes the hierarchy constructed according to the external criterion (sales) is the reverse of that set up by the internal criterion (serious journalism). The complexity of the chiastic structure so constituted is

> re-doubled by the fact that, at the heart of print media or television, each one of which functions like a sub-field, the opposition between a “cultural” pole and a “market” pole organises the entire field. The result is a series of structures within structures. (op. cit., 94).

Bourdieu regrets that values associated with the cultural pole (serious journalism, analysis, political reporting) are being displaced by the values of the marketplace (ratings, media visibility, marketing). In this sense, all journalism tends to the condition of television in its superficiality and quest for sensation. The journalistic field is increasingly subject to domination (directly or indirectly) by the market model, and this in turns threatens other fields of cultural production because the journalistic field exports its reliance on market forces to these fields (Schudson is mistaken here when he writes that Bourdieu claimed the journalistic field was “engulfing” the political field (Schudson, 2005: 216)). A direct consequence of journalism’s market-driven approach is the homogenisation of content, as editors rush to review the same books or films, interview the same celebrities and cover the same topics. Regardless of the intentions of individual journalists, journalism as a whole tends to uniformity: “Even if the actors have an effect as individuals, it is the **structure** of the journalistic field that determines the intensity and orientation of its mechanisms” (op. cit., 73; emphasis in original). Benson traces this back to the socialisation of journalists when he observes that “the social and educational attributes of new journalists serve primarily to reproduce the field” (Benson, 2005: 101). This is a point of some significance for the current research project since it offers an explanation of why lack of numeracy is widespread among journalists. It is not because individual journalists have made a conscious decision to play down the value of numeracy, but because numeracy holds very little symbolic capital within the journalistic field. The forces within the field do not value numeracy, and as a result, neither do journalists. The habitus of journalists – the dispositions and qualities which they

embody without being aware of it – militates against them celebrating or recognising numeracy as a valid or validating journalistic skill

There are essentially two ways – or sets of ways – in which the field may be transformed; namely, extrinsic or intrinsic. This is in consequence of the field's dialectical[27] nature. It is interesting that Bourdieu shies away from the term "dialectic", presumably because he wished to distance himself from the once-fashionable Marxist analyses of media; Eagleton accused Bourdieu of "plundering the resources" of Marxism while remaining "distinctly sceptical of Marxism as a whole" (Eagleton, 2004: 35), and elsewhere, Bourdieu remarks that "when one is trying to account for symbolic power … Marxist thought is more of a hindrance than a help" (Bourdieu, 2000: 177). Indeed, Bourdieu explicitly rejects the dialectic in its Hegelian form when he observes that conflicts over what constitutes authority in a field are in no sense "provisional contradictions preparing for inevitable transcendence towards a superior unity" (Bourdieu, 1998b: 113); perhaps provocatively, he has claimed a deeper intellectual debt to Pascal than Marx (Bourdieu, 2000: 2). But there is no doubt that the field both acts on and is acted on by the fields within which it is embedded, and the agents and institutions operating inside it. The external fields include the economic, of course, but also the political, state, religious, and online fields (for a discussion of the latter, see Levina and Arriaga, 2014). In terms of the concerns of this research project, an external action on the journalistic field could include greater focus on numeracy skills by accreditation bodies, or parliamentary scrutiny of media competency in relation to reporting of election polls. Hence one way to try to improve the degree of numeracy within journalism would be to put into place external pressures which have the aim of making numeracy more valued within the field. But Benson warns against the efficacy of such measures, since "field internal 'logics' will tend to persist even when conditions external to the field change" (Benson, 2005: 99).

The approach suggested by this research project is to address the field from within, by opening it up and making it more attractive to entrants with a largely STEM-based background. Crucially, this must apply to both the reporting and the production (sub-editing) branches of the profession. This is in essence, albeit in a different context, what happened in France in the early 1980s with regards to the reporting of the country's contaminated blood

[27] Wacquant refers to the "dialectical articulation" of Bourdieu's theory (Bourdieu and Wacquant, 1992: 11, n21).

scandal, as detailed by Bourdieu's sometime collaborator Patrick Champagne and Champagne's colleague Dominique Marchetti (op cit., chapter 6, pp113-134). By 1984, suppliers of blood products outside of France used by haemophiliacs had begun treating their concentrates to neutralise the HIV virus responsible for AIDS, whereas the French blood transfusion service continued to provide potentially contaminated blood until September 1985. Some patients claimed this decision was a scandal, accusing the French health authorities of knowingly distributing contaminated – and therefore deadly – supplies. Champagne and Marchetti argued that coverage of the issue was initially muted because of the structure of the journalistic field – medical reporting was specialised and technical, inherently conservative in nature and aligned with the interests of the medical establishment. However, transformations of the journalistic and medical fields which began in the 1980s saw a new generation of medical journalists emerge, who refused to abide by the rules of the past: these young journalists "distinguished themselves from other medical reporters by not belonging to any medical journalists' associations, rarely attending press conferences, and working exclusively with each other, often obtaining documents or information before everyone else" (Champagne and Marchetti, 2005: 127). At the same time, journalism itself became more market-driven, hungry for the sensational and the spectacular. AIDS reporting moved from the inside science pages to the front pages, and the journalists reporting on the stories were less deferential to their sources and more aggressive in their approach. Thus Champagne and Marchetti identify two waves of entrants into the domain of reporting of Aids. First were the young medically-inclined journalists who followed the austere, non-sensationalist style set by the doyen of French medical reporting, *Le Monde*'s Dr Escoffier-Lambiotte. They refused to dwell on the lurid and provocative aspects of the epidemic, preferring to keep their reporting technically rigorous. However, the opening up in the 1980s of the media field in France to commercial interests, combined with the retirement of Dr Escoffier-Lambiotte in 1985, led to a far more aggressive, accusatory mode of reporting, with the emphasis on human interest rather than scientific accuracy. Hence reporting of Aids, including the scandal of the contaminated blood, moved from the health pages to the front pages as general news reporters, unconstrained by the conventions of their scientifically-trained colleagues, applied the values of the mass media to an area previously dominated by the specialists.

While it can be argued that the net effect of the field's transformation was in this instance negative, in that it led to less responsible and more sensationalised reporting, the fact is that

the influx of new entrants with a habitus quite different to that of the preceding generation led to a qualitative shift in the nature of medical journalism. The implication of this current research project is that by encouraging a new generation of journalists whose habitus favours numeracy into the profession, the field will similarly shift, albeit this time in a more benign direction. The contention that quantitative changes (the number of entrants to a field) can lead to qualitative field effects is something Bourdieu himself raised when discussing the changes within the university field which led up to the events in France of May 1968. He argued that the influx of students following the post-war birth boom led to a corresponding increase in the number of researchers and teachers, which in turn threatened "to transform the functioning of the university market and to modify, through the transformation of careers, the equilibrium of forces within the teaching body" (Bourdieu, 1998b: 129); elsewhere Bourdieu noted that the increased emphasis placed on research in the 1960s "transformed" the status of teachers (op. cit., 123). As with Champagne and Marchetti's argument outlined above, the general point is that the transformation in the quality of a field (which the current research project is proposing should be attempted) was brought about by the introduction of new agents into the field. Of course, sheer quantity of entrants by itself is not enough to be a sufficient cause, but it is a necessary one.

Epistemological underpinning

The validity and applicability of the methods of field theory is predicated on the underpinning principle of relational epistemology, which considers the relationship between objects as the underlying fabric of reality. This is a proposition which forms the basis of the first postulates in Wittgenstein's *Tractatus*: "The world is the totality of facts, not of things … a fact is the existence of states of affairs. A state of affairs (a state of things) is a combination of objects (things)" (Wittgenstein, 1978: 5). Bourdieu's epistemology – which often draws on that of the early Wittgenstein - has been described as "naturalist, but not positivist" (Vandenberge, 1999: 33); the same writer summarises Bourdieu's project in the phrase "the real is relational"[28] (op. cit., 61), itself an inflection of Hegel's formula that "the real is rational and

[28] A phrase originally used by Bourdieu to describe his own epistemology in 1968 (Bourdieu et al., 1991: 253). The phrase also appears as one of the section headings in Chapter One of Bourdieu's *Practical Reason* (Bourdieu, 1998c: 3).

the rational real". Bourdieu himself commended structuralism for its relational way of thinking, which "identifies the real not with substances but relations" (Bourdieu, 1990a: 126):

> It is the structure of the constitutive relations of the space of the field which determines the forms that can be assumed by the visible relations of interaction and the very content of the experience that agents may have of them (op. cit., 192).

It follows that "the source of historical action … is not an active subject confronting society as if that society were an object constituted externally. This source resides neither in consciousness nor in things but in the relation between two states of the social" (ibid.). Again, in his introductory work to the epistemology of sociology Bourdieu and his collaborators write:

> … the meaning of the most personal and "transparent" actions does not belong to the subject who performs them but to the complete system of relations in which and through which they are enacted … Social relations cannot be reduced to relations between subjectivities driven by intentions or "motivations", because they are established between social conditions and positions and therefore have more reality than the subjects whom they link (Bourdieu et al., 1991: 18-19).

That is, the fundamental underpinning of reality is the social field, not the subject: "Apparent, directly visible beings … exist and subsist in and through *difference*; that is, they occupy *relative positons* in a space of relations … which is the most real reality" (Bourdieu, 1998c: 31; emphasis in original). Hence Bourdieu rejects the customary antithesis between positivist and interpretive methodologies: as one commentator put it, at the crux of Bourdieu's sociological practice is "his critique of persistent academic dualisms — objectivity versus subjectivity; positivist versus interpretivist; and legitimate knowledge versus illegitimate knowledge" (Rowe, 2017: 101). Bourdieu identifies in positivism (as developed from Comte's original work) an unwarranted belief in the epistemological integrity of things (as opposed to socially constructed objects); and in interpretivism an unwarranted belief in the primacy of the subject as consciousness.

Positivism as developed by thinkers including Mach and Carnap can be summarised in the words of the philosopher of science Karl Pearson, who declared that the "mind converts **all** facts whatsoever into science … the material of science is coextensive with the whole physical universe" (Pearson, 1892: 16). The arch logical positivist Carnap added that "science begins with direct observations of single facts. Nothing else is observable" (Carnap, 1974: 6). Observable facts are elevated by positivism into the source of knowledge, but the condition

of possibility of the existence of facts goes unconsidered: what constitutes a fact, by and for whom is it constituted and to what ends? What positivism disregards is that any apparently self-evidently "fact" is the work of historical, social processes; in Bachelard's anti-positivist analysis of fire, for example, rather than starting from the conception of fire as a simple fact, he begins with the observation that our first experience of fire is always necessarily as socialised fire, which is why Bachelard can conclude, *contra* positivism, that objects reveal more about us than we do of them (Bachelard, 1987: 2). Interpretivism, on the other hand - as associated with Durkheim, Weber and Husserl, among others - takes the position that reality is constructed rather than immediately given (is a process, not an artefact), and that in the final analysis, the source of knowledge is human consciousness. Husserl, for example, argues that objective understanding of the world is predicated on the thinking subject grasping "the very 'essence' of the objects which it intends":

> Since, however, essences cannot be inferred from the data present to consciousness … the only pathway to essences open to such a theory is that of intuition. Essences cannot be derived from appearances, they can only be seen in the appearances. The essence of whatever is is ultimately contained ideally and objectively in the very subjective acts whereby what is is present to consciousness. (Lauer, 1965: 22-23).

It would take us too far from the needs of the present research project to rehearse in any detail the critiques of the sovereignty of the subject-as-site-of-consciousness which developed from the 1930s onwards (via Freud, Heidegger and Sartre, among others) and which led to the various strands of deconstruction and post-structuralism which have destablised interpretivism. Derrida's analyses of différance, the trace and logocentrism, for instance, challenge the "dream of full presence" (Derrida, 1981: 292) and conclude that the subject is written by the text: "It is solely necessary to reconsider the problem of the effect of subjectivity such as it is produced by the structure of the text … without [the general text] there would be neither 'subject', nor 'history', nor the 'symbolic' etc" (Derrida, 1987: 88) (we note in passing that "writing" and "text" here both have generalised meanings). Hence the absolute interiority of consciousness as the always self-present source of pure intuition, upon which interpretivism ultimately rests, is radically critiqued by thinkers including Bourdieu who question its metaphysical basis.

Following Bachelard, Bourdieu distinguishes between "empirical" and "epistemic" objects. Bachelard – who, along with Cassirer, figures among the most significant influences on Bourdieu's thought - declared: "We have only to speak of an object to think that we are being

objective. But … scientific objectivity is possible only if one has broken first with the immediate object" (Bachelard, 1987: 1). Hence Bourdieu writes that the empirical individual is generally apprehended as "singular, that is to say, different, but without analysing the difference" – is, in other words, merely individuated:

> The constructed ["epistemic"] individual, on the contrary, is defined by a finite set of explicitly defined properties which differ through a series of identifiable differences from the set of properties, constructed according to the same explicit criteria, which characterize other individuals; more precisely, it identifies its referent not in ordinary space, but in a space constructed of differences produced by the very definition of the finite set of effective variables (Bourdieu, 1988a: 22).

Hence, for example, "the constructed Levi-Strauss processed and produced by scientific analysis does **not** have the same referent as the proper name which we use in daily life to designate the author of *Tristes tropiques*" (ibid, emphasis in original). This is why action in the field is attributed to agents (epistemic individuals defined by their place in the field) rather than subjects, and it is why this project has chosen to conduct its analysis at the level of the field rather than that of individuals or institutions: "There is action, there is history … only because there are agents who cannot be reduced to … individuals" (Bourdieu, 2000: 155). In a similar way, Bourdieu attributes action to the effects of relational structures (fields, dispositions, habitus) rather than to the consciousness of individual subjects, a stance which separates Bourdieu's thought from that of mainstream Marxism: for example, he criticises the ethnologist Jeanne Favret-Saada for remaining, like Marx, "enclosed within a philosophy of 'consciousness'", and dismisses the Marxist concept of "false consciousness" as an "intellectualist and scholastic fallacy" (Bourdieu, 2001: 40). (Incidentally, Bourdieu also rejects Marx's contention that classes have a real existence as a "false theoretical solution" (Bourdieu, 1998c: 31)). However, even with these considerations in mind, other research methods could have been employed in this project, such as focus groups among journalism professionals/commentators; surveys of newspaper readers; or an ethnographical study conducted within a news organisation's data hub to observe working practices. Constraints of time and cost played some part in ruling out these methods, but theoretical considerations were also pertinent. In general, anthropological research (focus groups, surveys, questionnaires) can be valuable for determining agents' self-interpretation of their actions, even when such an interpretation does not correspond to reality. Levi-Strauss makes this point when considering situations in which the researcher is faced with models constructed by the culture under investigation to explain observed phenomena:

> Though it is likely that … these models will prove unsatisfactory, it is by no means necessary that this should always be the case … Even if the models are biased or erroneous, the very bias and type of error are a part of the facts under study (Levi-Strauss, 1972: 282).

So even misinterpretation (or, in Bourdeusian terms, misrecognition) can be valuable data for the researcher. But crucially, analysis at the level of the actor is essentially truncated because it does not take into account the intra-relations between actors nor inter-relations between actors and their socioeconomic context – in short, it does not take into account the field.

An alternative to analysing use of numbers in news reporting could have been to focus on a specific sub-genre, such as science reporting (as carried out by Brandao and Nguyen, 2018: 78-92), sports reporting, or the uses and misuses of infographics (for the latter, see de Haan et al., 2018: 191-205). Indeed, these alternatives could form a useful extension of the current research project. That these options were not chosen is down partly to the researcher's own inclinations and partly down to limitations of time – a line had to be drawn somewhere on what content should be subject to analysis.

Bourdieu and the critics

The reception of Bourdieu's work has not been uniformly positive, of course, even among his admirers – Michael Schudson, for instance, castigates Bourdieu for the "fairly crude generalisations" of *On Television* (Schudson, 2005: 216). Perhaps the most provocative and penetrating critic of Bourdieu's approach is Jeffrey C. Alexander, whose *Fin de Siecle Social Theory* (Alexander, 1995) became something of a *cause célèbre* upon its publication. Alexander's critique has been described by Schudson as "spirited, highly critical" (Schudson, 2005: 222) but even Alexander acknowledges that Bourdieu's "exhilarating and exemplary" work is both original and important (Alexander, 1995: 128-216). By way of counterpoint, it should be noted that Bourdieu did not pull his punches when dismissing Rational Action Theory (with which Alexander has long been associated) as "disastrous" (Bourdieu, 2000: 155). Alexander claims that Bourdieu mischaracterises structuralism by over-emphasising its objectivistic tendencies while ignoring its ability to incorporate agency and choice (op. cit., 132-4); and that Bourdieu's conceptual keystones, such as that of habitus, lack rigour: "Like Bourdieu's other key concepts, habitus turns out not merely to be loosely defined … but to be ambiguous" (op. cit., 136). Both of Alexander's objections are unfounded, or at best over-stated. With respect to Bourdieu's critique of structuralism, it was the ethical rather than

theoretical stance of structuralism that led to his rejection of it (his objection to "the haughty and distant relationship established between the researcher and the object of his research"; Bourdieu, 1990a: 20). In terms of objections that his key concepts are poorly-defined, this is a point Bourdieu explicitly addresses. He begins by making reference to the ostensibly clear, transparent thinkers whose writings about the relationship between communication and culture are actually obscured by their "dark clarity". Bourdieu then enlists Wittgenstein in order to argue against the "false rigours of positivist methodology" and in favour of open and provisional (but not, Bourdieu insists, vague) concepts, which have great heuristic value because of their suggestive and evocative power. He points out that "many of the gaps or shortcomings for which I am sometimes reproached are in fact conscious refusals and deliberate choices" (Bourdieu and Wacquant, 1992: 95), and he goes on to give "open concepts" as one example of this. A relatively new discipline such as sociology benefits from open concepts because of their capacity to produce original effects, as opposed to the rigorously-defined rules and methods which accrete over time and serve only to harm an established discipline. Open concepts reject positivism and act as a reminder that all concepts have only systemic definitions – "notions such as habitus, field, and capital can be defined, but only within the theoretical system they constitute, not in isolation" (op. cit., 96).

Alexander's overarching charge of reductionism (his chapter critiquing Bourdieu is titled "The Reality of Reduction") seems to arise at least in part from a misunderstanding of the nature of the field. In Alexander's characterisation, the field embodies a purely active force which impels agents along specific trajectories – for instance, when Bourdieu asserts that "All the declaration of the professors on the subject of the academic institution and the social world … are motivated in the last analysis by their position within the field", Alexander glosses this as saying: "It is structural constraints [i.e. the field] that determine the activities of academic persons" (Alexander, 1995: 168). What Bourdieu is actually saying is that it is **position within the field,** not **the field itself**, which is determinate; that is, Bourdieu's is a relational approach, but it is an approach which Alexander misinterprets as a one-way imposition of constraints determined by the field. In this example, the fact that we are dealing with a structure of relations means that the academic person can act on the field as well as the field acting on the academic person. Without this possibility of reciprocal action, the thrust of the current research project would be futile, since it is predicated on the fact that the field can be transformed by agents (i.e., that the culture of journalism can change). The counter-theory which Alexander proposes is based on combining and uniting differences between the

individual and the social; the micro and the macro; the ideal and the material (op. cit., 193), whereas Bourdieu's ambition is not to unite but to dissolve such differences: "All these oppositions [theorist/empiricist; structuralism/phenomenology; subjectivist/objectivist] (and there are many others) seem to me to be completely fictitious and at the same time dangerous, because they lead to mutilations" (Bourdieu, 1990a: 34).

Given that journalism is the central focus of this research project, it is worth noting that Bourdieu often adopts an ambivalent approach to the profession, a cocktail of fascination and disgust. The disgust, levelled at the coarser, commercially-led aspects of journalism, finds voice in *On Television* but also appears at moments in his text when Bourdieu wishes to evoke the low-brow, the culturally-impoverished or the mendacious, most notably in *Homo Academicus* (Bourdieu, 1998b) although slighting references to journalism can be found throughout Bourdieu's work – for instance, after observing that the search for the truth is often obscured by "the most trivial appearances", Bourdieu amplifies the scope of this phrase by immediately adding: "… those of daily banality for daily newspapers". Newspapers are home to the most perfectly banal of discourses, and journalists are the most trivial of writers (Bourdieu, 2000: 8). *Homo Academicus* is ostensibly a study of the French higher education field but it cannot resist talking about journalism or journalists on almost every page; indeed, the very work owes its inception to a survey published in the periodical *Lire* of the "top 50" intellectuals in France (the fact that Bourdieu appeared in joint 36th place may have some bearing on his evident antipathy towards journalism). Portmanteau expressions such as "journalist-professors", "journalist-writers", "journalist-academics" and "academic-journalists" litter the text as though the status of journalism itself were indeterminate; it is an indeterminism reflected in the (translated) title of his polemic *On Television and Journalism* (the original Collège de France TV broadcast was titled *Sur la television* and was later supplemented by additional texts for UK publication), and echoed in phrases such as "… the mass media (journalism, television) …" (Bourdieu, 1998b: 83). Journalism is both separate from and subsumed by television (the parenthetical "(journalism, television)" suggests these are two mutually-exclusive aspects of the mass media, and yet journalism and journalists regular appear on television, just as television is often the object of journalism); it is as if television were both more and less than journalism, while journalism is identified solely with commentary, and especially political commentary, as if journalism were both more and less than itself.

Journalism, and especially the loaded but nowhere defined phrase "cultural journalism", is contrasted throughout *Homo Academicus* to academic rigour; journalism is seen as a short-cut to the symbolic prizes which others have earned through dint of hard work and dues paid in the currency of academia: time. It is "those teachers least certain of realizing the ambition of scientificity and modernity" who

> must transgress the old academic norms prohibiting all compromise with journalism[29] in order to obtain, outside the institution, and especially in so-called cultural journalism, a symbolic capital of renown partly independent of recognition within the institution … it represents the weak point of the university field for the intrusion of journalistic criteria and values[30]. … journalism offers both a way out and a short cut (op. cit., 112).

In giving an instance of this mendacious and improper short cut from journalism to academic prestige, it is telling that Bourdieu cites the case of the "journalist academic" Catherine Clement, well-known for profiling key intellectuals such as Jean-Paul Sartre and Claude Levi-Strauss, who because of her power to consecrate the reputation of others, in return has her own reputation consecrated as a "favour" (op. cit., 120). Here, the entirety of the journalistic field is conflated with the role of the commentator, ignoring the raft of news reporters, sub-editors and news editors who make up the vast bulk of journalism professionals and who have no interest in consecrating or being consecrated by anybody. That it is commentary rather than news reporting which Bourdieu means when he uses the word "journalism" is emphasised in the example which immediately follows, that of academics reviewing books written by journalists (ibid.). A further example of Bourdieu's identification of the "journalist" with the "commentator" comes in the letter he wrote to Frederic Vandenberghe declaring that the latter's critical interpretation of his political interventions in the public sphere "does not rise far above the level of journalism" (Vandenberghe, 1999: 62).

It is at this stage in Bourdieu's analysis of the journalistic field that charges of reductionism may be fairly levelled, firstly in treating both journalism and television as homogeneous and, secondly, in treating the effects of television on journalism as unambiguously univocal. That is to say, Bourdieu's use of "journalism" as a pejorative in *Homo Academicus* and elsewhere (albeit often disguised) operates on the same reductive level as does his vacillating conflation

[29] The phrase "dubious compromise with journalism" had been used on the preceding page.

[30] These values are subsequently equated with those of "middlebrow culture", as opposed to the authentically avant-garde (op. cit., 119).

of "journalism" and "television". Of course, the reductionism in *On Television* … can be partly accounted for by the telegraphic form of the argument – there is little room for subtlety in an address originally delivered in a two 50-minute TV broadcasts – and partly by the fact that any analysis whatsoever is inherently reductive. But the general thrust of Bourdieu's claim that the drive for audience share characteristic of television has a corrosive effect on (some forms of) journalism and public life in general seems well-supported by the evidence; journalists are finding, at best, that editorial decisions are based on real-time audience metrics and, at worst, their jobs are on the line should they fail to meet targets for social media engagement and page views. And yet, despite this important kernel of truth, Bourdieu's generalisations about journalism in *On Television* … do miss significant differences by smearing out the media into an homogenous whole; one has only to think of the ways in which a story such as the Labour anti-Semitism row has been covered by the BBC, the *Morning Star*, the *Jewish Chronicle*, the *New Statesman*, *Private Eye* and the *Daily Mail* to appreciate the gulf between them which no theoretical framework can hope to encompass in an homogenising term such as "the media". This blurring of distinctions by Bourdieu (ironic, given the seminal nature of his *Distinction*, 1984) suggests a blind spot when it comes to journalism, a rushing to judgement that is a little too hasty and which eludes the normally rigorous "epistemological vigilance" (elsewhere, Bachelard commends a "malign vigilance" as the scientist's surest guard against self-deception (Bachelard, 1987:1)), which is a self-proclaimed feature of Bourdieu's analyses. One might speculate as why this may be (a temperamental aversion to unwelcome journalistic scrutiny; the academic's disdain for "hack" writers; intellectual snobbery) but regardless of its genesis, Bourdieu has already reflected on this blindness. Writing about the philosopher and journalist Raymond Aron's attack on Parisian intellectuals in the 1950s (it may be significant that Aron was placed second in Lire's intellectual "hit parade"), Bourdieu declares Aron is

> entirely blind, as blind as those whose blindness he denounces, to the space within which he is situated, yet within which may be defined the objective relation which connects him to them, and which is the source both of his insights and of his oversights (Bourdieu, 1998b: xvi).

Bourdieu goes on to dub Aron "the most anti-intellectual intellectual" and wonders whether domination of the intellectual field is now dependent upon the ability to make "rational exploitation of the 'media', with everything that implies", because the intellectual field has become subservient to the "problems and procedures of journalism" (op. cit., 324). Perhaps it

is here, in this resentment of the subordination of the intellectual to the journalist and his own reluctance to play this game, that Bourdieu's ambivalent relation to journalism lies.

It is striking that Bourdieu's televised critique of television eschewed the conventional grammar of the medium (the broadcasts used a fixed camera and studiously avoided any of the techniques, such as zooms, pans, fades, transitions, traditionally employed to inject a sense of movement into shots of what is essentially a talking head), and was considered grave and profound, while the published transcript containing the self-same words was condemned (by journalists, at least) as being lightweight and lacking rigour. Bourdieu remarked that critics of the book mis-characterised it as "a series of utterly hackneyed positions punctuated by a smattering of polemical outbursts", a conclusion with which Greg Whelan concurs in his analysis of the work's reception (Whelan, 2002). In what may have been an attempt to ward off such accusations, the English edition of the transcript is bookended by a nine-page prologue plus a preface, and its academic rigour bolstered by the inclusion of a formidably foot-noted essay "The Power of Journalism", and an appendix ("The Olympics - An Agenda for Analysis") is thrown in for good measure. The usual academic apparatus of a bibliography, notes and a translator's note complete the effort to counter the charges of populism.

Hence the book *On Television and Journalism* is far from a simple transcription of what was uttered during the Collège de France broadcasts. Bourdieu gives as one reason for this what he terms "the transcription effect" - the elimination of the non-verbal cues which temper the viewer's understanding of what the speaker means; the academic paraphernalia which accompany the printed version of his lectures supplement the written word in an effort to compensate for the absence of the spoken word. But one might also view the supplementary texts which accompanied the lectures in their print form as a strategy to “academicise” a work originally conceived as a popular exposition and in that way to pre-emptively spike the guns of the journalists who, he correctly surmised, would focus their critical ire on the book. Bourdieu is attempting to subvert journalism’s claim to occupy a position from which his work can be judged; he wants to elevate *On Television* … beyond the reach of “cultural journalism” by placing it within the protection of the academic sphere. Again, Bourdieu’s relationship to journalism is not a neutral one.

Field theory and online journalism

This research project has confined itself to print newspapers, for methodological and theoretical reasons. The methodological reasons have been covered in the Introduction, and the theoretical reasons will be elaborated in the rest of this section. Bourdieu died in 2002, before online journalism had fully established itself. UK newspapers had begun experimenting with online publication from around 1996 (the current author helped launch a website for the *Liverpool Daily Post* in November of that year), and the BBC news website launched the following year. While there had been earlier entrants providing online news (CompuServe hosted news articles from the early 1980s and the *Daily Telegraph* became the first daily news website in Europe when it launched in 1994), it was not until broadband started to supersede metered dial-up internet access in the early 2000s and the network infrastructure became more robust[31] that news websites flourished. All this is to make the point that field theory as envisaged by Bourdieu never took online journalism into account, although subsequent writers have downplayed the significance of this omission. Benson and Neveu, for example, concluded that Bourdieu would "doubtless be skeptical of claims that internet technologies represent a fundamental break with previous systems of communication" (Benson and Neveu, 2005: 8), while Willig et al. in their introduction to the edition of the journal *MedieKultur* devoted to "Bourdieu and the Media" merely develop Bourdieu's thought from the point of view of mass communications in general, rather than journalism in particular (Willig et al., 2015). They argue that the ways in which different groups make use of the internet and the value they derive from it is related to their class and socioeconomic status, but they have little to say about online news or journalism specifically. Bengtsson's paper in the same journal theorises digital news consumption but not its production (Bengtsson, 2015). While it may be true that the advent of the Internet has not had a qualitative effect on the nature of journalism, it has certainly had an appreciable effect on newspaper finances and resources by allowing new competitors to emerge and thereby reducing the income of traditional news organisations. It has also had an effect on daily news practice, by making deadlines more fluid, making access to information and sources more

[31] The present author recalls that in 2001 national and international news websites were unable to handle the traffic surge following the 9/11 US attacks - most were unreachable throughout the day, including the author's own. This contrasts with July 2005, when a large number of news websites were able to report on the London bombings without crashing.

immediate, introducing new distribution channels, encouraging the use of multimedia, and providing real-time audience metrics. The latter development has perhaps had the most profound impact on news journalism because the data gathered about audience behaviour is available to both journalists and advertisers. Journalists can use the data to shape the news agenda and the way in which news stories are presented – for example, by studying real-time audience activity it is possible to identify articles of which only the opening paragraphs are viewed and consequently a video clip can be inserted at this point to encourage greater engagement with the rest of the article. A consequence of advertiser knowledge of audience behaviour is that advertisers can explicitly prevent their online advertisements from appearing next to news stories which contain negative keywords in their headline (such as "murder", "death" or "tragedy"); for obvious reasons, advertisers do not want to be associated with tragic events. Hard news is far more likely to contain unwelcome keywords and so generates less advertising income. Hence profit-oriented news organisations are incentivised to publish more anodyne lifestyle content at the expense of hard news in an effort to maximise revenues. Nothing in the foregoing changes the essential nature of journalism but it nevertheless has affected the techniques and process involved throughout the production chain. From the perspective of field theory, online journalism represents a modulation in the field but is not a field or sub-field in its own right.

The other shift in the media landscape has been the rise of social media, which is of course related to, but distinct from, online journalism. The blanket term "social media" is unhelpful in the present context as it conflates several platforms, practices and forms of activity which operate on entirely different levels – the politician using Facebook to provoke outrage and glee; the reporter using Twitter to crowdsource a feature on the impact of reality TV; the editor posting a video clip to promote a forthcoming news investigation; the newspaper reader engaging with a journalist on Twitter to challenge the premise of an opinion piece; and the ideologically-driven individual who re-tweets a series of far-right conspiracy theories - are all doing very different things. It is not that they occupy different positions with a putative "social media" space, but that they occupy different spaces from each other. One should consider social media as a tool, operating differently within different fields and sub-fields, rather than as a field in its own right.

This chapter has identified a general tendency in the existing research literature to equate journalistic numeracy with a set of core skills which either are not particularly important or,

conversely, which are important and can be taught. What has been lacking is an analysis of journalism at the level of the field and which therefore poses the question in terms of relational structures rather than individual competencies. The limitations of the latter approach are evident in the fact that despite a century of journalism training, inadequacies with numeracy in the news media are still being identified (cf. Chapter Four, below). This is the theoretical gap which the current research project seeks to address: in seeking to reproduce itself, the journalistic field reproduces the culture which allows numeracy to be undervalued. A change in that culture requires a transformation of the journalistic field, as the remainder of this project aims to show.

CHAPTER FOUR: A NUMERACY AUDIT OF TWO UK NEWSPAPERS

This research project posits that the frequency and type of numeracy errors which occur in reporting is an effect of the journalistic field. Further, the effect of the journalistic field is such that errors will be fairly equally distributed across time because numeracy is not and never has been highly valued as a journalistic competency and so, despite various attempts at training, the quality of news stories involving figures still leaves room for improvement. In the absence of the explanatory power of the journalistic field, it is difficult to explain why errors have not been largely eliminated over the decades of training and skill development initiatives. In order to examine the consequences of the field as proposed by this project, a research strategy was developed involving an audit of a UK national and regional newspaper to analyse the relative frequency and taxonomy of errors relating to numeracy. Following the approach of Maier in the U.S. (Maier, 2002), this project undertook the analysis of a series of articles from the *Liverpool Echo*, a UK regional daily newspaper, and the *Times*, a UK quality national daily, with the aim of determining the extent to which numeracy skills were involved in the production of the articles, whether errors had been made and of what type. The decision to analyse one regional and one national title was in consequence of the difference in the seniority of staff between the two. Typically, regional daily newspapers employ reporters near the start of their careers, either fresh from university or following a spell with a weekly newspaper (this was, for example, the career progression of the current researcher). National daily newspapers employ new entrants into the profession less frequently, as they generally take on experienced staff from the regional daily press or from other national titles. Hence the choice of regional and national newspaper enabled the evaluation of both early-career and mid-career reporters.

The *Liverpool Echo* is an evening tabloid newspaper published by Trinity Mirror North West & North Wales (part of Reach plc) and covering the greater Merseyside region. Its most recent audited circulation figure is 38,474 (Audit Bureau of Circulations, n.d.-a), compared with 76,378 copies in 2013 (Trinity Mirror, n.d.) and 110,000 copies in 2007. It is considered a centre-left publication with a readership primarily in the C1C2DE categories (*Liverpool Echo*, n.d.). The *Times* is a daily compact newspaper, having changed from a broadsheet in 2004. Its most recently audited circulation figure is 430,660 (Audit Bureau of Circulations,

n.d.-b), compared with 670,054 in 2007 and 442,000 in 1987. It is considered a centre-right publication with a readership primarily in the ABC1 categories (Newsworks, n.d.).

Articles were analysed for a period of one week across each of three decades: the 1980s, 2000s and 2010s. The specific data ranges selected at random were 3-8 August 1987 and 25-30 June 2007 for both titles, and then 2-7 March 2015 for the *Liverpool Echo* and 22-27 January 2018 for the *Times*. For the 2015 and 2018 newspaper, hard copies of each paper was studied. The earlier *Echo* editions were consulted on microfilm from the collection held in Liverpool Central Library, while the earlier *Times* editions were accessed online using the Times Digital Archive via Gale. In total, approximately 2,700 articles were studied, comprising around 900 from the *Liverpool Echo* and around 1,800 from the *Times*. Since there is no reliable way of determining in advance whether an article involves the use of numerical skills (e.g. it is not possible to filter on search terms), every article had to be read to establish whether it was relevant to this study or not.

Within the date ranges specified, the articles selected for analysis were those on the News and Business pages. In line with Maier's methodology, articles from other sections – such as Lifestyle, Sport, Opinion or Reviews – were not included, nor were news briefs (items of one or two paragraphs, usually supplied by news agencies), or regular columns. All 2,700 articles (plus graphic, if one was present) from the news and business pages were read to determine whether they involved numeracy skills. The operational definition of "numeracy skills" adopted was again that of Maier, namely that the article "explicitly or implicitly includes either a mathematical calculation (i.e. average housing prices or inflation rate) or a mathematical point of comparison (i.e. change in government expenditures or differences in school test scores)" (op. cit., 510). The adjectival use of figures, such as ages, heights, dates or distances, does not fall within this definition. This meant many business news articles were excluded. A typical example of the adjectival use of number is an article from p37 of the *Times* dated January 22 2018, part of which reads: "GKN Driveline, which accounts for 50 per cent of group sales and 47 per cent of profits, … ". Although percentages are given here, their function is purely descriptive and so this article does not fall within this paper's definition of requiring numeracy skills, and hence it was not included in the analysis which follows.

In this study, an error was judged to have been made based on eight categories, seven of which closely correspond to Maier's. That is, based on the information provided in the article, an error was flagged in one of the following circumstances (the criteria in brackets are Maier's):

1. Unclear/imprecise wording (Mathematical terminology was misused);
2. Mistakes in arithmetic (Numbers did not tally);
3. Incomplete or missing information/insufficient context (Inappropriate baseline for comparisons was used);
4. Meaningless or misleading use of number (Numbers were misinterpreted);
5. Incorrect mixing of units/dimensions e.g. imperial and metric; volume and area;
6. Graph axis did not start at 0 (Breakline[32] was missing in graphs);
7. Mismatch between body text and graphic/factfile (Inconsistency between text and graphic);
8. Spurious accuracy (Meaningless precision).

Four categories which Maier identified as interpretive (Needless numbers; Numbers sensationalised; Unquestioning use of numbers; Naked numbers) were not used because the evidence for an article belonging to one of these categories lay outside the article itself. As referred to above, Maier considered an article about recent 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 (op. cit., 516). By contrast, in the current study only errors that can be detected by reference to the information contained within the article (i.e. "immanent" errors) have been counted, which as a method has the advantage of being more easily replicable. Maier himself recognised future researchers might take this approach when he acknowledged that "some of the examples of errors cited in the study involved subjective determinations" and that future researchers "may reasonably take issue with these judgement calls. Their differences in opinion are welcome" (op. cit., 518). Maier may be gratified that the differences between the present study and his are minimal.

[32] A breakline in the axis of a graph indicates the data do not begin at zero.

Further, when it came to determining whether an article fell within category 2 (mistakes in arithmetic), the decision was taken to exclude from the analysis articles which do appear to involve arithmetic skills but whose accuracy or otherwise cannot be determined from reading the newspaper. That is because the purpose of this part of the study is to evaluate the effects of (the lack of) numeracy skills on the accuracy of reporting, rather than to measure the number of stories which display numerical proficiency, in the same way that Maier (2002) studied both the number of stories which involved numbers, and – separately – the types of numerical error which were committed. The decision to include within this error category only articles whose accuracy could be confirmed primarily affected articles from the business pages. A typical example is from p44 of the *Times* dated January 26 2018, which contains the sentence: "Shares in Canopy Growth were down 9.2 per cent to C$31.68 and CanniMed shares were off by 6.8 per cent at C$39.05" (it being clear the comparison was with the previous day's price). Since the basis of the comparison (i.e. the previous day's share price) is not given, it is not possible to check whether the percentage falls were as stated. Therefore such articles were not counted. The overall effect of this decision is that the number of errors identified in this category will be an undercount, since it is almost certain that errors will have been made in some of the articles whose accuracy it was not possible to ascertain.

Audits of newspapers are nothing new – indeed, one could argue (accepting a generous definition of the term "audit") they are nearly as old as newspapers themselves. Certainly the venomous "paper bullets" fired during the English Civil Wars in the mid-17th century were aimed squarely at fellow news-writers and routinely subjected rival publications to forensic (if not dispassionate) dissection of their content (Frank, 1961; Raymond, 1993; Black, 2001). In 1652 we find *Mercurius Mastix* lambasting newsbooks for accepting advertisements from quack doctors: "But why should we be angry with them for this? For it is commonly truer than the rest of their news … they have taken the Cryers trade from them, for all stolen goods must be inserted in these pamphlets – the fittest place for them, all theirs being stolen they do so filch from one another" (Williams, 1968:166).

Such analyses multiplied in frequency and sophistication in succeeding decades, the state of the Press becoming a staple of articles in Victorian periodicals (c.f. King and Plunkett, 2004) - but it awaited the entrance of journalism into the academy[33] before an audit in the modern

[33] In the United States, this entrance dates from 1908 (Winfield, 2008).

sense was first undertaken. One of the first such studies of accuracy in news reporting was that of Mitchell Charnley, who wanted to put popular distrust of newspaper accuracy to the test (Charnley, 1936: 394). He found that over half (54%) of the stories analysed were entirely accurate. However, he was not mainly concerned with numerical accuracy – the category "Errors in figures" is only one of 13 headings under which Charnley classified mistakes (ibid., 400). Twenty one such errors are detected in the 591 stories analysed, but no details are given as to frequency (did some articles contain more than one error?) or the precise nature of the error. Subsequent research projects have tended to be highly critical of reporters' numeracy skills; for example, one study criticised the "appalling lack of understanding of statistics and social science research, without which reporters cannot properly interpret the huge amount of data that the educational system produces" (Berliner and Biddle, 1999: 5). After noting the tendency of newspapers to report an international study of school maths performance in negative terms, these researchers ended on the apocalyptic warning that:

> By continuing the unfair, unremitting negative characterization of the nation's schools and youth, by searching for the blood and too often avoiding the more reasonable interpretations that are possible, and by failing to describe the magnificent achievements that also characterize public education, the nation's free press may ultimately become less free (ibid, 10).

However, the Berliner and Biddle study did not identify failings in numeracy as such; rather, they accused reporters of loaded descriptions, such as using "mediocre" instead of the more neutral "median" to describe US schoolchildren's performance: "This adjective was chosen less for technical appropriateness and more for its connotation of failure" (ibid., 8). Their charge is that news organisations wilfully – or, at least, heedlessly - disregarded subtleties in the data in order to make for more dramatic headlines and, presumably, thereby sell more newspapers.

Maier's audit of how reporters handle numbers, on the other hand, does focus squarely on numeracy (Maier, 2002); he went on three years later to compile a wider-ranging study into newspaper error in general which drew out the implications of frequent errors for a newspaper's credibility (Maier, 2005). For the 2002 study, Maier audited his local daily US newspaper, the *Raleigh News & Observer*, for mathematical errors. As Maier admits, the definition of "error" in this context is far from fixed: "The literature … is essentially silent on what constitutes mathematical error" (ibid., 510). In consequence, Maier shied away from

any “narrowly prescribed” definition of mathematical error. He identified 11 broad categories into which the errors and misinterpretations fell, the most common of which was where numbers do not tally. As an example of this category, a story about digital cameras predicted sales would quadruple from 3.8m units in 1998 to 12m units in 2001 – as Maier observes, this is barely a tripling, never mind a quadrupling, of sales: “Either the reporter muffed the calculation or unquestioningly accepted the company’s figures” (ibid., 513). Maier found the category labelled “Unquestioning use of numbers” to be particularly troubling, presumably as this represents a loss of the critical skills reporters are meant to bring to news stories. An example of this type of error concerns the report of a 70,000-strong crowd along the 1.2 mile route of a parade, which Maier points out would require observers packed five-deep on each side of the street at every 12 inches of the route (ibid., 515).

Not all the articles which Maier identifies are error-prone are so clear-cut, however; five of his categories are what he terms “errors of interpretation” and are more subjective. For example, an article based on statistics showing that African-Americans had prospered markedly over a five-year period was flagged as erroneous because it lacked the human dimension: “Entirely missing were African-Americans discussing how new-found prosperity affects their lives” (ibid., 516). This classification is highly debatable 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 newsdesk realised interviews were desirable but no reporters were available, or the pressure of deadline meant there was no time to conduct interviews. In short, without additional contextual information, it is not possible to determine with any degree of validity that this article ought to be considered an example of mathematical (or, indeed, any other type of) error.

The conclusion which Maier draws is that when numbers are misused in the news, “what is generally lacking is common sense, not higher math” (ibid., 516). Interestingly in the context of the current research project, Maier concludes that responsibility for errors “involves the entire editorial process” rather than the fault being laid solely at the feet of individual reporters. Maier’s recommendations include making basic maths a requisite skill in a journalism degree as well as ongoing, contextual training (“Innumeracy among journalists cannot be overcome by an occasional workshop or class exercise”, ibid., 517). That is, Maier argues that what is at stake is a systemic failure; one which it will be argued later in this

dissertation is an effect of the journalistic field rather than an aberration within it. As will be seen, this distinction has important consequences for the proposed remedy; Maier wishes to make a correction at the individual and institutional level, while the current researcher additionally proposes a correction to the field itself.

There was a noticeable difference in the number of articles from both papers which involved numeracy skills as described above - a total of 34 in the *Liverpool Echo* and 230 in the *Times*. For the *Liverpool Echo*, there were 13, three and 18 such articles in 1987, 2007 and 2015 respectively, of which errors were found in three, one and six articles (Figure 1). For the *Times*, there were 60, 96 and 74 articles in 1987, 2007 and 2018, with errors found in 20 articles in both 1987 and 2007, and in 15 articles in 2018 (Figure 2). The same information is shown in percentage form for the *Liverpool Echo* in Figure 3 and the *Times* in Figure 4.

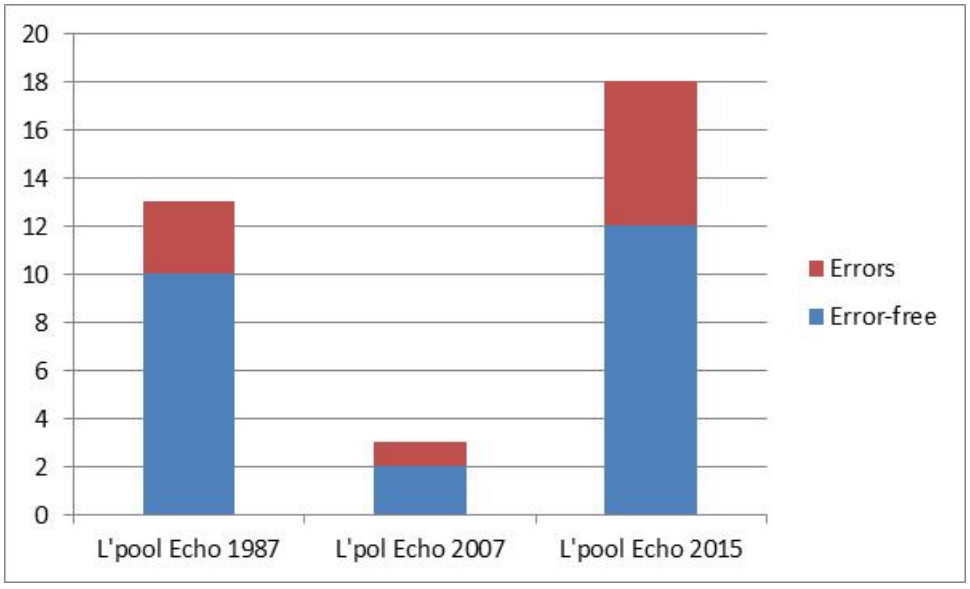

Figure 1: Number of articles involving numeracy skills in Liverpool Echo

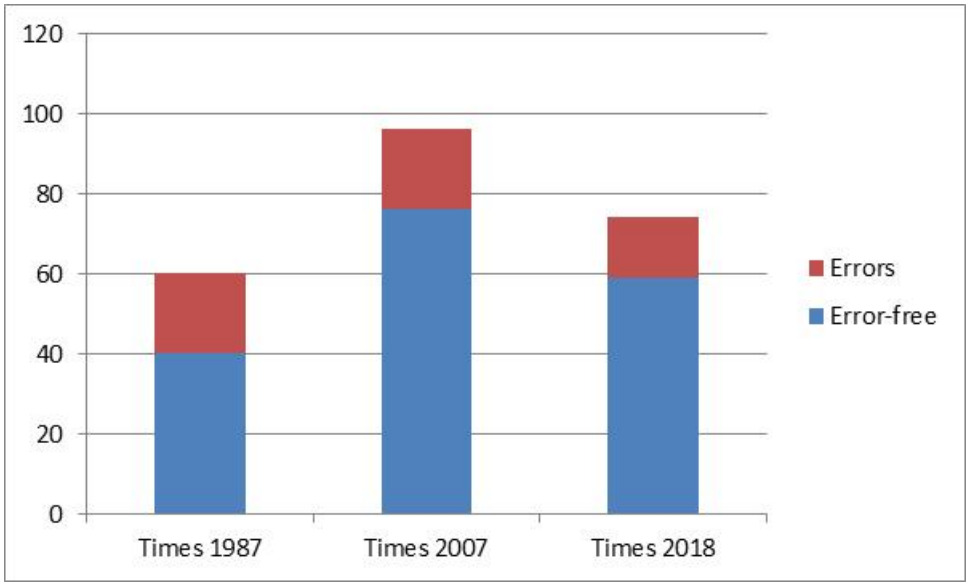

Figure 2: Number of articles involving numeracy skills in the Times

Initially, the most striking feature is the low number of articles identified in the *Liverpool Echo* in 2007 (only three, one of which was about the success of the newspaper's own relaunched website) and this reflects the newspaper's deliberate focus at this time on human-interest, lifestyle and celebrity stories as opposed to hard news. However, the percentage of erroneous vs. error-free stories remained relatively stable, as was the case for the *Times*. One immediate conclusion is that it appears there has been no recent acute deterioration nor improvement in journalism numeracy skills, which is consonant with the field theoretical explanation proffered by this research project.

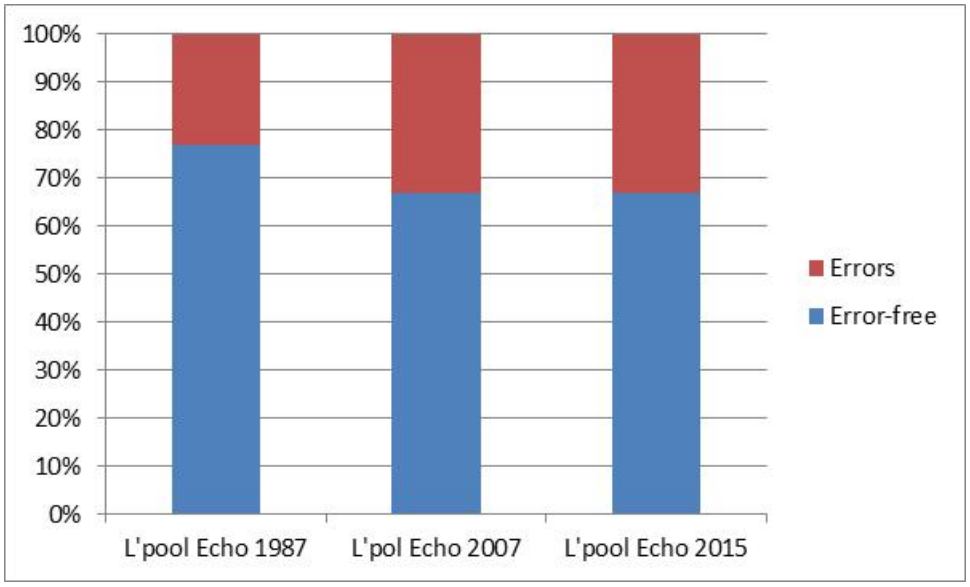

Figure 3: Percentage of error-free vs. error-prone articles in the Liverpool Echo

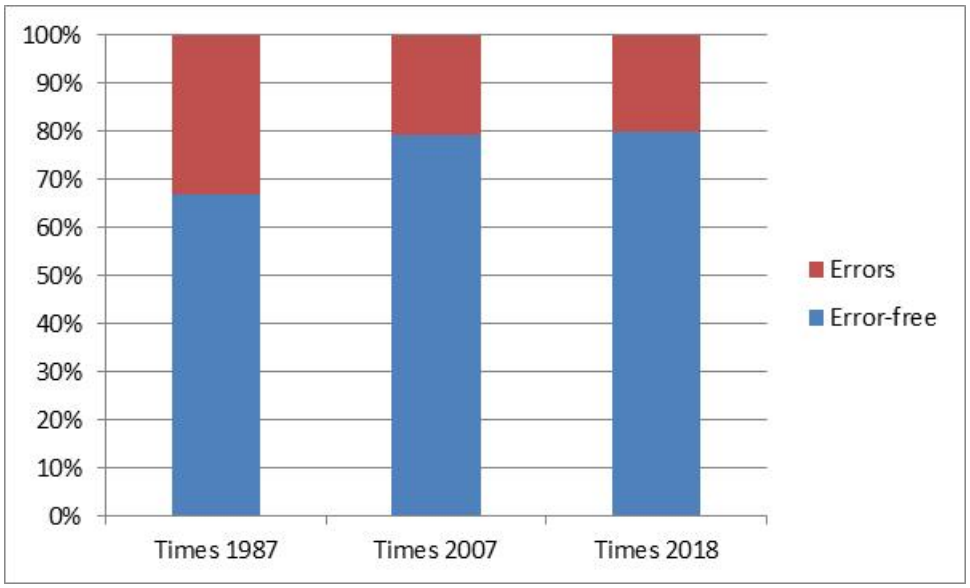

Figure 4: Percentage of error-free vs. error-prone articles in the Times

It is also clear that there were far more stories requiring numeracy skills in the *Times* as opposed to the *Liverpool Echo*, even though on average there were fewer errors, and this can in part be attributed to the fact that staff on the *Times* are generally more senior (and so more experienced) than those on the *Echo*; and that the greater editorial resources of the *Times* allow for a more rigorous revision (checking) process.

It was suggested in Chapter One that specialist reporters, especially those working on the business desk, would not necessarily be as number-phobic as general news reporters. The following two charts show the absolute number of general news and business news articles involving numeracy per newspaper per year, and the same information expressed as a percentage:

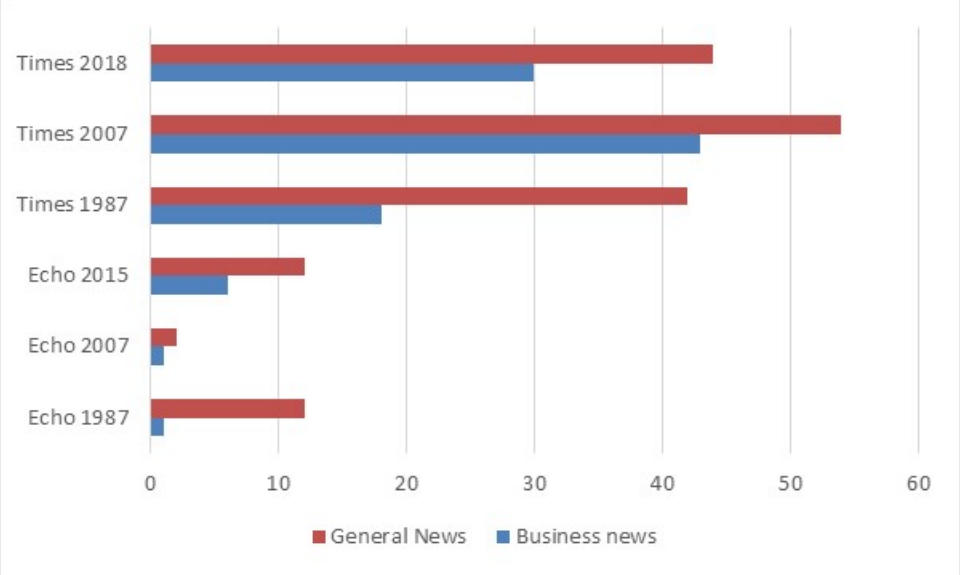

Figure 5: Absolute number of news and business news articles per paper per year

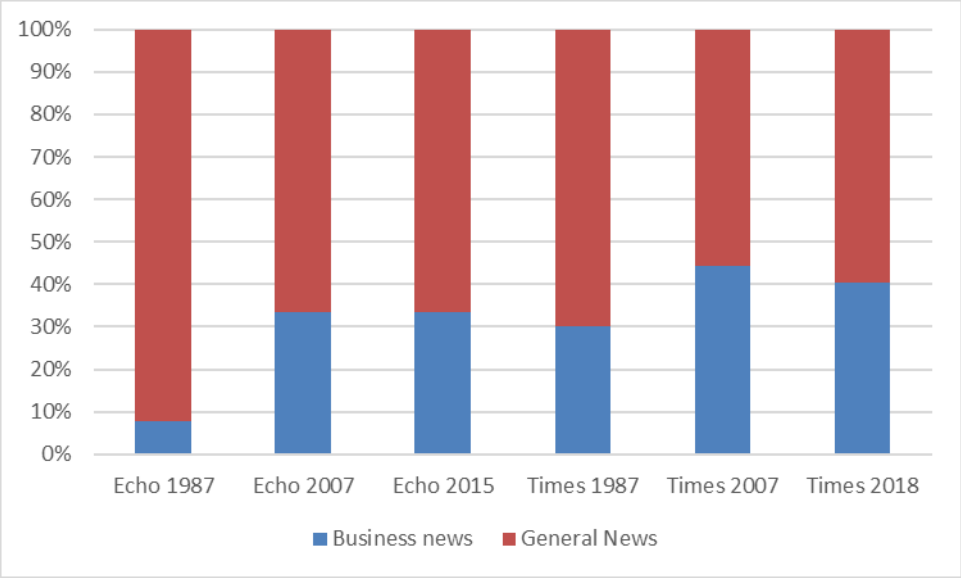

Figure 6: Percentage of news and business news articles per paper per year

For the *Echo*, there are too few data points to draw meaningful conclusions, but the picture for the *Times* (Figures 7 and 8) is relatively consistent, with around 30%-45% of the articles

studied coming from the business pages over the years. There is no surprise here as one would expect many business stories to fall within the criteria for inclusion in this study detailed above. When it comes to errors within the business news pages as opposed to general news pages, however, there is a marked difference – only the *Times* will be considered for this comparison, given the limited nature of data from the *Echo*.

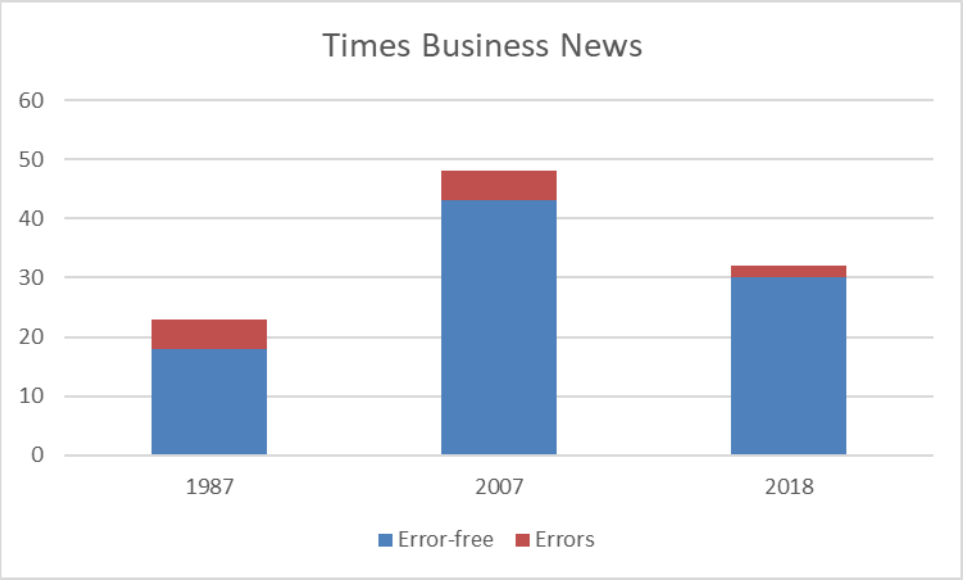

Figure 7: : Number of error-free and erroneous articles from Times business pages

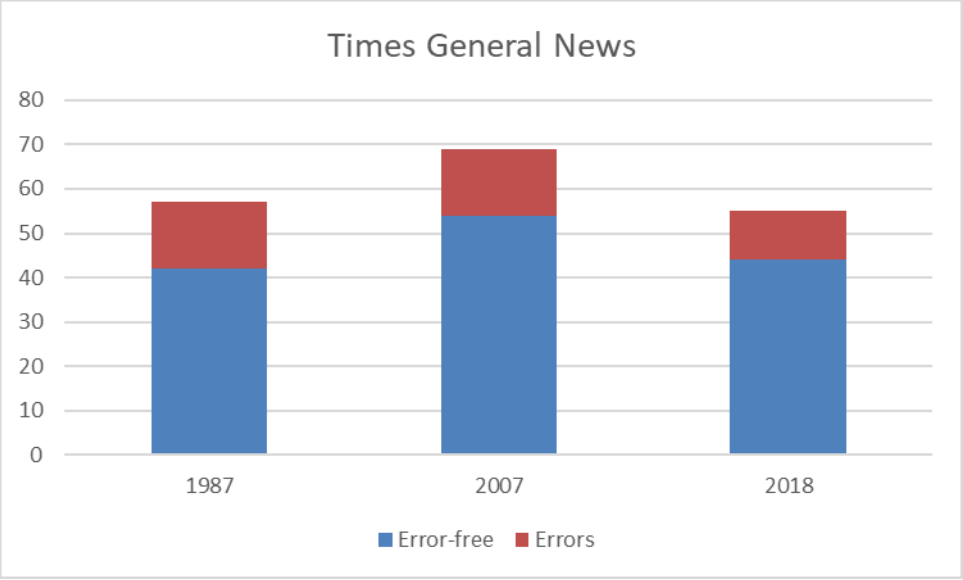

Figure 8: : Number of error-free and erroneous articles from Times general news pages

Figure 7 gives the absolute number of error-free and erroneous articles from the *Times* business pages. The percentage of erroneous articles as a percentage of the number of business news articles analysed was 8.3%, 5.2% and 2.7% from 1987-2018 respectively. The comparable percentages for the general news articles shown in Figure 8 were 32%, 25.4% and 24%. These two sets are of a different order of magnitude; even allowing for fluctuations within each category, there is clearly a marked difference between the two sections.

This supports the contention made earlier that the habitus of journalists within sub-fields such as business news is likely to be different from that of the general news reporter, which in this instance is demonstrated in the much lower error rate. We can readily identify a number of reasons why this may be so: business reporters deal with numbers on a daily basis; business reporters may be selected for the role because they are numerate to being with, or self-select for the same reason (i.e. only those applicants who feel comfortable dealing with figures apply for jobs on the business desk); business sub-editors are often promoted from the ranks of business reporters and therefore are more likely to spot errors; and information supplied to the business desk in the form of releases, reports or market statements is more likely to originate from organisations with a vested interest in getting the numbers right in the first place. The specific logic of the business reporting sub-field tends to minimise the type of error under discussion. Note that errors are not completely eliminated, but they are between a factor of three to eight times less common than on the general news pages.

Taxonomy of Errors

The eight categories of error listed above are exemplified in the following section, where the examples given illustrate the error in question but do not necessarily represent all of the errors identified:

1. Unclear/imprecise wording: This category identifies errors in formatting or phrasing. An example is from a *Liverpool Echo* story in 1987 which refers to the year 2000 but writes it as "2,000", confusing a label (the year 2000) with a numeral (2,000). The *Times* of the same year uses "20 per cent" and "one third" in the same phrase in a report on private hospitals, presumably to introduce variation: "By the end of this year it hopes to cut the number of those waiting for more than a year, now 120, from a third to less than 20 per cent of all those waiting for operations" (*Times*, 6/8/1987, p4). Rather than switching the metric from percentages to fractions, it would have been better to write: "… from a third to less than a

fifth …", as otherwise the reader is left to perform the conversion for themselves and while hardly onerous, it is unnecessary. There is a further ambiguity in that the comparison is between those waiting more than a year with all those waiting (although the number waiting for less than a year is not given) – does the reporter mean "the number of those waiting for more than a year will be cut from a third of all those waiting for operations to a fifth of all those waiting for operations", or "… will be cut from a third of those waiting for a year to a fifth of all those waiting for operations"? Again, from later that week, the *Times* reports an increase in the number of motorists given breath tests compared with the previous year as "20 per cent" - although figures later in the article show the actual percentage is 21.1 per cent. The percentage could easily have been qualified to read "… just over 20 per cent", maintaining accuracy at the cost of just two words. There were nine instances of this type of error.

2. Mistakes in arithmetic: An article from the *Echo* in 1987 about the vote to merge the Liberal party with the SDP claims 25,895 minus 19,228 is 6,669, when in fact it is 6,667 – this is evidently a simple error in subtraction. In the same year, a *Times* article about the SDP-Liberal merger claimed the turn-out of the SDP membership was 77.7 per cent, and that the membership stood at 58,509. On those figures, 45,461 votes must have been cast. Yet the combined total given of those who were reported to have voted in favour (25,897) and against (19,228) comes to 45,125, which is 77.1 per cent. Of course, there may have been 336 spoilt papers, but this is mentioned nowhere in the article. On the face of it, the maths is simply wrong. A final example from the *Echo* in 2015 contains two maths errors in the same report on council tax. First, it is claimed that Band A tax-payers would see their payments rise by £9 a year, said to be "18p a week" – in whole numbers, it is in fact 17p a week (17.31p, to be precise). And since council tax is levied from April-January (i.e., over a 10-month rather than a 12-month period), the actual increase tax payers would see would be higher, at 20.45p a week. Second, readers were told "council tax payers are set to see a 1.9% rise in their bills" and therefore Band A properties would see bills rise from £1,056.14 by £9 – such an increase (from £1,056.14 to £1065.14) is in fact a rise of only 0.85%. Even more confusingly, a story the previous day had explained "council tax will rise from £1,056.14 for a Band A property to £1,077.12" (which is an increase of £20.98 a year, or 1.99%). The 1.9% increase mentioned elsewhere would have led to Band A owners paying £1,076.21, or £20.07 a year more. The more the *Echo* explained this story, the more confusing it became. There were 10 articles in this category.

3. Incomplete or missing information/insufficient context: This is the most common category. It includes articles about polls or surveys which fail to mention essential details such as the margin of error or, in some cases, the methodology. It also includes mention of the term “average” when there is no indication as to which average is being used, such as the 2018 *Times* story about homeownership which twice mentions average (“… the average age of people when they buy their first home has risen …”; “… first-time buyers need £48,591 for an average deposit”). In the latter case in particular, the arithmetic mean is not a particularly suitable measure (the wide disparity between property prices in the south-east and the rest of the country would distort it), but it is not clear which average has been used. A further common example is the lack of a baseline when describing percentage change, such as the 1987 *Times* article which reported that “beer production was up 1.4 per cent in June” – whether that was compared with the previous month, the corresponding month the previous year, or based on a rolling total was not specified. A final example from the *Echo* of 2015 about a smoking ban in hospitals said that 98,000 adults were thought to be smokers in Liverpool, which was “a quarter of the population”. But is this a quarter of the total population or of the adult population? There is no way of telling from the information presented in the article. There were 34 articles in this category.

4. Meaningless or misleading use of number: Expressing large numbers or quantities in everyday units can be an effective way of bringing their significance home. The *Echo* in 1987 attempted to do this in order to describe the vast amount of surplus butter held by the EU (then called the EEC). This quantity of 19,917 tonnes was, *Echo* readers were informed, “enough to put a tasty coating on the 92 football league pitches in the country”. Apart from the fact that imagining 92 football pitches is itself quite a feat (not helped by the fact that the area of a football pitch may vary between 4,050 sq m to 10,800 sq m, with the Football Association recommending an area of about 6,440 sq m (Football Association, 2012)), but the amount of butter involved is entirely dependent on how thickly it is spread, making the representation wildly imprecise. In 2015, the *Echo* reported that a bicycle designed to help the University of Liverpool set a speed record was "35 times more aerodynamic than a regular pedal bike" – but there is no indication of what measure of aerodynamic efficiency is being cited or, more meaningfully, how that would translate into a faster bicycle, so the number 35 serves little purpose. There were five errors in this category.

5. Incorrect mixing of units/dimensions: None of Maier's 11 categories corresponded to this one, which suggests it is a relatively uncommon error. A *Times* article from 2007 describes a volume of 50-60 cubic metres as an "area", and the same newspaper in a report on the war on drugs confuses the number of people taking cocaine with the amount of cocaine taken. There were four errors in this category.

6. Graph axis did not start at 0: There were two examples in this category, both from the *Times*. It involves suppressing the y-axis, so that the vertical axis does not start at zero. In 1987, a report on interest rates was illustrated with three graphs (see Figure 7), none of which had a y-axis starting at 0. The convention in such cases is to use a broken y-axis to show it does not start at zero, but this is not the case here:

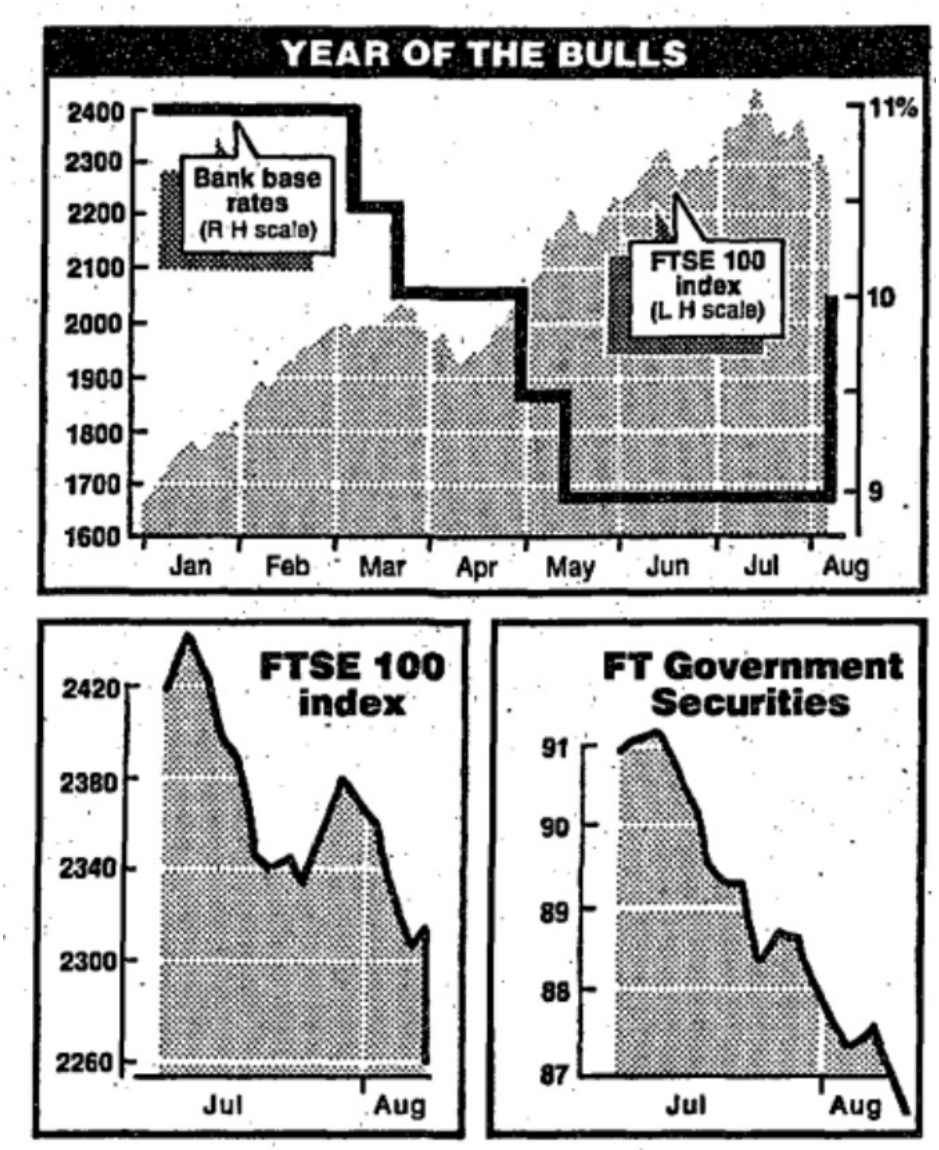

Figure 7: Graphs from the Times August 7 1987, p19. Note y-axes do not start at 0.

The error is so commonplace that W. J. Reichmann was already drawing attention to it over 50 years ago: “This suppression of the zero line is a weakness to be noted in many charts reproduced in the national Press where printing space is at a premium and where it is therefore not desired to reproduce the empty bottom half of the chart” (Reichmann, 1964: 32). This invariably leads to a false impression, as Reichmann goes on to note: “The whole of a picture must be seen to enable one to understand its full value” (ibid.). The second example, from an article about crime figures in 2018, is even less justifiable since the y axis starts at 3 rather than 0, but the space saved at the bottom of the graph by doing this is minimal as it only goes up to 15.

7. Mismatch between body text and graphic/factfile: There were again two examples in this category, both from the *Times* in 2007. An article about expenditure by members of the Royal Family claims in the text that Prince Charles's annual outgoings were £9.7m, while the accompanying graphic has it at £9.9m; the second story, about sales of the Harry Potter books, gives the total as 350m in the text, but the factfile gives the total as 325m. In both cases, the graphic and factfile were almost certainly produced by someone other than the reporter (a graphic artist and a sub-editor, respectively), who had either not read the article correctly or were working from an alternative source for their information.

8. Spurious accuracy: The sole example in this category comes from a 2018 *Times* article about first-time homebuyers. It was reported that the number of such buyers in London was estimated to be 42,983 – a degree of precision which is all the more remarkable as the other estimates in the article are rounded off to the nearest 100. It appears the reason for this precision is that reporter Tom Knowles was presented with the estimated London figure for 2007 (an eminently sensibly-rounded total of 57,900). Armed with the fact that this fell by 26 per cent over the decade, he then calculated the resulting figure for 2017 down to the last individual homeowner (this assumes the percentage decrease he was given was actually 25.8 per cent, which it is reasonable for the reporter to have written as "26 per cent" in the article). Given the 2007 estimate was only specified to the nearest hundred, the reporter ought to have rounded his calculation of the estimate to 43,000. While spurious accuracy is not especially pernicious in this particular example, Reichmann makes the point that in general it "can lead to serious misconceptions" (op. cit., 117).

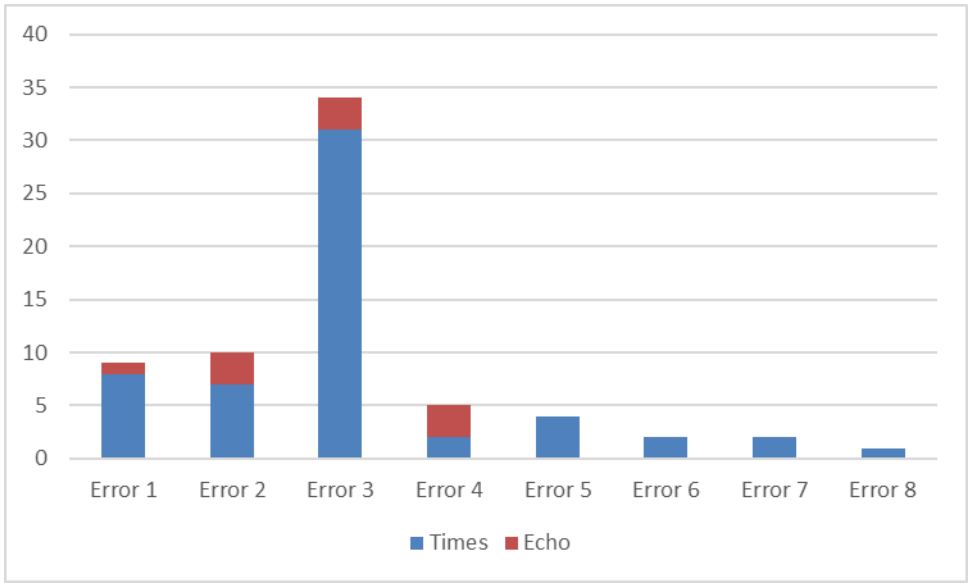

Figure 8: Types of error broken down by newspaper title.

The failure to put figures into context (error type 3) is the most prevalent error to emerge from this research, the majority of which are from the *Times*. Errors from the *Liverpool Echo* were almost equally spread between the four categories in which they appeared, while error types 1 and 2 were fulsomely represented in the *Times*' articles. It is not possible to compare these findings with those of Maier, since he did not give figures for his various error types. On the face of it, whether eight, 11 or 80 categories of error are identified, it would seem newspapers regularly get it wrong. But in fact, it is striking how few purely arithmetic errors were found. The present study found only a single example of a mistake in calculating percentage increase/decreases (namely, the *Liverpool Echo* story on council tax mentioned above); in his US study, Maier found none, which is, as he correctly notes, "a striking achievement in a profession notorious for not getting percentages right" (Maier, 2002: 518). He suggested that repeated criticism in the past had resulted in greater attention being paid to this particular error and as a result, it was much more closely scrutinised. But of course, one cannot prioritise everything – a focus on one particular aspect of numeracy may be at the expense of overlooking others.

The fact that failing to contextualise numbers was the most common error type suggests there is a lack of awareness about the importance of doing so, either through the reporter omitting this information or the production journalists editing it out because of lack of space. But what is omitted in these cases is important information such as margin of error, for example. To indicate how straightforward it is to incorporate margin of error into a story, here is how the

US website FiveThirtyEight reported their findings into how the approval ratings of presidential hopefuls changed when they announced their candidacy: “O’Rourke’s net favorability rating (favorable rating minus unfavorable rating) among Democrats fell from +45 points before his announcement to +40 after it, although the changes were within the margin of error” (Rakich, 2019). The caveat acts against reading too much into the apparent drop in O’Rourke’s ratings following the launch of his presidential bid, whereas the unqualified reporting of the change in popularity would suggest a loss of momentum in his campaign.

A second example from within this error category concerns lack of detail about a poll’s methodology, which is essential to determine its validity (as mentioned elsewhere, many news organisations will no longer report on the findings of marketing-based polls and surveys because of their methodological incoherence). For example, samples drawn from the internet tend not to be random unless extreme care is taken over their constitution. An instance of this type of error is from an article in the *Times* of January 27 2018, p23, headlined “Wedding couples fall victim to online scams”. The main body of the article was based on data gathered by an organisation called Action Fraud regarding bogus wedding services, but an associated story tagged on at the end concerned the number of teenagers who said getting married was something they aspired to. The claim, based on a survey carried out by the Centre for Social Justice (CSJ), was that “the vast majority” (78 per cent) of teenagers wanted to get married when they grew up, although there was no detail in the brief, five-sentence report about how the data were gathered. A search on the Centre for Social Justice website revealed the source to be a submission by the CSJ and an organisation called the Family Stability Network calling on the Government to amend its sex education and relationships (RSE) policy. The two bodies had jointly commissioned an opinion poll from Survation, and the submission document appears to be the basis of the *Times’* report that 78 per cent of 14-17 year olds “aspire” to marriage. However, the wording in the submission is ambiguous – the sentences summarising this part of the Survation poll read:

> Young people want to get married as adults, RSE shouldn’t ignore marriage: Eight in ten (78 per cent) teenagers (aged 14-17) want to get married. Only 4 per cent of teenagers rule it out completely. Not only do young people want a lasting relationship in adult life, they aspire to get married (Centre for Social Justice, 2018: 6).

The final sentence suggests teenagers agreed with a statement along the lines: “Do you aspire to get married?”. However, the appendix which summarises the Survation findings tells a different story. It gives the sample size as 1,011 children aged 14-17 in England (unfortunately, the link given to the full data tables on the Survation website is broken), and shows that the 78 per cent of respondents is made up of those who agreed with the statement “I definitely want to get married at some point in my life” (35 per cent) along with those who agreed with the statement “I probably want to get married at some point in my life” (43 per cent). “Probably wanting” to do something is an eccentric definition of an aspiration, normally defined as “something yearned for/hankered after”. So a more accurate news report of the contents of the CSJ submission would be: “Just over a third of teenagers aspire to get married, while the plurality view it as something they would probably do”. Admittedly, that makes for a less dramatic intro to the news story, and is probably not the message which the CSJ (a right-wing think tank with socially conservative views) would wish to see appear in headlines. Blastland and Dilnot make a similar point when they delve into a youth crime survey from 2005 which one newspaper headlined with the words: “Yob Britain! 1 in 4 teen boys is a criminal!”. Based on their analysis of the original report, the authors proposed the following more unwieldy but far more accurate headline: “One in four boys, depending how they interpret our question, admits to getting up to something or other that isn’t nice, a bit thoughtless maybe, and is sometimes truly vicious and nasty; more than that, we can’t really say on the evidence available to us” (Blastland and Dilnot, 2008: 14). It wouldn’t sell.

As an aside to the CSJ example, a search of the Survation website’s archives failed to locate the original data tables in the categories for January 2018 (when the report was published) or December 2017 (when the field work was carried out). Following an email exchange with Survation, it turned out the data tables were published in the Archive section of their website for February 2018, where finally the margin of error could be found (it was 3.1 per cent). This is mentioned to indicate how time-consuming it can be to track down a set of figures to their original source, and how much easier it is for a time-pressed journalist to repeat the numbers quoted in a press release without further checks.

That lack of arithmetic prowess did not lie at the heart of all errors is obvious from examples drawn from error type 5, which is the incorrect mixing of units or dimensions. A report into London car bombs from the *Times* dated June 30 2007, p7, claimed a single canister of propane would spread a flammable vapour cloud “over an area” of 50 to 60 cubic metres,

when of course a cubic metre is a measure of volume, not area. In their defence, the reporter may argue they used the word “area” in the sense of a “region”, but the choice of word is at best unfortunate. It unnecessarily complicates the question of how far would the blast (or at least, the vapour which would fuel the blast) spread? This is best understood in terms of blast radius, which is the radius of an imaginary hemisphere originating at the source of the detonation; the locus of the blast describes a hemisphere rather than a sphere because the downward component (into the ground) can be ignored in comparison with its propagation through air. It must be conceded that expecting the reader to visualise the extent of a hemisphere with volume of 50-60 cubic metres is a tough ask over the breakfast marmalade.

A second example of an error type 5 appears in the same edition of the *Times*, this time on a p45 article about a crackdown on cocaine use in Spain (“Waiters join the war on drugs as cocaine use soars in Spain”). A United Nations study found “3 per cent of Spaniards aged 15-64 regularly inhaled cocaine in 2005. This is double the amount consumed in 1999”. The phrasing here is puzzling. “Double the amount” refers to the amount of cocaine consumed, while “this” refers to the percentage of cocaine users – it may be there is an unacknowledged assumption that the quantity of cocaine consumed per capita did not change between 1999 and 2005, in which case the number of users would indeed be indexical of the amount consumed. Or it could be a clumsy way of saying that 3 per cent of Spaniards inhaled cocaine on 2005 compared with 1.5 per cent in 1999 (i.e. the percentage of users doubled – this does indeed seem to be what is meant, as discussed immediately below); or even that the absolute number of users doubled over that period. The data appears to derive from the UN Office on Drugs and Crime. In its report for 2005, the figure given for cocaine consumption in Spain actually relates to the year 2003 and is 2.7 per cent (UN Office on Drugs and Crime, 2005: 367); the corresponding figure in the 2000 report relates to 1999 and is 1.4 per cent (UN Office for Drug Control and Crime Prevention, 2000: 90). So it would appear the *Times* report should have read that the UN study found “2.7 per cent of Spaniards aged 15-64 regularly inhaled cocaine in 2003. This compares with 1.4 per cent in 1999”. This takes the same amount of space in print, but is immeasurably clearer. What is missing from the *Times* report are the qualifications with which the UN reports hedge their findings. For example, the 2005 report cautions that:

> Assessing the extent of drug abuse (the number of drug users) is a particularly difficult undertaking because it involves measuring the size of a hidden population. Margins of error are considerable, and tend to multiply as the scale of estimation is

> raised, from local to national, regional and global levels. (UN Office on Drugs and Crime, 2005: 383).

While it is unreasonable to expect a newspaper to summarise five pages of caveats surrounding research methodology in a 500-word article, it is an indication of how numerically complex seemingly straightforward news reports can be when examined in detail. At the heart of the numeracy deficit, it seems, is a failure to comprehend rather than a failure to calculate. The fact is that general news reporters at least are not appreciating, and are therefore not communicating, the full significance of the numbers about which they are writing, nor are production journalists always stepping in to correct such omissions. That is why this research project argues for a transformation of the field – of journalistic culture – rather than focusing only on honing individual reporters' maths skills. This puts the present researcher at odds with Maier, who concluded that the remedy lay in training, albeit on an industry-wide scale. Tackling lack of numeracy at the level of the individual misses the institutional and cultural factors which mitigate against numeracy being valued by many journalists in the same way that literacy undoubtedly is.

The significantly fewer errors identified in the business news pages adds credibility to this analysis. Whatever different is happening within the business section compared to what is happening within general news is clearly working; the current research project claims the difference is due to the nature of the sub-field, and that the journalistic field needs to be transformed so that it more homologous to the business news sub-field. That is not to argue that journalists should all be business reporters, but that the respect for and care over numbers which is typical of the business sub-field ought to be encouraged more widely. That requires a change of habitus as much as an emphasis on training.

CHAPTER FIVE: NUMERACY, HABITUS AND CULTURAL CAPITAL

As detailed elsewhere in this study, journalists can be ill at ease when dealing with figures. Bourdieu's field theory offers an explanation for this in terms of habitus, in that new entrants tend to self-select on the basis of their habitus ("This isn't for the likes of me"; or "this is what people such as us do"); as quoted earlier, Kenyon noted that "the profession attracts men and women with a literary bias and many of them meet difficulties (which they do not always overcome) in handling figures" (Kenyon, 1948). New entrants go on to obey the logic of the field by devaluing what the field holds in the lowest regard. Habitus – the law of the social order inscribed within the socialised body – plays a highly important role here, as it is responsible for an agent's positions and dispositions, for the games they choose to play and the stakes they choose to play for. It is theorised that once subject to the logic of the field, new entrants to journalism are not encouraged to develop numeracy because numeracy holds little value in terms of cultural capital. In short, those potential students who are fearful of numerical data tend to be drawn to journalism as a way of avoiding figures (because of habitus), and once they enter the field, there is little incentive to enhance their numeracy skills (because of cultural capital). As an example, colleagues of the present author recall asking undergraduate students what they thought of mathematics—many replied that it was a dislike of mathematics at school that led them to choose journalism as a degree subject in the first place. It is a view echoed in the 2014 advice to prospective students on the website of the University of Oregon's journalism department: "If you have your heart set on it, you can avoid math" (although, in fairness, the next sentence continues: "… should you take math? Of course you should!" The webpage has since changed). The consequences of poor numeracy skills among journalists are spelled out by Amelia Genis in her study examining the level of numerical competence among the profession in South Africa: "When they do use numbers, the numbers often do not make sense, either because they were not examined for discrepancies or plausibility, or because they were not put in context" (Genis, 2001: 9). Forbes columnist Dan Seligman added: "After many years of observing media colleagues at work, I would say most of them were standing behind the door when quantitative skills were handed out" (Seligman, 2002).

It goes without saying that not all journalists struggle with numeracy, nor do so in the same way—journalism is no more homogeneous a profession than any other. In their study into

how journalists' perceived maths ability determines their efficacy, Curtin and Maier (2001: 732) point out that "quantitative studies are needed to confirm or deny the universality of the constructs [i.e., related to maths anxiety] that emerged from this research". Evaluating numeracy levels is a complex issue (e.g., Gillman, 2006; Ranney et al., 2008; Boersma and Klyve, 2013; Madison, 2014), and it is not the purpose of this chapter to engage with this task. Its more modest goal is to explore whether journalism students are comfortable with numeracy by comparing their performance on a numeracy quiz with that of peers from a different discipline. The study involved 72 first-year undergraduate (Level 4) students, of whom 32 studied journalism and 40 studied statistics. In each case, the entire year-group cohort had been invited to take part, and students were given the option of whether they wished to participate or not; there were neither inducements to take part nor penalties for declining to take part. Of course, journalism students are not journalists (at least, not yet)—however, from experience at the author's home institution, around two-fifths of journalism graduates do go into the profession. Since there is no magic wand which increases graduates' numeracy once they start employment, it seems reasonable to suggest that if the journalistic field militates against the development of numeracy skills, then journalism students who are ill at ease with numeracy will go on to become journalists who are ill at ease with numeracy.

All students were given the same numeracy quiz comprising 10 questions; six questions were based on Ward et al. (2011) , and one was taken from Lipkus et al. (2001), this question having also been used in the study of Ward et al. The remainder were devised by the current author—see the end of this chapter for the list of questions and answers. Following the approach adopted by Ward et al., the rationale behind the type of questions selected was to draw them from everyday contexts and not to rely on any assumed contextual knowledge (Ward et al., 2011: 11). It was a pen-and-paper test, and students were allowed to use calculators but not allowed to access the Internet. They were given 10-15 mins to complete the test, which was carried out during breaks before or between timetabled sessions to make it seem less formal and hence less daunting. No preparation was necessary—the test was carried out immediately after students volunteered to take part. Options for the answers were a combination of multiple choice (with four options) and fill-in-the-blank. It is recognised that 'maths anxiety' can affect some students (Maier and Curtin, 2004; Ward et al., 2011), so the test was labelled a "Numeracy Quiz" to make it sound less like an exam. Students were also asked whether they had studied mainly STEM subjects (such as mathematics, physics or science) or arts-based subjects (such as English, history or media studies) at "A" level or

equivalent (roughly equal to the U.S. SAT II). Students intending to take a degree at university normally go on to study "A" level examinations from the age of 16-18, either at school or at sixth-form colleges. Many universities demand three passes at "A" level as a prerequisite for study at undergraduate level, although this requirement can vary. Students tend to specialise in science-based or arts-based "A" levels (say, pure and applied mathematics and physical science on the one hand; or history, English and politics on the other). There is no requirement for applicants wishing to study journalism to have an "A" level in a science-based subject (although a pass in GCSE mathematics is usually required). In consequence, it is typical for a journalism undergraduate to have studied no science or mathematics since the age of 16. Twenty-eight (87.5%) of the journalism students had taken subjects at "A" level which were exclusively or predominantly arts-based; three students (9.4%) had taken science-based subjects; and the remaining student had taken a mixture of both. Five journalism students had taken mathematics to "A" level or equivalent—one had a Grade B, one had Grade D, two had Grade E and one had Grade U. Among the statistics students, 32 of them (80%) had a predominantly science-based background; five (12.5%) had an arts-based background, and the remaining three (7.5%) had a mixture. Due consideration was given to the ethical dimensions of the research, which was conducted in accordance with the ethical approval granted in January 2016 (see Appendix 3).

Data Presentation

Figure 9, below, shows the percentage of students from each discipline who correctly answered each question. In general, the statistics students outperformed the journalism students, as expected. The mean score for the journalism students was 7.78 with a standard deviation of 1.184, and the mean for the statistics students was 8.63 with a standard deviation of 1.102. The value for Welch's t-test of equality of means was –3.098. Questions four and five are exceptions to the observation that statistics students did as well as or better than the journalism students. All journalism students correctly answered question four, whereas two statistics students gave the wrong answer. The error seems to be a slip in mental arithmetic, as both the statistics students who answered incorrectly gave the answer "2051" instead of "2061" (and two further statistics students initially wrote "2051" but crossed it out and then selected the correct answer —none of the journalism students did this).

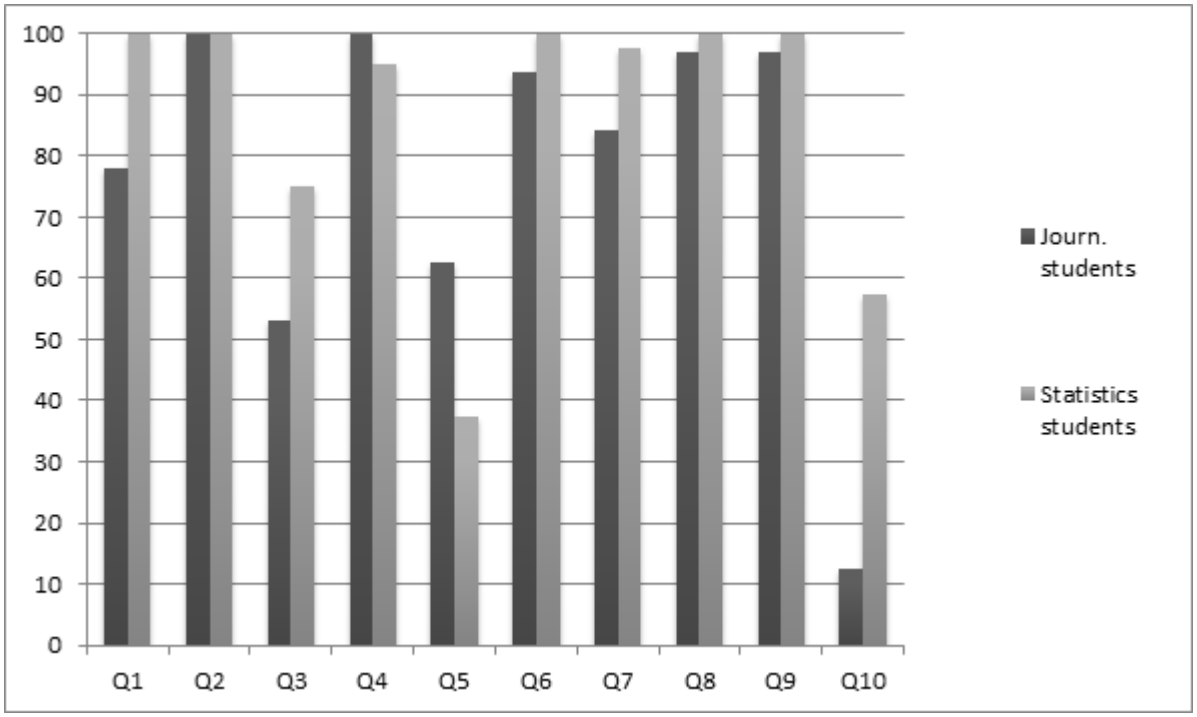

Figure 9: Percentage of students answering each question correctly

Question 5 proved to be more problematic. The correct answer was "2% in 10 years," and the "Answer" field of this part of the question paper was left blank for the students to write in their responses. However, 22 (all but three) of the statistics students who got this item wrong had written simply "2%," possibly because they took the "...in 10 years" part of the answer as going without saying. On subsequent re-examination of the source of this question, a discrepancy emerged. The question was initially drawn from Ward et al., who indeed give the answer as "2% in 10 years" (Ward et al., 2011: Appendix A). However, Ward et al. had in turn taken their question from the 2001 study of Lipkus et al., whose paper gives the answer as "2%" (Lipkus et al., 2001: 40). Because of this ambiguity, question 5 has been excluded from the analysis in Figure 10. The mean score for journalism students when Q5 is excluded was 7.16 (sd: 1.110), and that for the statistics students was 8.22 (0.881), with an associated Welch t-test of –4.436. If the study were to be repeated in the future, this question will have a gapped Answer field (" % in years") to make it clearer what is required.

The largest variance is with Q10, where only four journalism students (12.5%) gave the correct answer, compared with 23 statistics students (57.5%). Among the journalism students, 11 students (34.4%) did not attempt to answer, while for the statistics students, only one

student (2.5%) did not attempt an answer. This result is consistent with the view that the statistics students felt far more confident about attempting an answer. Interestingly, Q6 also involves percentages, although here the problem is cast in non-mathematical language—working out the tip on a restaurant bill. This question was answered correctly by 30 of the 32 journalism students (93.75%) and attempted by them all, which indicates that the journalism students have little difficulty with the technique of calculating percentages. It is, rather, the language used that appears to have defeated or at least deterred the journalism students, which supports the view of Curtin and Maier (2001: 720) that "perceived math ability, not actual ability, appears key to determining the extent that journalists work effectively with numbers". The extent of the difference in performance between the two groups of students is vividly illustrated by Figure 10, which partitions the students by the number of correct answers they gave (Q5 is excluded, for reasons given above).

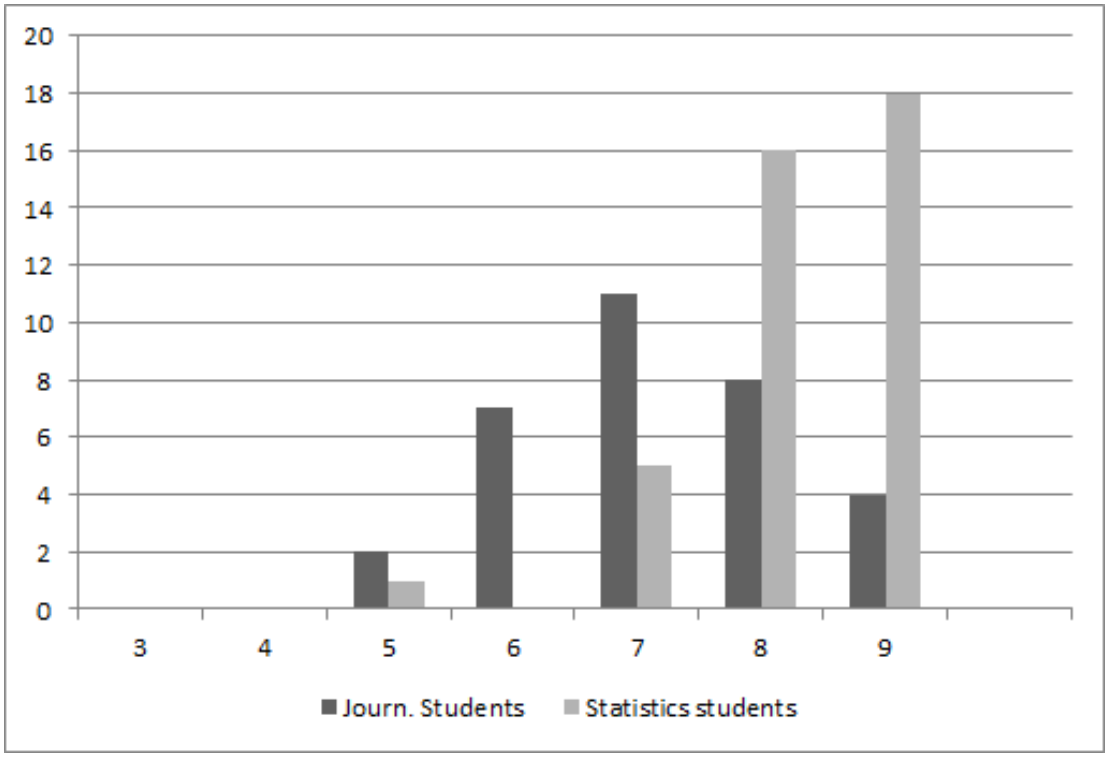

Figure 10: The two frequency distributions of correct answers (Q5 excluded). Number of students is along the y-axis; number of correct answers along the x-axis.

So what types of mistakes did the journalism students make? The first question asked for half of one-third, which all the statistics students answered correctly. Eight of the journalism students answered "two-sixths," doubling denominator and numerator rather than just the

denominator. Q3 proved more challenging, requiring students to evaluate 20% of 80%. Thirteen journalism students got it wrong (giving three different answers between them), while another simply wrote: "Don't know." For Q7 (where the statistics students again all answered correctly), there were four "Don't knows" and one incorrect answer. The "Don't knows" were out in force for Q10, with 11 of the journalism students (34.4%) either writing "Don't know" or leaving the answer field blank. Yet none of the statistics students failed to give an answer to any question. The fact that so many of the journalism students failed to attempt an answer to Q10 is something to which we will return.

Factors at Work

There is evidence here that journalism students are generally quite capable when it comes to dealing with numeracy questions. Of course, as one might anticipate, they are not quite as strong as statistics students, as Figure 10 in particular illustrates - yet the fact the journalism students nevertheless obtained a mean score within one point of the statistics students implies their mathematical ability is generally good and the gap in maths skill between the two groups is not large. Given that journalism students (many of whom go on to become journalists) fare quite well with maths problems, why is it that journalism has a numeracy problem? The present author wants to list a few of the more widely recognised reasons for numerical failings before going on to explain the situation in terms of habitus and the field. Six of the main factors contributing to journalists' numerical errors are:

1. pressure of time;
2. limited or unreliable sources;
3. lack of knowledge or interest;
4. lack of space;
5. mistakes introduced during the editing process;
6. errors in transmission[34].

Of these, time pressure is the most significant and can lead to many of the others. It is not just the reporter in the field who toils under the burden of imminent deadlines (a burden made

[34] Five of these errors were listed by the *Columbia Journalism Review* (CJR) in its analysis of why journalists get numbers wrong (CJR, 2009).

even more onerous with the rise of 24-hour news[35] and digital-first publication strategies)—the news editor who insists on a topical angle, the sub-editor who knocks out a quick headline, and the executive who creates a "write-off" (a summary designed to pique interest in the full version of an article inside the newspaper) for the front page are equally pressed for time and equally prone to distort, misinterpret or over-sell an otherwise perfectly crafted news story. As an example, a reporter at one of the current author's former newspapers wrote an accurate account of the annual soccer match between politicians and journalists which took place during a Labour party conference in Liverpool. Unfortunately, the headline read: "Journalists beat Labour XII in football match," (*Liverpool Echo*, 2011) which suggests that the sub-editor who wrote it either did not know that 'XII' is '12' in Roman numerals, or that there are only 11 players in a soccer team. Such mistakes are by no means rare; Maier's three-month audit of a daily newspaper found "mathematical errors to be fairly prevalent—a new type of numerical error was identified about every other day" (Maier, 2002: 507).

Staffing levels, too, play a part in why numerical errors creep in. The Pew Research Center quotes figures from the American Society of News Editors' Newsroom Employment Census showing that "after falling 11% in 2008 and 6% in 2012, overall newsroom employment was down 3% in 2013—the most recent year for which figures are available—to 36,700" (Barthel, 2015). Francois Nel estimated that between 2001 and 2010, "the UK's mainstream journalism corps has shrunk by between a quarter and a third" (Nel, 2010). Not only does fewer reporting staff mean that an individual reporter needs to work harder, but some reporters now write their own headlines as well, meaning that the traditional "second pair of eyes" associated with the sub-editor are no longer brought to bear on the story. In addition to such innocent blunders, the editorial stance of a news publication may affect its handling of data. In the run-up to an election, a staunchly right-wing newspaper may present poll data in a radically different way to a rival left-wing newspaper—it is barely worth mentioning the numerous ways in which data can be deliberately massaged, misrepresented or omitted (e.g., Reichmann, 1964; Huff, 1991; Best, 2012). A noteworthy example was the use of poll data by *The Sun* purporting to show that one-in-five British Muslims supported jihadi terror groups such as ISIS. The widespread criticism of the way the newspaper treated the data led the polling organisation which carried out the survey to distance itself from the report, saying

[35] The very title of Rosenberg and Feldman's 2008 polemic against 24-hour news culture aptly sums up the problem: "No Time to Think".

it did not "endorse or support the way in which this poll's findings have been presented by the *Sun* newspaper" (*Guardian*, 2005). Finally, some argue that the very form of news—its need for narrative, drama and novelty—leads journalists systemically to simplify and to de-contextualise their stories, which in turn means less emphasis is placed on verifiable data and more on opinion (Davies, 2009). While this criticism may be true of some tabloids, it is too sweeping a generalisation to cover the majority of quality newspapers, and does not explain how most newspapers do manage to get it right most of the time (Maier, 2002).

All the above, however, are well-recognised as causes of error in stories which involve numeracy. In exploring why journalism students (and journalists) sometimes get it wrong, the current researcher wants to put forward the view that one of the reasons is "cultural", as opposed to purely technical. This chapter's emphasis on cultural limitations leads to a recommendation that, if not novel, is certainly unfamiliar—namely, that journalism schools ought to draw their intake from the ranks of the science, maths and technology (STEM) students as well as from the traditional pool of English and creative writing students (in fairness, Curtin and Maier, 2001: 733, do propose "making math a requisite skill for a degree in journalism," and Madison, 2012, persuasively argues the case for teaching STEM students how to write).

Changing the Culture

It is a claim of this thesis that a theoretical model of habitus and symbolic capital (specifically cultural capital), can go some way towards explaining the reluctance of journalists to engage with numbers. One reason for considering the possibility that cultural factors are at work is that the level of mathematical ability required to report most news stories is minimal, and so what frequently seems to be lacking is cultural confidence, not a grounding in mathematics – as the performance of the journalism students suggests. There are many cultures— cultures of style, of language and of belief. As noted in Chapter Three, two of the dominant cultures of the modern world were famously contrasted by C. P. Snow in his influential 1956 essay *The Two Cultures*. Snow coined, or at least popularised, the term "the two cultures" both in this *New Statesman* article and in a lecture three years later in order to highlight the polarisation of society between the arts and the sciences (Snow, 1959). While the debate has developed in sophistication over the intervening decades (Brockman, 1996; Bernstein, 1993; Orrill,

2007[36]; Leavis, 2013), Snow's underlying contention remains valid—lack of understanding between scientists and non-scientists is damaging to the wider intellectual development of society. As Bernard Madison (2012: 2) has observed, while Snow's view "may be an exaggeration of what we have today" regarding the breach between scientists and humanists, "we are not far away". The culture of the man of science valorises analysis, rigour and quantitative thinking, while that of the man of the arts values instinct, spontaneity and creativity. However much members of each group may differ from each other, each group is bound by a common element which radically separates its members from the members of the other group: "Without thinking about it, they respond alike. That is what culture means" (Snow, 1959: 6).

As Figure 10 above shows, there were some differences in the performance of the two groups of students in the numeracy test, yet none of the questions required any deep mathematical facility or knowledge. Notably, those questions which were framed in non-mathematical language (such as Q2 or Q6) show no appreciable difference in performance; however, the final question, which explicitly requires students to calculate a percentage increase, showed the greatest difference. This performance is consistent with the proposition that one factor at work is the effect of habitus. How well students fared with Q10 partly depends on which group the student is in: statistics students happily tackle Q10 even though they may get the answer wrong; journalism students shy away from engaging with it. This behaviour is consonant with the view that confidence rather than ability between the two groups plays an important role, with the journalists showing greater trepidation about risking an answer. The behaviour is a trait of habitus rather than knowledge or ability, and it is the sense in which Bourdieu's cultural norms and expectations go to work, silently determining what is thinkable and hence what is achievable — delimiting the possibility of providing answers, thinking a problem through or challenging the imagination. Given that the habitus of the journalism student is such that numeracy is not highly valued, why does this not improve over time? The answer is because numeracy is not a stake within the journalistic field; it is not a prize to be valued. The tendency, therefore, is for journalism students not to develop their numeracy skills because this is not a behaviour which the field rewards. This is a view supported by the perspectives of working journalists interviewed by Curtin and Maier (2001:

[36] Orrill pithily sums up what is at stake in the formulation that "opposition to quantification has become deeply-seated in the heritage of humanism" (Orrill, 2007: 56).

734): “I don’t know what the answer [to improving maths confidence among journalists] is, but we’ve got to change the culture.” Hence the following section examines how that culture originated and developed through consideration of the writings of Henry Care.

Henry Care – Proto-Journalist

The writing career of Henry Care is instructive in this context, as it exemplifies the way in which an interest in numeracy was able to flourish prior to the establishment of the journalistic field. At this point, towards the end of the seventeenth century, there were no cultural expectations exerting pressure on a writer such as Care, nor had the social conditions leading to a specifically journalistic habitus been formed. As a result, Care was able to give free rein to his interest in both literacy and numeracy unencumbered by field effects. Henry Care (Carr or Cave, in some texts) has previously been referred to in this research project as a proto-journalist, and his career has been extensively studied by Lois G. Schwoerer (2004). At the time Care was writing (from 1670-1688), the term “journalist” was of course unknown, but more to the point, the very notion of what it meant to be an intelligencer, news-writer or “Scribler” was indeterminate. It is a matter of societal circumstance rather than inevitability that journalism in later years came to be associated with the literary field, and that writers such as Swift, Defoe and Thackeray were held up as examplars of the profession (“In the hands of Defoe, the English newspaper first earned its conventional title by becoming … a Fourth Estate”; “the newspaper man’s vocation seldom brought him into creditable notice before Swift’s genius had elevated the calling” (Escott, 1911: 78, 92); Thackeray’s article on the death of Prince Albert in the Cornhill magazine which he edited was “so exquisite in … grace of sentiment” that his publisher had it framed in his study (Robertson Scott, 1950: 62)). Care is a glimpse into what the role of and expectations for a journalist may have become, had the profession not taken its literary turn in the years following his death.

Care was born into a modest, probably impoverished background, and it is likely he received some legal training in his youth (Schwoerer, op. cit.). He is best-known for his series of anti-Catholic, pro-Dissenting tracts published as *The Weekly Pacquet of Advice from Rome*, from 1678-1683. Schwoerer describes the *Weekly Pacquet* as “the most important popular history of the seventeenth century in England” and Care as the most important popular historian of

early modern England[37] (op. cit., 44). The *Weekly Pacquet* is Care's most sustained work and is regarded by some as the first regular newspaper; it preceded Benjamin Harris's *Domestick Intelligence* by six months and although its topic is the history of Roman Catholicism, its ulterior purpose was to comment on the unfurling Exclusion Crisis amid the ferment caused by the Popish Plot. The *Pacquet* typically consisted of eight pages measuring approximately 5 ½ inches by 7 ½ inches and the pages were consecutively numbered within five volumes (although a parallel fifth volume was published by Care's original printer), so Care and his readers clearly considered it a continuing publication. The final two pages were generally given their own heading, "The Popish Courant", and set in a larger body font so it appeared as though it were a separate publication, in which Care satirised Catholic beliefs and publications. When the *Weekly Pacquet* was prosecuted for defying the Licensing Act in 1680, presiding judge Chief Justice Scroggs described the publication as "a newsbook or pamphlet of news" and censured publishers and booksellers who "undertake to print news foolishly" (Fox Bourne, 1887: 44). The point is that Care's status as a proto-journalist is well-supported by the evidence of his publications and the way in which he was treated by his contemporaries.

One of Care's earliest publications was what we would characterise today as a self-help guide, *The Female Secretary* (published in 1671), which took the form of a series of model letters aimed at the poorly-educated letter-writer; in this case, specifically aimed at the "gentlewoman", whose educational opportunities had diminished over the preceding century. Though the format was hardly original, stretching back nearly 100 years in England and further in Europe, Care's was the largest collection of its kind at the time. What is most interesting about the choice of subject matter is that among the last works he published, in 1687 (although sections were written earlier), was also a self-guide, this time aimed more generally at "FORREIGNERS", "Children and Ignorant People", and the "Countrey-man" (Care, 1687: title page, preface, p90), although its main intended audience was probably merchants and those who plied the "Mechanic Arts". Significantly for the purposes of this research, it includes a section on arithmetic which outlines "as much of that Necessary Art, as most Professions and Ranks of Men have occasion to make Use of it" (op. cit.). In Care's

[37] A view not universally shared – one press historian of the period concludes a passing reference to the *Weekly Pacquet* with the words "Little notice need be taken of Care during this reign [Charles II]" (Muddiman, 1923: 213).

view, that extended as far as "the Rule of Three" (proportion), which was especially common in commercial arithmetics (Flegg, 1984: 126), which supports the view that his intended audience was commercial and mercantile. While the idea of a self-made man writing a self-improvement guide may strike the modern reader as an early example of an encouragement to social mobility, the text is not designed to help its audience transcend their allotted place in society but better to fulfil it. Care expresses the hope that by means of his book, his audience will "Learn as much of that Necessary Art, as most Professions and Ranks of Men have occasion to make Use of" (Care, 1687: preface); that is, he hopes they will learn enough to perform and conform to their role in society, rather than supplying them with the means to rise above it. In this sense, superficial comparisons with later self-improvement manuals, such as Samuel Smiles's Self Help (first published in 1859), are misleading.

While guides to letter-writing were more common by the 17th century than guides to arithmetic, Cave's textbook was by no means the first. Among the earliest, and by far the best-known, such writer was Robert Record (or Recorde), whose six-volume set of instructional manuals was published between 1543-1557, one volume of which was still being re-printed as late as 1699 (Pauvel, 1989: 2). Record is chiefly remembered as the originator of the symbol "=" to represent equality because, as he wrote, "noe 2 thynges can be moare equalle" than two parallel lines. His chosen form of presentation was the dialogue – a more "literary and humanistic" form which draws on Platonic rather than Aristotelian sources (op. cit., 3) and which prefigures Galileo's more celebrated use of the form (Boyer and Merzbach, 1989: 323). Record was evidently less circumspect than Galileo, though, since he ended his days in prison, possibly because of political or religious reasons. In contrast to Record's use of the dialogue, which by this time may well have come to seem stylistically dated, Care uses the fluid, conversational style developed over his years as a propagandist, addressing the reader directly ("you are to observe, that we commonly express all Numbers by these Nine Figures …", Care, 1687: 75). The second person is used throughout, including the longer first section on language, and Care is not afraid to employ humour to make his point; in a section giving examples of homonyms ("Of words much alike in Sound but unlike … in Signification"), he illustrates the difference between the words "nose", "news" and "noise" with the colourful exemplar: "What a noise do you keep with your snotty Nose, that we cannot hear the News" – a reference, surely, to his own occupation. This supposition is strengthened when we recall Care published a pamphlet entitled "Snotty Nose Gazette; or Coughing Intelligence" in November 1679.

Care's arithmetical syllabus is far less advanced than Record's, of course. Record's six-volume set[38] included such advanced topics as the newly-discovered method of extraction of cube roots (commonly attributed to del Ferro around 1500 but only published by Cardano in 1545), while Care covers only basic arithmetic operations up to the so-called "rule of three" (in which three quantities in proportion are given, from which the fourth is to be determined). The Rule of Three, explains Care, is "as far as most PROFESSIONS have Occasion for". Even in Care's time, the Rule of Three was hardly cutting-edge material; it was known to the ancient Egyptians, who applied it (admittedly without describing it) in the Rhind papyrus dating back to 1650 BC, and the problems are certainly earlier (Boyer and Merzbach, 1989: 18). Care's notation and presentation, such as the "galley" method of division, was still being taught up to the 19th century in parts of Europe (Flegg, 1984: 115).

Care is clearly master of his material and there is no suggestion he worked with a collaborator (although he readily admits he drew on earlier authors – see below), so we can infer Care's grounding in at least basic mathematics was sufficient to give him the confidence to undertake this part of the book. At one point, he comments on European attempts (only partially successful) to align the calendar with the actual movement of the heavens by adopting the Gregorian calendar with the words: "If I mistake not, I could propose a Method which should keep our Reckoning even with the Suns Course forever" (op. cit., 73), which exhibits no lack of belief in his own talent[39]. The examples Care gives have a real-world context; for example, rather than proposing an abstract instance of multiplication after giving a series of rules, Care writes: "There are commonly reckoned 365 days in a year, and I am 39 years of Age, I would like to know how many days I have Lived?" before going on to calculate the product as 14,235 (op. cit., 87) – leap years being expressly ruled out under the terms of the question.

Intriguingly, if the age given in the above example was Care's true age at the time of writing, it would imply the book was written or revised in 1685-86, whereas Care's biographer Schwoerer suggests it was written earlier, perhaps in 1683-4, before Care joined James II's court and was out of favour with the authorities, thus having time on his hands. Schwoerer

[38] Although Pauvel (1989: 5) convincingly suggests the majority of Elizabethan readers got no further than the first volume.

[39] Great Britain finally adopted the Gregorian calendar in 1752.

supports this date on the basis of Care's statement in his preface that the book was written "in a tedious time of inforc'd Leisure and Retirement" (Schwoerer, 2004: 225). But an alternative possibility is that the main body of the work (on spelling and grammar) was indeed written at the earlier date; that Care's remark above relates specifically to this section; and that the section on arithmetic was added nearer to its publication in July 1687, the date it was approved by the licensor Robert Midgley. Such a possibility is supported by Care's remark in his preface that to his Tutor he has "**added** an Introduction to Arithmetic" (op. cit., emphasis added), which could of course have been composed at a later date. There is one further hint as to the sequence of composition – Care leaves the reader with a series of worked examples, one of which begins: "Now suppose I am 41 years old …" (Care, 1687: 103). It is tempting to think these final exercises were added at the last minute, which would give 1687 as the date the sentence was written. Of course, it may be that both the ages given in the text were entirely arbitrary, bearing no relation to Care's actual age at time of writing; but it is curious the ages coincide with the dates so neatly. If the considerations discussed above are correct, this would provide fresh information regarding the sequence of composition of the *Tutor*.

The examples in the Arithmetic section are drawn from the military, agricultural and commercial worlds, grounding the lessons in territory which would have been practical and familiar to Care's readers. It is a technique of which modern champions of numeracy education would approve - for example, "Common to all of the definitions is that QL [Quantitative Literacy] is the ability to apply mathematical operations to real-world problems" (Ward et al., 2011: 4), or again: numeracy is "the power and habit of mind to search out quantitative information, critique it, reflect upon it, and apply it in … public, personal and professional lives" (Grawe and Rutz, 2009: 1). The selection of examples is not random; Care makes an effort to furnish his readers with real-life situations to which they can relate, rather than treating the subject purely in the abstract.

Care acknowledges he has drawn on previous works; he has "partly by my own Observations, and partly from the Ablest Authors on this Subject, Collected and Digested the following Rules and Directions", but there is no doubt the writing style and tone is his own. Throwaway comments indicate Care was either working from memory in places or at least wished to give that impression (and it is difficult to imagine why he would wish to do so were he not working from memory); in the first section on language, for instance, he lists words that begin with the letter "c" but are pronounced "s" before adding: "All other words (as near as I

can remember) …", while in the following paragraph he assures the reader, "There are seven words (I can think of no more at present) beginning with …" (op. cit., 27). The style is much more that of casual conversation than a formal training manual. Style is very important here - the lack of a fully developed arithmetic symbolism in 17th C. England (which in any event would have appeared alien to Care's intended readership) means operations such as division and proportion (the "rule of three") are described in words rather than illustrated by formulas. While this can result in sentences which strike the modern reader as convoluted, this is typical of arithmetic text books of the period and Care is perfectly clear at every step of his explanation. In short, Care is master of his material and is no mere puppet ventriloquising the work of others. This suggests his own numeracy skills are highly developed.

There is evidence that Care viewed mastery of arithmetic as morally desirable, as well as of practical benefit. In his 1686 pamphlet "The Character and Qualifications of an Honest Loyal Merchant" (Care, 1686), he puts forward the proto-Whig argument that the merchant-trader is "one of the most useful members in a State" and should be treated with respect and honour rather than with contempt and disdain – the argument would become well-worn in the eighteenth century, reaching its apogee in Defoe's *Complete English Tradesman* (1726) where Defoe observes that "the tradesmen in England fill the lists of our nobility and gentry" (cited in Mackie (Ed.), 1998: 291). Care's own panegyric to the tradesman contains the observation that: "HE is well-skill'd in that Foundation of Arts, the Science of Numbers: for as Merchandize (next after Religion and Justice) is the life of the Weal-Publick, so Practical Arithmetick is the Soul of Merchandize" (Care, 1686: 7). It was precisely in order to spread knowledge of "Practical Arithmetick" that Care wrote the second part of the *Tutor*, as it covers the very ground he identifies as the ideal merchant's *sine qua non*: "Measures, Weights and Money of all forreign Countries … not only by their several Denominations but also in their Instrinsick Values in weight", rates of exchange, calculation of wages, tolls and taxes, and bookkeeping. To take just one worked example from the *Tutor*: "If one Sea-man have 14 s. per Month Wages, what will the Wages of 3349 Sea-men for the same time come to?" (Care, 1687: 88). It is as if, then, the *Tutor* is part of a moral mission to provide that education which is the basis of the all-important merchant class.

The reading public evidently harboured no misgivings about purchasing a book on numeracy written by a man so closely associated with the writing of periodicals; *The Tutor to True English* was re-issued in 1668 and 1690 and a second edition appeared in 1699, according to

the introductory note to the facsimile edition (this note should, however, be treated with caution as it erroneously labels the arch anti-Catholic propagandist Care as "a controversial journalist with Catholic leanings"). Contrast that with the situation today, where the fact that a mathematics book had been written by a news reporter would be more likely to injure than increase sales. A case in point is the recent best-seller *Alex's Adventures in Numberland*, where author Alex Bellos is described on the fly-leaf as an academic first and subsequently as having "worked for the *Guardian*" (Bellos, 2011). In fact, Bellos spent a decade working as a reporter, initially with the *Brighton Argus* and also as a freelance, yet the publisher refrained from marketing the title as by a "journalist" or "reporter", judging quite reasonably that such a description might undermine public confidence in its numeracy credentials. In terms of the publishing field, journalists clearly have less symbolic capital when it comes to expertise on the subject of numeracy. In a similar way, numeracy has little cultural capital within the journalistic field itself, certainly within the sub-field of general news reporting, a fact that Alex Bellos acknowledged when he wrote how it was "disquieting to realize just how innumerate most journalists are. … For my colleagues, the calculation [about road cones on a motorway] was a step too far" (Bellos, 2011: 9).

However, Henry Care was writing at a time when fields as such barely existed, never mind the journalistic field ("The journalistic field emerged as such during the nineteenth century"; Bourdieu, 1998a: 70); in fact, fields are constitutive of modernity. We take here a widely-shared view that modernity begins in the mid-17th century (c.f. Trainor, 1998: 135: "Writers such as Hobbes and Locke ... inaugurated modernism"). Neveu remarks: "Bourdieu's theories follow Weber and Durkheim in portraying modernity as a process of differentiation into semi-autonomous and increasingly specialized spheres of action. These spheres or 'fields' are structured systems of social relations" (Neveu, 2007: 336). So the fact that Care was operating prior to the establishment of the journalistic field allows us to glimpse how that field could have been structured otherwise. Fields and sub-fields are always contingent. They are also subject to change. These points are crucial to the thrust of the current research, since it argues that one way to improve the quality of numeracy within journalism is via a transformation of the field. The example of Care's *Tutor* shows there is nothing about the journalistic field which is inherently antithetical to numeracy.

Further, Bourdieu argues that fields are subject to the force of inertia; once a set of practices takes hold, it requires effort to shake them off, and so the earliest configuration of the field

tends to dominate. As Benson puts it: “According to Bourdieu, the ‘rules of the game’ that are established at a field’s founding tend to endure” (Benson, 2005: 95). Bourdieu conceives of this as a form of “path dependency”, because the stakes of struggle within a field depend on “the state of the possibilities bequeathed by previous struggles” (Bourdieu, 1996). At the outset, then, the morphology of the field is up for grabs; but once it coalesces into a formation, cultural inertia tends to preserve its structure. In the case of journalism, the field’s formation occurs in the first decades of the nineteenth century as industrial, technological and socio-political factors shaped journalism into a quintessentially literary form. Its highest values were enshrined as those of fine writing rather than fact-finding, and its touchstone was the polished prose of Addison and Steele, not the tawdry news stories which filled the gaps. This development has not been entirely beneficial to journalism’s progress; as the current writer has argued elsewhere, up until the turn of the 20th century, “news” was conceived as a low-value commodity which was unearthed rather than created (Harrison, 2020). The figures, statistics and numerical facts which constituted the raw material of news stories were therefore doubly under-valued, as unrefined ore destined to be smelted into commonplace news reports. The concept of news reporting as an act of creative originality, as exemplified in practices such as the interview and the news investigation, are inventions of the late 19th century. The glimpse into proto-journalism afforded by the example of Care suggests this subordination of numeracy to literacy as the journalistic ideal was not inevitable and can be modified, and on occasion even reversed.

Of course, this argument does not preclude other factors, such as those discussed earlier, having an effect too. Even so, society needs reporters and production journalists who can analyse, interrogate and challenge quantitative information. While it remains true that journalists can always draw on the expertise of data specialists or statisticians on an ad hoc basis, it is their ability to frame questions and to express conjectures that is the journalist’s most valuable skill—the data specialist can only find answers where it is known (or suspected) that questions lurk. One solution is to further improve training for journalists and journalism students—an approach which has obvious merit. Genis (2001) proposes several steps for remedial action, and handbooks exist for journalists struggling to get to grips with number-based stories (e.g., Wickham, 2003; Livingston and Voakes, 2005; Cohn and Cope, 2012; Miller, 2015; chapters in Nguyen, 2018). Improvements in journalism numeracy training will tend to lead to an increase in technical proficiency and so such training is to be

encouraged; some practical suggestions for implementing improvements are made in Appendix One.

However, a second approach suggests itself—and that is not only to modify journalism training, but to disrupt the culture of journalism itself. Rather than recruiting journalism students exclusively from the pool of those whose habitus has led them to gravitate towards subjects such as English and history, an alternative is to encourage those who value numeracy to apply to be journalists. In other words, journalism should be presented as an appropriate and attractive choice of university study to students who have excelled in maths or science at school. This is rarely the case at present—in the UK, there is considerable financial incentive for sixth-form students (i.e., those aged 16-18) who have studied science or mathematics to take STEM (science, technology, engineering and maths) degrees, not least because of the serious shortage of teachers in these subject areas. At the risk of making an over-generalisation, quantitatively-minded students at age 15 or 16 are guided to study maths or science, while their arts-inclined peers are shepherded towards creative writing or journalism. The lack of STEM students applying to study journalism has two consequences. First, the culture of journalism remains firmly based around the arts[40]; second, positions in data journalism tend to be filled by candidates who do not have journalistic backgrounds (since journalists rarely have the interest in applying). There are notable exceptions, such as the European Journalism Centre's recent online data journalism course (EJC, 2014), but these initiatives are not degree-level programmes aimed at prospective students. We should therefore not be surprised to learn that reporting that requires numeracy skills is neither as widespread nor as vigorous as it might be. The habitual coinage of a journalist's cultural capital is words, not numbers.

A natural objection is that students with a strong interest in numeracy may not be effective communicators. But there is no reason to think it is harder to teach communication skills to a science-based student than it is to teach the value of numeracy to an arts-oriented student (and it is not always the case that arts students have strong communication skills!). Indeed, some educators believe this approach would be a positive boon to STEM students: "Quality writing is … what STEM students need to learn" (Madison, 2012: 3). The challenge is not

[40] In the words of *Forbes*' writer Dan Seligman: "Liberal arts graduates control the media, which doubtless helps the prose – but generates endless screwups in numbers" (Seligman, 2002).

only in the teaching but also in recruitment, since there is no tradition of STEM students being encouraged to study journalism—yet this could prove crucial to journalism's mission of "enhancing people's understanding of the world on issues likely to empower them as citizens in a democracy" (Cushion, 2012: 2). An influx of STEM students would help shift the centre of cultural gravity from an environment which treats numbers with disinterest to one which thrives on the precision they bring. Naturally, this approach does not preclude efforts to bolster numeracy among existing journalism students, which remains a necessary though complex challenge.

On a pragmatic level, it must be acknowledged that institutional inertia militates against any changes to admissions policies or procedures happening speedily or painlessly. Accordingly, an interim approach would be for journalism students to work alongside STEM students on joint projects or within workshop groups. Such activity undoubtedly occurs on an ad hoc basis in many institutions (at the current author's own institution, journalism students have worked alongside coders from the ScraperWiki data aggregation project ScraperWiki.com to produce data-driven news stories), but there is no evidence this practice is common on a systematic or widespread basis. The pedagogical value of such interdisciplinary teaching and learning is summarised by Ellis (2009: 10) when he writes that, while the discipline-based approach has its conceptual advantages, it is also limiting: "There is always the possibility of substantial omission if knowledge is wholly structured within disciplines." Journalism would benefit from a change in culture in addition to improvements in training. Although there may be structural obstacles (for example, Madison, 2012 points to the difficulty of finding suitable instructors), there are pedagogical benefits from such an unorthodox approach. In bemoaning the gap between the culture of the arts and that of the sciences, C. P. Snow (1959: 9) spelled out what was in danger of being missed: "The clashing point of two subjects, two disciplines, two cultures—of two galaxies, so far as that goes—ought to produce creative chances."

Numeracy Test: Question paper and answers

Please attempt to answer all questions. You should circle the correct answer or write the correct answer in the space provided. Do NOT put your name on the paper – all answers are submitted anonymously.

Question 1: You want to make a small cake. You plan on using half of a cake mix. If the box tells you to use 1/3 of a cup of sugar, how much do you need to make your small cake? [adapted from Ward et al]

a) 2/6

b) 2/3

c) 1/4

d) 1/6

Question 2: If it takes you exactly 22 minutes to get to university, what time should you leave to arrive there at 9am? [adapted from Ward et al]

a) 8.32am

b) 8.38am

c) 8.42am

d) 8.44am

Question 3: If 80% of the population is exposed to swine flu, but only 20% of those exposed actually contract it, what is the percentage of the population that actually gets it? [Ward et al]

a) 42%

b) 60%

c) 16%

d) 20%

Question 4: Halley's comet passes by the Earth every 76 years. The last time it came was in 1985. When is the next time that it will pass by the Earth? [Ward et al]

a) 2051

b) 2076

c) 1985

d) 2061

Question 5: If person A's risk of getting a disease is 1% in 10 years, and person B's risk is double that of A's, what is B's risk? [Lipkus et al; subsequently used by Ward et al]

Answer: 2% in 10 years

Question 6: You are at a restaurant and receive very good service. On a £40 bill, what is a

15% tip? [adapted from Ward et al]

a) £6

b) £2.88

c) £8.90

d) £4

Question 7: You have a fair coin, which means the chance of getting heads on a single toss is ½. Suppose you toss the coin 10 times and get 10 tails in a row. Is the chance of getting a head on your next toss more than, less than or equal to ½? Explain your reasons briefly. [adapted from Ward et al]

Answer: It is still ½. Each toss is independent.

The chart below (Figure 11) shows how many bronze, silver and gold medals were won by Britain, USA, Russia and China in the 2012 Olympics compared with the 2008 Olympics. The final three questions are based on this chart.

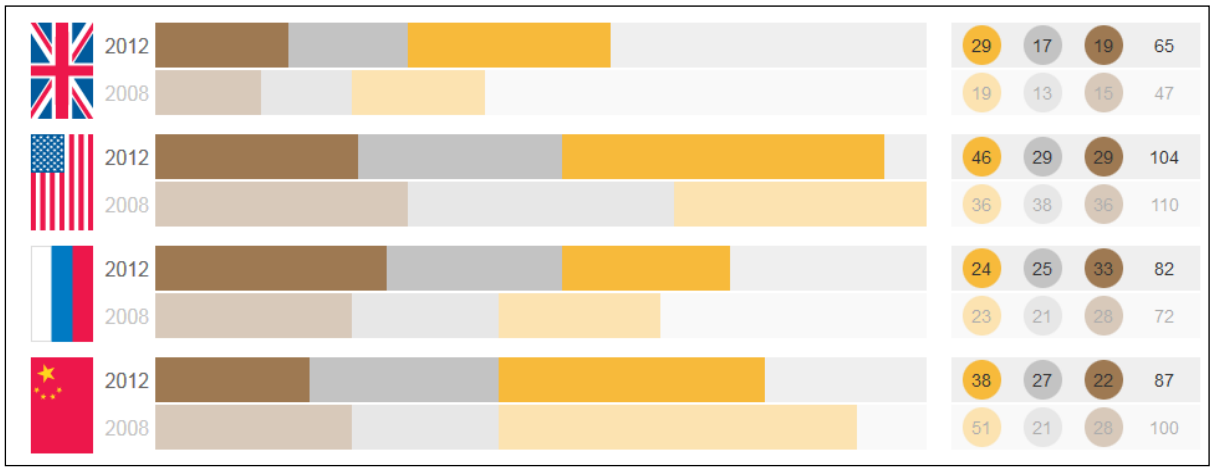

Figure 11: The chart on which questions 8-10 are based.

Question 8: Which team of those shown won the most gold medals in 2012?

Answer: USA won the most gold medals in 2012 (46 of them).

Question 9: Which team of those shown won the fewest bronze medals in 2008?

Answer: Britain won the fewest bronze medals in 2008 (15 of them).

Question 10: Approximate the percentage increase in Britain's total number of medals from 2008 to 2012.

Answer: Range 33%-40% is acceptable (to one decimal place, the answer is 38.3%).

CHAPTER SIX: CASE STUDIES

What practical effect can the undervaluation of numeracy have on the quality of journalism? One way to determine this is through a series of case studies, which analyse examples of impoverished or incorrect reporting. It is theorised that field-specific effects - the lack of a "feel for numbers" (habitus) coupled with a disincentive to improve matters (low cultural capital) – contributes to this state of affairs. 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 health reporting and focuses on a perennial scare story, that concerning the risks associated with eating processed meat such as bacon, while the fourth 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 relationship between reporters and figures. Finally, the increasingly common use of non-probabilistic polling is discussed. The aim in this chapter is to flesh out the practical consequences of some of the shortcomings in journalists' level of engagement with numeracy identified previously, which this research project posits is brought about by and through the journalistic field.

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 interpreted and reported, in part due to the innumeracy of some reporters. In essence: "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 (2017b) 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".

Part of the problem with media coverage, Silver argued, apart from a liberal bias against a populist such as Trump, was its failure to interpret correctly the outcome of a probabilistic election forecast. For instance, Jim Rutenberg of the *New York Times* penned a post-election analysis which criticised news organisations (including Rutenberg's 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 actual prediction was headlined "Hillary Clinton has an 85% chance to win" (Katz, 2016) and opened with the assertion that "a victory by Mr. Trump remains possible" (ibid). 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". That is because a probabilistic forecast is an expression of uncertainty: "If a model gives a candidate a 15 percent chance, you'd expect that candidate to win about one election in every six or seven tries" (Silver, 2017b). After castigating Rutenberg for his innumeracy, Silver admits the way the data were presented was confusing, since probabilities and polls are both routinely expressed as percentages. Who could blame the public for mistaking a forecast showing Clinton's 85% chance of winning as meaning that she enjoyed a 85%-15% poll lead over Trump (which would have represented an unheard-of 70 point lead)? 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 fractions, with percentages playing second fiddle (Figure 12 below).

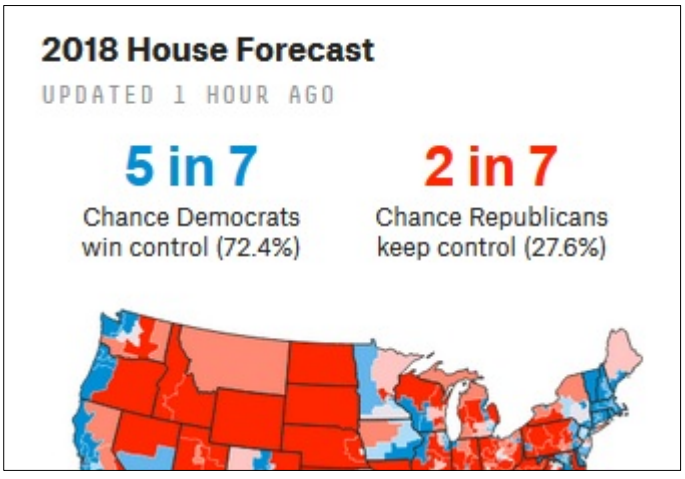

Figure 12: FiveThirtyEight website expressed its US mid-term poll prediction in fractions

In listing reasons why mis-reporting and mis-interpretation occur – aside from good old-fashioned innumeracy on the part of reporters – Silver identifies two major factors, both of which are effects of the journalistic field. The first is the tendency of news media to present

certainty over uncertainty, since uncertainty is a handicap in today's highly competitive marketplace. That is, the position of a news organisation vis-a-vis competitors in the field tends to make them err towards presenting certainties rather than acknowledging uncertainties – subtlety does not sell. The second is what Silver dubs the "editorial culture" of the organisation, its emphasis (or lack thereof) on fitting the news into a preconceived narrative in order to meet deadlines and reader expectations (Silver, 2017b). As Murray put it in a related context, it is often hard to tell stories well from a journalistic perspective because of "the temptation to turn news accounts into morality plays in which opposing scientific (and political) forces are cast as heroes and villains" (Murray et. al., 2001: 176). Note that the foregrounding of narrative as an editorial organising principle is an effect of the field because it allows for the production of complex, ongoing reports within tight timeframes, and this is highly desirable for print media seeking to emphasise their interpretative, analytical role. The need for such a role has been forced on the press by the progressive entry into the field of rival forms of media (radio, television, social media) which are better suited to publishing breaking news quickly.

This last point requires some elaboration. Prior to the 1920s, print was the primary source of breaking news – if something noteworthy happened, the readership generally had to wait until the relevant newspaper or magazine was published or delivered before they found out about it. Since there were no other authoritative news outlets, print news media had a monopoly on breaking news, and up to the late 19th century would, for instance, devote entire pages to verbatim speeches from Parliament or from public meetings, in the knowledge that this would be the first their readers learnt of the proceedings. As this monopoly was eroded through the 20th century, print media realised that while they could not compete with the speed of broadcast and digital media, they could offer far deeper levels of analysis and interpretation. As one commentator put it in the wake of the London bombings of 2005: "What kind of newspaper would you make for tomorrow? We need everything but the news" (Porter, 2005). The disturbances in the journalistic field created by the advent of radio, television and digital media had the effect of modifying the practices of print news organisations by forcing them to turn to the long narrative rather than relying on the snap news item. But Silver's point is that sustaining such a narrative leads to an accretion of values and positions which it is difficult to slough off. Having embarked on the narrative of an unelectable outsider doomed to lose to the establishment figure of Clinton, institutional inertia militated against the *New York Times* revising that view in spite of evidence to the contrary. Silver concludes: "News

organizations reporting under deadline pressure need to be more comfortable with a world in which our understanding of developing stories is provisional and probabilistic — and will frequently turn out to be wrong" (Silver, 2017b).

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 6am-midnight, seven days a week for the six weeks preceding the May 7 poll date (Arnold, 2017: 217). Although primarily aimed at broadcast media - on the basis that 75% of respondents to a 2014 Ofcom survey reported they got their news from television – Full Fact also provided support to newspapers from all political quarters. The organisation noted they received a large number of media requests from journalists "displaying varying degrees of statistical literacy" (ibid., 218). Although reporters could have obtained the data they needed from other sources (such as the Office for National Statistics or the Office for Budget Responsibility), the journalists appreciated the speedy response they received from Full Fact: "It is easy to see why journalists would go straight to Full Fact when working under intense time pressure, often outside of normal office hours" (ibid.). An example of the charity's work was scrutiny of a press release from the Trussell Trust, the UK's largest provider of foodbanks. The release was reported as showing 1m people were using food banks. In fact, this figure related to uses rather than users; the true figure was nearer 500,000. Full Fact encouraged the Trust to issue a clarification and helped a Guardian journalist word a correction to a published article which had been based on the inaccurate figures (ibid, 219).

After the election, Full Fact analysed the types of errors which most commonly cropped up, and divided them into four main categories, namely comparisons over time; claims based on insufficient research; lack of clarity over what the statistics mean; and confusing baselines. These are all areas which a numerate journalist ought to be able to identify and challenge, and so it is significant that Full Fact's assistance was required. Examples of each category are as follows:

1. Comparisons over time. Labour leader Ed Miliband claimed three times as many people were on zero-hours contracts compared to 2010. 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” (ibid., 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. Insufficient research. The Liberal Democrats pledged to extend the universal infant free school meals policy to “improve academic attainment”, based on the results of a pilot scheme. While the pilot scheme did find an improvement in performance, the research was unable to account for why this should be, and there was no follow-up research to check whether the improved performance had continued or whether free schools meals accounted for any improvement. Subsequently, the Liberal Democrats were careful not to make claims about the effect of the policy and amended their pledge to make clear they would only implement it “following a full evaluation” of the initial policy.
3. Lack of clarity. Then prime minister David Cameron said during the party leaders’ TV debate: “We have created two million jobs” 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 33.5m jobs, there were 31m people in employment. Cameron later changed his wording to “two million more people in work”. One would expect a number-savvy journalist to challenge unclear use of statistics.
4. Misleading baseline. 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 acknowledged that despite their best efforts, journalists continued to provide examples of 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) may have led journalists to include "inaccurate or unsubstantiated quotes … without challenging them or offering further analysis" (ibid., 226).

An evaluation of the Full Fact initiative was carried out by the National Centre for Social Research (NatCen). It concluded there had been evidence of an improvement in the use of data by both politicians and journalists: "Full Fact was part of a group of organisations who had started to change the way politicians and the media approached data and statistics. There was a sense that the election campaign in particular had seen a much more careful approach to using data" (NatCen, 2015: 15). One of the participants summed this up by saying: ""Compared to previous elections I think that probably politicians and some media outlets were a bit more careful about what they said" (ibid., 13). The exercise overall was judged a success by NatCen, whose report concluded: "All participants [in the evaluation project] held the view that there was a need for Full Fact's Election Centre" (ibid., 15).

Full Fact went on to respond to the BBC Trust's 2016 impartiality review of the BBC's reporting of statistics (BBC Trust, 2016) and concluded that "the BBC needs to be braver in challenging statistical assertions if it is to be a useful public service" (Full Fact, 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 claimed £350m 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.).

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 number. They look at a report published the previous year by the World Cancer Research Fund (WCRF) which advised people to avoid processed meat, such as bacon, because an extra ounce of bacon a day increased the risk of colorectal cancer by 21 per cent (Blastland and Dilnot, 2008: 108). But as the authors point out, after acknowledging that the facts as reported were perfectly correct, "nothing we have said so far gives you the single most essential piece of information, namely, what the risk actually is" (ibid.). When they calculate this, it turns out that typically five 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 six in every 100. So for 99 men out of 100, the extra bacon introduces no extra risk (see **Relative vs Absolute Risk**, in Appendix One below). 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. However, they warn that "Natural frequencies could easily be adopted more widely, but are not, so tempting the conclusion that there is a vested interest both for advocacy groups and journalists in obscurity" (op. cit., 115).

Blastland and Dilnot identify a second problem with reports of risk, and that concerns the confidence interval (also known as confidence level). This is the level at which researchers have confidence in the results of their research and is often set at the 95% level, which means there is only one chance in 20 that the research findings were due to chance:

> Though even with a confidence interval of 95 per cent there is still a 5 per cent chance of being wrong. This is a kind of modesty the media often ignore. The news often doesn't have time, or think it important, to tell you that there was a wide range of plausible estimates and that this was just one, from somewhere near the middle … Any journalist who acts as if the range of uncertainty does not matter and reports only one number in place of a spread of doubt, conspires in a foolish delusion (op. cit., 122)

The advice is echoed in a handbook aimed at journalists, which urges: "The confidence level should always be reported as part of the story because it gives the readers a chance to assess the results for themselves" (Wickham, 2003: 75). So bearing in mind these two key exhortations to journalists -about expressing risk as natural frequencies and including the confidence interval in their articles - how was a more recent re-run of the "bacon-causes-

cancer" story reported? The *Guardian* carried the story under the headline "Even moderate intake of red meat raises cancer risk, study finds" (Boseley, 2019), based on a report which used data on nearly half a million adults registered with the UK Biobank, making it the largest such study ever carried out in the UK. The third paragraph of the article contains the information 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". So once again, relative risk is prominently reported – but given previous criticisms of this very story as detailed above, surely the absolute risk was also given? Perhaps surprisingly, it was not mentioned at all. Even worse, the following paragraph said the "risk increased by 20% with each extra slice of ham or rasher of bacon (roughly 25g) the study participants ate, and by 19% with each thick slice of roast beef or the edible part of a lamb cutlet (about 50g)" (op. cit.). Again only relative risk is mentioned, but the wording gives the misleading impression that eating a single rasher of bacon increased risk by 20% - it means, of course, eating that amount daily over the course of the six year-long study. The main cause for concern with this article, however, is that despite its relative length (740 words), and the fact that three experts including the 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 are alarming. Is this alarm borne out by the evidence?

The *Guardian* article does link to the report on which it was based (Key et al., 2019). Turning to the report, it 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 works out at 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. However, an important consideration is that this ignores the fact that people in the latter group tended to smoke and drink more, were more overweight and generally were more prone to health issues including cancer. When the report took these factors into account using standard statistical measures, the increase in risk was indeed 20 per cent as reported in the *Guardian*. When expressed in terms of natural frequency, that represents an additional 8 people per 10,000 compared with the cohort who ate red and processed meat infrequently. While that is an appreciable number, it is far less

alarming than the headline statistic of 20 per cent, 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 per cent to 37 per cent at the 95 per cent level, a very wide margin (and even at the 95 per cent level, there is still a five per cent chance of being wrong). The omission of the uncertainty regarding the research findings makes for more dramatic copy but at the expense of accurate and balanced reporting. As Blastland and Dilnot observe about the version of the story they analysed, exaggeration and spurious precision may not actually be lying – but "we would hope for a higher aspiration from … serious newspapers and broadcasters than simply getting away with it" (Blastland and Dilnot, 2008: 116).

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 *Times*, complete in the case of the *Times* with a graphic (*Times*, Monday January 22, 2018: 14) supplied by Edge Hotel School (although not credited as such by the *Times*) – see Figure 13.

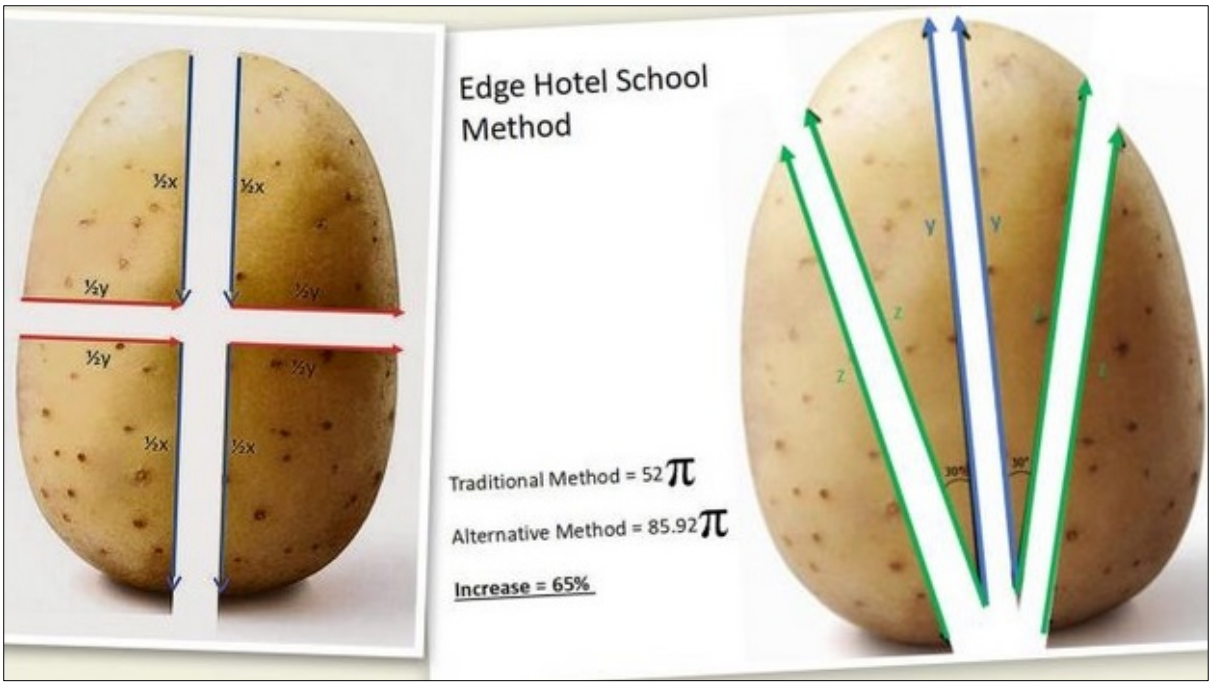

Figure 13: Graphic as used in The Times

Unfortunately, the *Times* had edited the original image (Figure 14) so as to remove the dimensions of the potato, which gives the impression that the internal surface area of **any** potato is 52pi – clearly a nonsense, since 52pi is a constant (just over 163), whereas the size of a potato can vary arbitrarily.

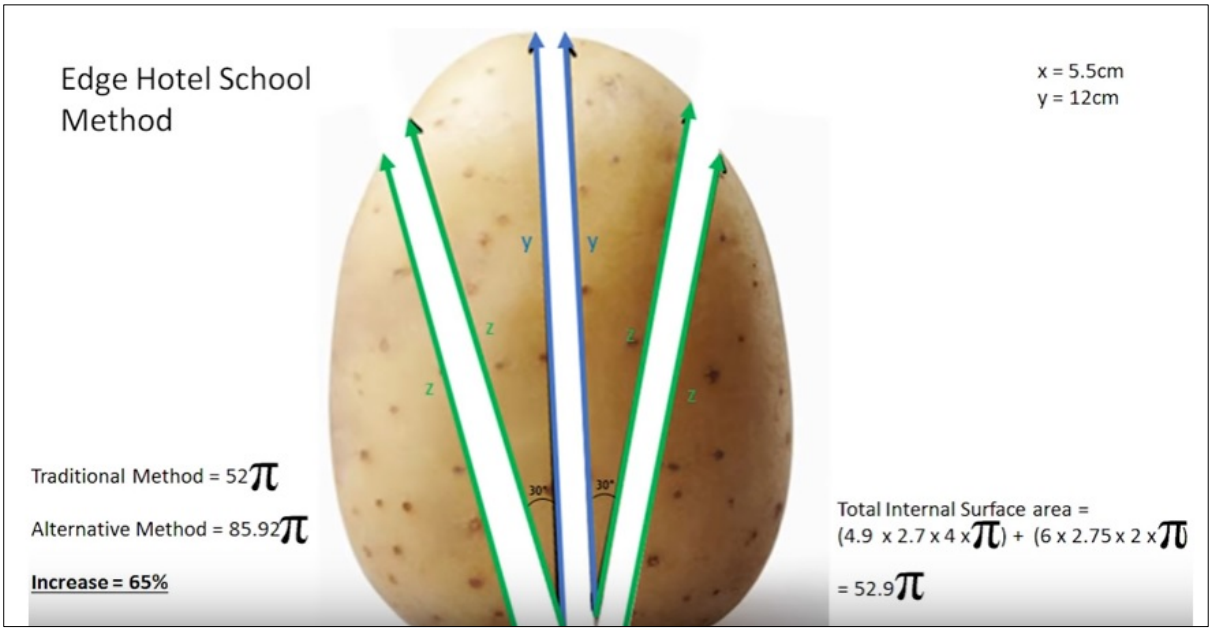

Figure 14: The original graphic produced by Edge Hotel School

As the original image makes clear, the calculations are based on the dimensions of a specific potato, given in the top right corner. 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 (= internal surface area + external surface area) will be less than 65%. In fact, for the potato of the dimension 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 (and 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 lacks crucial information to the extent that it does not make sense, points to a lack of numeracy awareness. A claim of this research is that if numeracy 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 – and perhaps other details in the caption would have been made clearer, too. It is fair to say that for this particular story, it hardly matters whether the graphic was clear or not as what is at stake is eminently trivial. 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 reporter could have followed the example of the current researcher and checked the literature for potato-related research. There is surely journalistic mileage to be had 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. The 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" (op. cit., 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.

Case Study 5: Journalism, Polls And Non-Probability Sampling

Most news organisations rely on polls and surveys as the basis for articles on a regular basis, from opinion polls measuring support for political parties, to surveys about public perceptions about crime or about business confidence for the future. Indeed, marketing companies have taken to issuing dubious consumer surveys so frequently that many newspapers no longer cover them, on the basis that the so-called "surveys" are nothing other than disguised advertisements. Robust, methodologically-sound polls, on the other hand, can be a genuine source of news, as long as the context and limitations of the poll (such as its margin of error) are clearly explained to the reader. One numeracy textbook for journalists advises: "The margin of error should be included in all stories related to polling along with an accurate interpretation of the meaning of the percentage" (Woodruff Wickham, 2003: 73), while another cautions that if one candidate in a poll is ahead of another by less than the margin of error, then "the news report should clearly say so and should caution against concluding that one candidate leads another" (Cohn and Cope, 2012: 135).

A relatively recent development in polling involves non-probability sampling, which has introduced yet-to-be-resolved dilemmas for news organisations about how to correctly present and contextualise these findings. Non-probability sampling crops up most frequently in polls concerning voting intentions for political parties. Before examining the issues thrown up by the growing prevalence of non-probability sampling, it will be helpful to contrast it with the technique of random sampling, in which each member of the relevant population (e.g., those eligible to vote) has an equally likely chance of being included in the sample. This apparently simple requirement is actually very difficult to achieve in practice, and hence is an expensive exercise to carry out rigorously (one reason for the search for cheaper alternatives). The immense benefit afforded by random sampling is that randomness is extremely well-understood mathematically, and a host of important properties can reliably be inferred, such as standard deviation (which leads to knowledge about the margin of error) – but only on the premise that the sample truly is random. One notorious case of lack of randomness leading to

an incorrect prediction was the US presidential election of 1936, in which the respected weekly news magazine *Literary Digest* surveyed 10m American adults to ask whether they intended to vote for Franklin Roosevelt or Alf Landon (they had correctly predicted the result of previous elections). Around 2.4m of the *Digest*'s straw ballots were returned, allowing them to forecast a comfortable victory for Landon by 57% to 43%. Unhappily for the *Digest*, Roosevelt won the presidency by an even more emphatic margin of 61% to 37% of the popular vote (American Presidency Project, n.d.). In the aftermath, the flaw in the *Digest*'s methodology was exposed: by relying for its sample on car owners, country club members and telephone owners (all signifiers of wealth and exclusivity in Depression-era America), their sample was hideously skewed towards affluent Landon supporters and was therefore of no predictive value. The lesson for pollsters was that a sample's randomness was the essential factor, not its absolute size. As it happened, upstart pollster George Gallup had already heeded that lesson, allowing him to correctly identify FDR as the victor. Gallup went on to dominate polling for the next half-century, while the hapless *Literary Digest* soon thereafter bit the dust (Meyer, 1991: 217-8).

Reichmann (1964) gives an example to illustrate the often subtle difficulties of obtaining a random sample. He cites a study purporting to show that one out of every two women get backache; but a moment's reflection on teenagers and younger women dispels the notion that half of them are crippled by back pain. What, he asks, is going on? (op. cit., 242-244). The first problem is that the term "backache" is not adequately defined; further, some of the subjects of the study only revealed they suffered from backache when specifically asked about it, suggesting their condition was less serious than the women who disclosed the information unprompted. Hence acute lumbago was being conflated with a sore lower spine. But the major flaw was with the sampling: the study on which the newspaper report was based involved 100 women patients of a particular doctor, of whom 50 said they had backache. "All that this sample can tell us is about that particular doctor's patients," observes Reichmann – perhaps this doctor's part of the country was low-lying and damp, making all types of backache more prevalent. But even if his practice were typical of the rest of the country, the sample still only tells us about the relative health of the population of patients. The sample includes no representatives of women who are not patients; their chance of being included in the sample is not equally likely as those who are patients, and hence the sample is not random and cannot allow us to draw any conclusions about the female population at large. Reichmann concludes his example by noting the same newspaper article "naively"

reports that a third of patients attending bone and joint clinics also complained of backache. Since the back represents such a major portion of the human skeleton, the figure is not surprising, as Reichmann witheringly observes: “One might as well report that 100% of all patients in tuberculosis hospitals are suffering from tuberculosis. Of course they are; that is why they are there” (ibid.).

Given a truly random sample (or quasi-random), however, results can be generalised to the population under study as a whole; this is what makes random sampling so valuable. In particular, it allows pollsters to give a margin of error for their data, without which the reader cannot form a fair judgement of how seriously to take the poll. Typically, voting intention polls in the UK use a sample size of around 2,000 people, with a margin of error of +/- 2.5% at the 95% confidence level, meaning that if the survey were repeated 100 times, we would expect 95 of those surveys to be within 2.5% either way of the true result. Newspapers need to give the margin of error in order for readers to fully understand what the poll is saying; to report that support for Party A is at 48% while that for Party B is at 44% is meaningless without knowing that the margin of error is 3%. In this case, the result is within the margin of error, since support for Party A lies between 51%-45% and that for Party B between 47% - 41%. In its submission to the BBC Trust’s Impartiality Review on the use of statistics, the Royal Statistical Society (RSS) takes issue with the BBC’s editorial guidelines which state that: “It will usually be appropriate to report the source of figures, and sometimes the margin of error, to enable people to judge their significance” by countering:

> We believe 'usually' to be unnecessarily vague. Reporting margins of error is essential for readers to critically assess the reliability of a source. We understand that statistics based stories need to be presented in a way that is newsworthy but it is always important for readers to have all the facts. The margin of error should therefore always be made clear so the public can have confidence in the statistical information being presented to them and be able to assess it for themselves (BBC Trust, 2016: 10).

However, this entire approach to contextualising poll results has been thrown into disarray with the re-emergence of non-probability sampling[41]. It has become popular since the turn of the century, partly because it is cheaper than random sampling. In an age when polling has become so prevalent (and budgets so tight), that is a powerful argument for its adoption. The

[41] Forms of non-probability sampling, such as purposive sampling and quota sampling, were widespread until the 1950s.

method came to the attention of the current researcher when a news article appeared in the Guardian under the headline "Economic boost hits Labour's poll ratings" (*Guardian*, 14 January 2014, p1). The article cited an ICM poll which claimed Labour's lead over the Conservatives had dropped five percentage points since the previous month, and that they were now on 35% compared with the Tories' 32%. Although information on the sample size (n=1,005) and methodology (convenience sampling[42]) appeared at the end of the article, no mention was made of margin of error, which of course is essential to evaluating the claim that Labour's lead had been "squeezed to three percentage points" (ibid.). Given a 2% margin of error, for instance, the lead may in fact be anywhere between plus 7 points to minus 1 point. The researcher contacted ICM to find out what the margin of error was, only to be told that because the results had been weighted to the profile of all adults, there was no margin of error. The result, according to ICM, "was what it was". That is, the results of the survey had been weighted and this compensated for any potential biases in the sample, such as under-representation of some population groups or over-representation of others.

However, the lack of clarity over the theoretical foundations of some approaches to non-probability sampling have led to concerns from the prestigious American Association for Public Opinion Research (AAPOR) which were detailed in its task force report (AAPOR, 2013). Examples of non-probability sampling include clinical trials, opt-in panels and intercept surveys (such as stopping people in shopping centres). The Task Force goes on to say:

> These designs have not been explored in detail by survey researchers … Because of their limited use in surveys, the assumptions required to make valid inferences from non-probability samples are not well understood by survey researchers (AAPOR, 2013: 6).

In the case of the weighting technique mentioned above, the Task Force noted that although in principle it could remove some or all biases in the sample, "the key issue is how effective they are in practice" (op. cit., 24).

The AAPOR Task Force agreed that non-probability sampling can provide accurate results, particularly in the case of election forecasts, but point out that transparency is essential

[42] "Convenience sampling" is defined by AAPOR as "a form of non-probability sampling in which the ease with which potential participants can be located or recruited is the primary consideration" (2013: 17).

because there is a higher burden than in the case of probability samples to detail the methods used. The relevance of this for journalism is clear – when reporting stories which involve the use of non-probability sampling, it is more important than ever to provide "health warnings" which allow readers to judge the validity of the interpretations made. Given that non-probability sampling is likely to become more frequent (as it is cheaper to carry out than probability sampling), it would be helpful to readers if a standard form of words were used, and web links provided to the detailed polling methodology. In the words of the Task Force: "A clear description of methods and assumptions is essential for understanding the usefulness of the estimates … Too many online surveys, in particular, consistently fail to include information that is adequate to assess their methodology" (op. cit., 105-6).

This baton has been taken up by the Royal Statistical Society (RSS) and the American Statistical Association (ASA), who investigated whether polling errors were getting worse in light of critical remarks made in the House of Lords urging pollsters to "get their house in order" (Hill, 2018). Referring to the problem of calculating confidence intervals for non-probability sampling, Hill writes: "The UK has been lagging behind the US in addressing this problem", but he approvingly cites the May 2018 requirement by the British Polling Council (BPC) that its members include the following statement in its polls:

> "All polls are subject to a wide range of potential sources of error. On the basis of the historical record of the polls at recent general elections, there is a 9 in 10 chance that the true value of a party's support lies within 4 points of the estimates provided by this poll, and a 2-in-3 chance that they lie within 2 points" (Hill, 2018).

Hill goes on to praise this as a "welcome uplift" from the UK to US standards, but adds it is still not as sophisticated as equivalent US wording.

In order to see whether and how news organisations incorporate the BPC statement into their reporting, the *Observer* political polling articles for July 10 2018 (Helm, 2018) and September 15 2018 (Savage, 2018) were examined (these were the only poll articles the *Observer* published subsequent to the BPC statement at the time of writing). The regular polls are published in conjunction with the polling organisation Opinium, which is a member of the BPC (British Polling Council, n.d.). There was no mention of uncertainty in either article, and the statement did not appear in any form. More surprisingly, the same was true of the source articles on the Opinium website. The statement from the BPC did not appear in either the summary reports nor within the data tables. When contacted by the current

researcher, the BPC conceded this was an omission: “The statement should at least be included on the details of polls of vote intentions posted by members” (private communication by email). Prof John Curtice, president of the BPC, told the author of this research project that “ideally” news organisations would publish the statement when reporting voting intention polls (private communication by email). Clearly, this is unlikely to happen without guidance from polling bodies themselves. It is also clear that if journalists are aware of the existence and importance of such statements, there is a greater chance that the statements will be published.

The journalists most likely to have this awareness are precisely those with an appreciation of numeracy. As an example of a well-reported polling story, a *Guardian* article about Scottish National Party (SNP) members’ support for a second Brexit vote shows a high degree of sophistication (*Guardian*, 2018a). The article begins with the findings of a YouGov poll showing that 79% of SNP members backed a second Brexit referendum, adding that the polling was carried out on behalf of the People’s Vote campaign. Information about who commissioned polling is not always included in articles. The article goes on to point out some methodological shortcomings – the sample size was 665 and 73% of the sample were over 50. Nearly a third of the sample was over 65. However, no allowance was made for the make-up of SNP members, which is neither as elderly nor biased towards males as the sample. In short, “this was a largely male and elderly group of pro-EU political activists. There was no weighting against the SNP’s actual membership and no information on where they lived, their educational background or social class” (*Guardian*, 2018a). The sample was compared with a large-scale study of SNP members, which found the median age was 56 and that 50% were younger than 54. Having criticised YouGov’s methodology, the *Guardian* gave them the opportunity to respond. The pollsters claimed that “it is standard practice in researching ‘niche groups’ to offer unweighted data” (ibid.).

Not all media organisations were as punctilious as the *Guardian* over the way they reported the story. *The Week* magazine’s website simply reported that “A YouGov poll of SNP party members shows a huge majority support a second Brexit referendum” with no qualifications or analysis of methodology (*The Week*, 2018), while the *Independent* (which actively campaigns for a second referendum) wrote:

> A YouGov poll of the SNP's members showed on Sunday that an overwhelming majority not only support a People's Vote on the outcome of Brexit negotiations, but also want the party's 35 MPs in Westminster to give their positive backing for such a proposal. The poll shows that the party's grassroots would support staying in, rather than leaving the European Union, by a margin of 93 to 7 per cent, excluding 'don't knows'. (Watts, 2018).

Note the exclusion of "don't knows" in the *Independent*'s report, which makes the majority in favour of a second vote far more impressive than the 79% reported by the *Guardian*, especially as the Independent gives no data on the size of the sample. As Philip Meyer stresses: "'Don't know' is data … The inability of a respondent to choose between different alternatives is important information, and this category should be considered as important data – as important as that furnished by people who can make up their minds" (Meyer, 1991: 141). One might conclude the *Independent* breached this rule in order to make the YouGov results conform to the thrust of its own campaign in support of a second referendum. Disappointingly, none of the media organisations listed above provided a link to the original YouGov data on their websites.

Non-probability sampling is a complex issue, and even the 123 pages of the AAPOR Task Force do not claim to be a comprehensive treatment of the subject ("We do not claim to have produced an exhaustive study," p7). In the circumstances, it is unreasonable to expect non-statisticians to be *au fait* with all the detail involved. However, it is reasonable to expect journalists to question the validity and robustness of polls or surveys, and to have sufficient confidence to demand that polling organisations provide supporting evidence where this is lacking. But as long as numeracy and quantitative reasoning are under-valued in the journalistic field, this is unlikely to happen on a regular basis.

CHAPTER SEVEN: CONCLUSION

This research project has analysed the question of the value placed upon numeracy in terms of symbolic capital within the journalistic field. This is an original and distinctive contribution to knowledge (and specifically to professional knowledge) since it applies a highly-developed and fruitful theoretical approach to a topic of great significance, but one which has long been under-represented in the research literature and has never before been discussed within the context of Bourdieu's field theory. Previous studies have identified the various issues within journalism caused by a disregard for numeracy, beginning in 1936 with Charnley up to the most recent study edited by Nguyen (2018), and the present study has also discussed some of these issues in Chapter Four. The longevity of the association between journalism and inadequate levels of numeracy posed the over-arching question: why has this link endured for so long? The fact that this question has not previously been framed as such is of considerable theoretical interest since it implies a limited understanding of innumeracy as a deficiency in competence rather than, as argued here, as a form of culture which is reproduced; that this reproduction is neither intentional nor unconscious has been propounded at length above, particularly in Chapter Three.

Part of this research project can be seen as a response to the challenge issued by Maier that "further study of mathematical accuracy in the press is needed" (Maier, 2002: 517), a challenge which Chapter Four sought to address. By reviewing around 2,700 articles across three decades, the analysis found the level of errors within stories which involved numerical calculation was relatively stable at between 25%-30%. By far the most common type of error was that of failing to put numbers into context, which one might expect of reporters who failed to appreciate the importance of details such as margins of error, sample size or sampling methodology; it is true that errors in basic arithmetic constituted the second most common category, but this type of mistake occurred only a third as often as failing to specify context. The conclusion is that the errors identified were those one would expect from within a culture which does not value numeracy highly. The present researcher argues that by changing that culture, one can expect to improve the level of reporting of stories such as those analysed in Chapter Four. Chapter Five approached the research question from the opposite direction: it sought to gather data which acted as an index for "numeracy culture" among student journalists; that is, how comfortable two different groups of students were

with manipulating and presenting quantitative information. It was argued while journalism students did not lack maths skills, they had less of a “feel for” numeracy because of their habitus, necesssarily attuned to the journalistic field. Journalism culture, within which numeracy lacks the status of symbolic capital accorded to literacy, means their numeracy levels tend not to develop subsequently; that is why this project argues that the introduction of applications with STEM qualifications onto journalism courses would help transform the culture in a positive way. Hence this research project also aims to make a contribution to professional practice by improving the quality of journalism.

The case studies and the guide to writing with numbers which forms Appendix One apply the theoretical concerns identified earlier to real-world situations: what practical effect does the undervaluation of numeracy have on reporting, and what steps can be taken by working journalists and student journalists to combat this? In fact, a version of both these sections has already been used by colleagues of the current researcher teaching Level 4 (first year undergraduate) journalism students as part of their introductory modules.

Research outcomes

The observation underlying this project was that journalism does not value numeracy highly; and the theoretical claim was made that this tendency to undervalue numeracy is an effect of the field rather than a deficiency among individual journalists and that this tendency tends to be reproduced by the field. It is argued that the quality of journalism would be improved if numeracy were more highly valued. The results presented in Chapter Five suggested that journalism students were less comfortable with numeracy than statistics students, even though they were perfectly capable of doing the maths. This conclusion in line with a research project carried out by John Gillespie at Nottingham University, which addressed the question: “Do arts students have a ‘skills deficit’ in numeracy; and if so, how best can the skills be developed in undergraduate programmes?”. The Nottingham project assessed 198 first year undergraduate students and found that overall 44% achieved the equivalent at or above key skills level 3 in application of number; for arts students, this fell to just 27% (Gillespie, 1998). With commendable understatement, Gillespie noted: “This indicates a significant numeracy skills deficit” (op. cit.). More significantly for the purposes of the current research project, Gillespie also questioned students about their feelings on taking part in the research and discovered a high level of anxiety, embarrassment and stress: “It showed that lack of confidence was possibly more of a barrier to successful application of numeracy

than poor calculating skills, which may be rusty but can be retrieved" (op. cit.). This research project claims that the notion of the journalist field, as developed by Bourdieu and his collaborators, offers an appropriate and robust conceptual framework within which to theorise the factors behind the lack of value attached to numeracy. The interaction between the field and the habitus of the agents who inhabit it provided an explanation for the tradition within journalism of poor numeracy skills, since the field tends to reproduce the structure which underpins it. Taken as a whole, then, the findings of this research project have led to the following conclusion: **In order to address the issues in journalism created by the lack of regard for numeracy, it is necessary to transform the journalistic field itself.** This is no way obviates the need for numeracy training and development for journalists and journalism students. In fact, anyone who has observed a journalist feverishly working on their expenses claim, calculator in hand and swamped by coffee-stained receipts, will scoff at suggestions that members of the news media are mathematically-challenged – they can do the sums but do not value doing them. It does not require a higher degree in calculus to work with numbers, but it does require applying common sense and the same critical thinking that goes into any other news story. As part of a programme for addressing the undervaluation of numeracy within journalism, then, the *Journalists' Guide To Reporting With Numbers* which appears as Appendix One is a corrective based on the types of errors identified earlier in this study and which experience confirms crop up in professional practice. The intention is that it can be used as part of a CPD module or training guide. As explained earlier in this project, the provision of such a guide is in alignment with field theory, as fields are dynamic systems which can evolve in response to pressures and interventions from external related fields. When exhorting journalists to value numeracy, it helps to be clear about what they are being asked to value: Appendix One sets out concrete examples of good practice when researching and writing stories which involve numbers and calculations.

Next steps

This research project has sought to demonstrate that field theory provides a fruitful explanation for the initial observation that journalists are not always sufficiently numerate to discharge their democratic function of informing in an entertaining way. This project has done so in four ways – first, by looking at the habitus of entrants into the profession (using a sample of journalism undergraduates); via an audit of newspapers to identify the types of errors that are made in practice; through analysis of historical evidence; and through a series

of case studies. It could be argued that talk of the field and symbolic capital is beside the point, when all that is really needed is greater mathematical or statistical training for journalists. The problem is, that has been tried many times before, from Paulos's Columbia course on dealing with numbers to numerous newsroom initiatives and undergraduate interventions. There is no sign of the issue going away. Part of the problem is that many entrants to journalism are not at ease with numbers to begin with and are resistant to embracing numeracy. This is all part of the culture of journalism, "the way it is", and which is usefully captured by the notion of habitus. As discussed earlier, there has long been an assumption that entrants who feel uncomfortable with handling numbers gravitate towards journalism as a career because they feel it is a numeracy-free zone, and so solutions aimed at improving journalists' numeracy have concentrated on the training and development of individuals at university or in the workplace. While this research project wholeheartedly endorses such an approach as necessary, it argues this in itself is not sufficient because numeracy is not especially valued within the journalistic field, and so the perception of numeracy as of marginal value is reproduced. Prestige, professional advancement and collegial acceptability accrue to those who fit in with the prevailing culture, not those who challenge it.

What, then, does this research project recommend by way of practical implementation of its conclusions? It is a two-pronged proposal. The first is to support current efforts to train and develop existing journalists and journalism students; the Journalist's Guide to Numbers is part of that effort. As argued in Chapter One, the industry may start to demand increased numeracy levels of entrants, since employers are increasingly reluctant to invest time and money into training where this can be supplied by the Higher or Further Education sectors. There is no "one size fits all" approach, although hands-on training which is seen as relevant and practical (which teaches numeracy rather than maths) is to be preferred. As Bourdieu expresses it in a related context:

> What the teaching must transmit or reinforce … is not knowledge … but skill or, more exactly, the art of applying knowledge, and applying it aptly in practice, which is inseparable from an overall manner of acting, or living, inseparable from a *habitus* (Bourdieu, 1998b: 57).

Gillespie's research at Nottingham echoes this: "The integration of numeracy - or any key skills for that matter - into main programmes of work or endeavour is critical" (Gillespie,

1998). The ever-present danger is that provision of numerical/quantitative training will be merely a box-ticking exercise – as Weiss and Retis-Rivas caution in relation to data journalism: "When journalism students nowadays are required to learn the latest skills in digital, social and multimedia technology, the focus on data journalism could be an afterthought and just not make the list of courses they need to take before they graduate" (Weiss and Retis-Rivas, 2018: 11). Among the recommendations for training, the following have been identified as key areas to be addressed:

- 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;
- When reporting medical/health studies, always give the level of confidence and provide a link to the original article where this is not paywalled;
- Use natural frequencies to explain risk;
- Put numbers into context using appropriate and relevant analogies;
- Do the hard work for the reader by performing calculations for them;
- Contextualise results or findings ("How big is it?", "What does that mean for me?");
- Avoid technical jargon, especially words which are used in a different sense in ordinary speech ("significance", "trivial", "bias", "error", "normal", "random").
- Doubt and uncertainty are facts, too; do not attempt to gloss over them, for example by ignoring "don't know" responses to a survey.

Much of the above would fit naturally into the undergraduate curriculum, although there is also the case for universities to develop CDP modules at Master's level to deliver this material. Some of the principles outlined above have been incorporated in the *Journalists' Guide To Writing With Numbers* which forms Appendix One to the present work.

But the second prong is to encourage non-traditional entrants into the profession, namely those with a background in quantitative thinking, such as those engaged in scientific, statistical or mathematical studies (so-called "STEM" subjects). In particular, this encouragement should be aimed at those who wish to study at university but whose habitus dictates that journalism is not a "natural" choice, and this can be achieved via the involvement of careers officers, programme marketing material, activity "taster" sessions, recruitment talks and the wording of programme specifications. It is anticipated that drawing journalism recruits from a numeracy-rich pool will lead to a transformation of the journalistic

field, in which numeracy becomes much more highly valued as part of the profession's culture. An objection which is often raised is that teaching a numerate person how to write as a journalist is harder than teaching a journalist how to be numerate, but this is a false dichotomy. As mentioned in an earlier chapter, news writing is a specific technique (or, more accurately, set of techniques) that bears less of a relationship to *belles-lettres* than one might think; indeed, those – such as the present author - who have taught news writing to university students of a literary inclination find that the first task is often to "un-teach" their existing writing style before rebuilding it from the ground up with news writing style. That people with a feel for quantitative reasoning can readily be taught this style is clear from the fact that such people are already employed within news data hubs and as data journalists, and are producing journalistic content on a regular basis. Indeed, there is a widely-held view in the profession that a "nose for news" (the ability to recognise a news story as such) is much more important than the ability to write well, and that therefore curiosity is the fundamental journalistic skill. As one senior editor's contribution to a *Financial Times* (*FT*) guide to journalism put it: "News reporters do two things. They find news. And they write news. The first is hugely more important" (Brown, 1998: 1). Kevin Brown, who at the time was the *FT*'s industry editor, goes on to explain that writers with a literary flourish are sometimes needed to bring a big story to life but, he adds, they "are not irreplaceable … there are good editors who can turn dull prose into lively English" (ibid.). The institutional barriers to recruiting more quantitatively-inclined entrants into journalism at university level have also been discussed above, and centre on the fact that journalism lecturers, no less than students, are often reluctant to engage with numeracy, and for the same reasons – their interests and inclinations tend to the literary aspect of journalism. Any field transformation produced by the changes proposed in this research project would not be confined to journalism; it would also affect the university field. Changes to the make-up of entrants onto university journalism programmes would eventually filter through to the make-up of the academic body, as those students with academic aspirations enter the profession as lecturers, graduate students or researchers. In this way, a virtuous circle can be envisioned, in which quantitative thinking becomes embedded within the corpus of teachers as well as the taught.

Some objections

Among the objections which can be levelled at this research project, there are two which appear to carry particular weight. The first is that numeracy is not, after all, such an issue

within journalism – it is just that isolated examples are blown out of proportion to give a false and unduly negative picture of the profession. The second is that, regardless of the scale of the problem, bringing in more journalists with a STEM background would fail to address it and that instead all resources should be devoted to remedial training and education projects, rather than diverting energy into changing journalism culture. Support for the first objection would at first blush seem to come from researchers such as Maier, whose newspaper audit concludes with the "provocative proposition" that "perhaps mathematical incompetence in the newsroom is not as rife as commentators inside and outside the news profession contend" (Maier, 2002: 518). This objection is answered by Maier himself and by the newspaper audit carried out as part of the current research project in Chapter Four, as well as the comments from well-respected academics and practitioners reported in the Introduction. The finding of the audit conducted as part of this research project are in line with Maier's – which is to say, errors were found across a range of similar categories, often involving elementary maths, leading to the conclusion that, in Maier's words, "journalists need to use numbers better" (op. cit., 516). That is, although Maier warns against tarring all journalism with the brush of innumeracy, lack of numeracy skills is nevertheless a problem which requires action. In a phrase used elsewhere in this research paper, what is at stake is "a failure to comprehend rather than a failure to calculate". There may be an element of hyperbole in the shoulder-shrugging observations of commentators that journalists simply cannot add up; but within this exaggerated characterisation lies a kernel of truth. So Maier is right that the situation is not hopeless; however, his and the current research projects suggest the situation is certainly in need of improvement. Journalism's case of innumeracy is a chronic rather than an acute one.

The second objection takes issue with the philosophical thrust of this project by rejecting as irrelevant or inappropriate either the validity or the application of field theory (or both). The validity of field theory was defended above, but a reflection on its applicability as a theoretical basis is appropriate here. Field theory is a means of surveying journalism as an activity and set of institutions subject to specific constraints; which is to say, a way of looking at it in its dynamical and structural aspects. This recommends itself as a philosophical approach which avoids both the formal limitations of structuralism (its ahistoricality and resistance to the concept of agency), and the subjectivism of an approach based on the exceptionalism of individuals or the inexorable march of institutions untethered from any material context. Because of this, field theory presents itself as a fruitful toolkit for thinking about journalism and imagining its future improvement – by its nature, field theory

imposes a holistic view of both the problem and any solution. It may be helpful at this point to justify the characterisation of structuralism as essentially ahistoric. The founding father of structuralism was the linguist Ferdinand de Saussure, whose *Course in General Linguistics* analysed language in terms of its signs, in which sound and semantics were necessarily conjoined, like the two sides of a coin. For Saussure, the object of analysis was the sign as a differentiated structural element – a sign could function insofar as it could be distinguished from all the other signs in the system owing to its differences from them, not because of any intrinsic quality of the sign itself[43]. What emerged was a differentiated synchronic structure in which elements derived meaning from their position in the structure; the structure itself was inherently timeless, comprising a snapshot of the relationship between elements at that time. There is nothing in the concept of structure to allow for dynamical considerations; structure is frozen in time and impervious to change: "Bourdieu's objection to strictly internal analysis [including structuralism] […] is quite simply that it looks for the final explanation […] within some sort of ahistorical 'essence'" (Johnson, Introduction to (Bourdieu, 1993a: 10)). As Bourdieu himself declared: "**The separation of sociology and history is a disastrous division**" (Bourdieu and Wacquant, 1992: 90 (emphasis in original)). This schema of a differential structure was applied by other disciplines, most notably anthropology where Levi Strauss applied it to kinship structures ("Although they belong to **another order of reality**, kinship phenomena are **of the same type** as linguistic phenomena", Levi-Strauss, 1972: 34, emphasis in original), and philosophy where Althusser applied it to his readings of Marx:

> Levi-Strauss was the first French advocate of a structural, non-historical approach to humanistic studies ... Althusser endeavoured to show that Marxism could provide a structuralist method of investigation from which human subjectivity and historical continuity were consciously excluded (Kolakowski, 1985: 483).

Bourdieu's early investigations were themselves imbued with structuralist presuppositions; he scathing dismissed his 1963 ethnographical work on the Kabyle house as "perhaps the last work I wrote as a blissful structuralist" (Bourdieu, 1990b: 9).

Although many structuralists acknowledge the role of historical change in their analyses ("Even the analysis of synchronic structures, however, requires constant recourse to history",

[43] At one point, Bourdieu compares intellectuals to phonemes in a language, in the sense that he or she "exists by virtue of a difference from other intellectuals" (Bourdieu, 2005: 40).

Levi-Strauss, op. cit., 21), critics point out they fail to take into account the historical and social dimension of the structures they analyse, including questions such as: how did these structures take their present form, and in whose interest was that? what are the conditions under which structures develop, and in what ways does the development of one structure affect that of another? So while structuralists acknowledge the effect of historical processes on the objects of study (i.e., the elements within their structures, what Wacquant, 1992, dubs the "empty places", p19), they generally fail to appreciate the effect on the structures themselves. As one editor of Bourdieu's work put it, structuralism "fails to recognise that formal properties, both past and present, are themselves socially and historically constituted" (Johnson, introduction to Bourdieu, 1993a). It is to this extent that Bourdieu's "field" comes into play – its metaphors are spaciotemporal rather than purely spacial because change and dynamism is built into the very notion of a field; a field of play is dynamical and ever-shifting, rather than rigid and eternal. In the words of Bourdieu's sometime collaborator Loic Wacquant, fields have "a historical dynamism and malleability that avoids the inflexible determinism of classical structuralism" (Bourdieu and Wacquant, 1992: 18). This is what makes field theory applicable for a study such as this which argues in favour of a transformative approach to the issue of journalism numeracy: "The principle of the dynamics of a field lies in the form of its structure and, in particular, in the … various specific forces that confront one another … As a space of potential and active forces, the field is also a **field of struggles** …" (Bourdieu and Wacquant, 1992: 101 [emphasis in original]); again, the field "is a force-field as well as a field of struggles which aim at transforming or maintaining the established relation of forces … fields are force-fields but also fields of struggle to transform or preserve these force-fields" (Bourdieu, 1990a: 143,194). The emphasis on the dynamical nature of Bourdieu's thought, insisting as it does on the historical rootedness of the practices under investigation, has been termed "genetic structuralism" (in no way related to Lucien Goldman's methodology of the same name), although in more recent years, the term "reflexive sociology" has become more common; latterly, Bourdieu also adopted the term "differential anthropology of symbolic forms" (Bourdieu, 2000: 16). The point about transformation is that it is not a one-way process, of course – once a field has reached a certain point of development, it can transform further or indeed transform back. Transformation is not only possible but inevitable. It is precisely this plastic capacity of the journalistic field which holds out of the promise of its improvement through the elevation of the symbolic capital associated with numeracy. By enhancing the cultural status of numeracy

within journalism rather than simply enhancing the numerical skills of journalists, a more lasting and far-reaching improvement of the quality of journalism can be achieved.

Theorising practice/Practising theory: The necessity of self-reflection

> A description which contains no critical reflection on the position from which it is articulated can have no other principle than the interests associated with the unanalysed relation that the researcher has with his object (Bourdieu, 1998b: 16).

If we are to take seriously the idea of the "field" and its mode of operation, then any researcher investigating its effects needs to take into account their own place in it. It must be acknowledged that this procedure is completely alien (even objectionable) to an academic discourse which is predicated on the pure objectivity of the researcher; but Bourdieu's point is that in order for research to be scientific, this relation of objectivity must itself be objectified (Bourdieu, 1998b). He claims it is an illusion – indeed, the academic illusion *par excellence* - that the relation of researcher to their research is a neutral and transparent one. This is "the scholastic illusion of distance from all positions" (Bourdieu, 2000: 154); Bourdieu's contention is that the researcher is always **implicated** in their research, in all the meanings of this word. It is not possible here to rehearse in full the analysis of the Platonic *scholé* which Bourdieu undertakes in *Pascalian Meditations* (Bourdieu, 2000) and elsewhere except to note that for Bourdieu the ahistorical universalist discourse to which academia aspires is founded on specific social conditions which include the labour of others; academia is not situated outside or beyond social practice but is predicated on it and bears its stamp. As Rowe observes, Bourdieu's reflexive sociology

> asks for the academic researcher to re-examine the purposes behind their research, or the self-invested interests that impose 'blind spots indicative of her/his own vested interests' (1992, p. 259). In many ways, the researcher needs to turn the gaze back on their selves, but not for 'narcissistic entertainment' (2003, p.286) and neither to achieve scientific authority. Rather, to engage with and critique power dynamics and relations, or the 'structuring structures' (habitus) and 'configuration of relations' (field) that are simultaneously instructive and prescriptive (Rowe, 2017: 105).

In the interest of clarity, it is worth emphasising that Bourdieu does not claim the researcher is consciously influenced by her or his interests, ambitions or outside influences, as proponents of Rational Action Theory (RAT) might claim (Bourdieu's dismissal of RAT is particularly peremptory, as noted elsewhere in the present work), but neither does he see unconscious bias at work. It is, rather, the **non-conscious** effect of the habitus, a calculus without calculation, against which Bourdieu cautions and it is this which fuels the demand for

self-reflection. This is why self-analysis (an awareness of their own position within the field) is one of the prerequisites of the reflexive sociology practiced by Bourdieu and its necessity is underpinned by the "epistemological vigilance" which Bourdieu champions[44] (Bourdieu, 1998b: 15). It is an indication of the significance that Bourdieu attaches to the principle of the researcher's self-awareness that it is one of the few occasions when he explicitly invokes Marx: "Marx suggested that, every now and then, some individuals managed to liberate themselves so completely from the positions assigned to them in social space that they could comprehend that space a whole" (op. cit., 31); in the same way, Bourdieu continues, the researcher must objectify his or her own relation to the field of power in order "fully to grasp historical reality as such". Without this privileged vision, the researcher is in danger of falling prey to the "positivist ***self-confidence***" (emphasis in original) which represents "the most formidable social obstacle to the progress of science" (ibid.). In other words, there is no viewpoint which is not a view from a particular point – in Wittgenstein's formulation: "The subject does not belong to the world; rather, it is a limit of the world" (Wittgenstein, 1978: 57).

Hence, despite the academic conventions against which it perhaps violently clashes, the current researcher must put into practice the theoretical demand for self-reflection and consider his own position within the academic field which, like any other, is a site where the legitimacy of symbolic capital is tested and contested. This symbolic struggle is carried out by bureaucratic means such as programme and curriculum development, research projects, committee work, trade union activity, and the quest for academic and professional recognition. An aim of the current research project is to enhance the status of numeracy within journalism, and consequently within the teaching of journalism. Such an enhanced status is bound to be in the interests of those tutors and lecturers within higher and further education who specialise in teaching numeracy or who have high numeracy skills; in short, those who are very much like the current researcher. This is no accident, of course, since research topics are (understandably) usually driven by personal interest or expertise; but the transparent obviousness of this interest in no way neutralises it. It is only by recognising one's position in the field that one can take it into account.

[44] One can hear in this phrase a perverse echo of Bachelard's notion of the "malign vigilance" needed to carry out the epistemological break (Bachelard, 1987: 2).

The first point to consider, therefore, is that the more research-intensive their institution is, the greater the benefits to the researcher are likely to be. In its analysis of the 2014 REF results, the Guardian ranked LJMU, the home institution of the current researcher, 62nd out of 154 institutions (*Guardian*, 2014), although LJMU's research outputs were much more highly ranked for the specific Unit of Assessment (UoA 36) under which the Journalism department falls, coming around 20 places higher (REF 2014a; REF 2014b). That is, LJMU has a widely-regarded research profile, especially for the Communication, Cultural and Media Studies UoA, which includes journalism. Secondly, the current researcher has not sought to establish a profitable (in either symbolic or monetary terms) niche in the research ecology based on a drive to encourage numeracy among journalists. These two factors taken together mean there is far less at stake in this project for the current researcher - in terms of institutional benefits or the accumulation of academic capital - than there is for researchers working at purely research-based institutions such as think-tanks or policy units. While this does not guarantee the present research is free from field effects (should that even be possible), the researcher has reflected on them and attempted to take them into account.

Directions for future research

There is an obvious question to ask about this research project's proposals: will they work? Will a combination of education and training, plus an emphasis on bringing STEM students into journalism, help improve the quality of news gathering and reporting? Two avenues of research would help answer this question. First, a longitudinal study into how comfortable journalism students are with numeracy in the wake of an increase in the number of students with a STEM background would track performance. It is hypothesised that numeracy levels would increase from the base recorded in this paper. As part of this strand, it would be helpful to record the proportion of STEM students entering journalism as this could enable correlations to be established. Second, a more extensive audit of the frequency and types of errors made by news organisations than that which this project had the resources to attempt could be carried out over regular (annual or biannual) periods. It is again hypothesised that errors will decrease and the quality of news reporting improve (one indicator of this would be the number of news stories which involve the use of number), albeit over the long-term. Field theory is "tailor-made for cross-national research", observes Benson (Benson, 2005: 86), so extending this research to countries outside the UK would be a natural progression. Of course, the context will be different in each case but it is hypothesised that in countries where

the practice of journalism is most closely aligned with the UK (such as the US, Canada and Australia, for example), a similar picture will emerge regarding numeracy (indeed, the studies of the American scholar Scott Maier already suggest this). While Bourdieu himself has been criticised for failing to take into account the subtleties of trans-national research (see Benson and Neveu, 2005, pp85-112; pp224-243), it remains true that field theory has the flexibility and generality to accomplish such a task. Additionally, the *Journalists' Guide To Writing With Numbers* (see Appendix One) could provide the basis of a professional development module or form part of an undergraduate curriculum (and indeed this is due to happen at the current author's home institution), a marked shift in emphasis since it has been noted in Chapter Two that numeracy has rarely been highly prized within journalism higher education programmes.

Coming full circle

This research project grew out of an observation made 30 years ago that confidence when dealing with numbers was confined to a handful of journalists on whom the newsroom overly relied. In turn, that raised the question as to whether this was an unusual situation or one which was typical of the profession as a whole. Personal experience and the research provided here strongly suggests the latter, and the analysis presented above seeks to place the issue of numeracy within a wider theoretical context. What, then, might the news reporter 30 years hence think about the numeracy skills of their colleagues – what form might the shape of journalism culture take assuming the recommendations advocated in this research project are implemented? Undoubtedly, technology will play a crucial role, but it is to be hoped the shift in culture will have the more profound consequences, in terms of the type of news story covered, how it is presented and the way in which it is received. General news journalists who are comfortable handling data will routinely be assigned to work on data-rich investigations which today are hived off to specialist Data Journalism units, which in turn will lead to a cross-fertilisation of ideas and approaches between individuals. Senior news managers and editors, having themselves experienced the shift in journalistic culture, will be receptive to data-driven stories and more likely to value reporting which requires numeracy skills. In short, a richer and more forensic journalism will emerge. In his prefatory remarks to a major collection of essays which he edited on this subject, An Nguyen recently issued the following rallying call:

> We hope that the book [*News, Numbers and Public Opinion* …][45] offers the news profession some systematic perspectives and principles to build a pragmatic framework for a more effective, more fruitful interaction between journalism, statistics and society. We have never needed such theoretical and practical work as badly and urgently as we do today (Nguyen, 2018: 14).

In sentiment, if not in detail, the present research project wholeheartedly echoes those words.

The present project represents the culmination of extensive and original research designed to throw light on questions of considerable significance to civic society: How can journalism best perform its democratic functions? Why has numeracy traditionally been undervalued as an element of this role? What impact has this undervaluation had and is still having on our society? What can be done about it? These are weighty questions to consider and the researcher trusts their urgency has been fully communicated, regardless of the extent to which he has succeeded in answering them.

Towards the end of the time taken to produce this thesis, 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. Expert advice is converted into social action because the public can see the evidence it is working, and that evidence takes the form of numbers. If public confidence in those numbers were to be shaken (as it appears to have been 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; as 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

[45] At this juncture, one almost hesitates to invoke the title of Bourdieu's essay "Public Opinion Does Not Exist" (Bourdieu, 1993b), which provocatively concludes: "I'm simply saying that public opinion in the sense implicitly accepted by those who carry out opinion polls … simply does not exist" (op. cit., 157).

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. If the case for valuing numeracy highly within the journalistic field were not compelling prior to the commencement of this research project, recent events have ensured it has become so. This research project has made an original contribution towards bolstering that case.

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APPENDIX 1: A Journalist's Guide To Writing With Numbers

Rate

A reporter receives a press release from a local action group. It says that a village in their patch has the highest number of hit-and-runs in the county at 52, so the reporter immediately rushes to write about the region's most dangerous drivers ... until they are brought short by the newsdesk. How many people live in the village? Answer: 5,500. Did the reporter notice that the press release mentions a neighbouring village (pop. 1,250) which had 44 hit-and-runs in the same period? So although the number was higher in village 1, the rate was nearly four times higher in the neighbouring village - 0.035 as opposed to 0.01. Which is the more dangerous now? Of course, that is an artificial example, but the problem of confusing absolute numbers with relative numbers (in this case, the rate) is a common one (see also **Absolute vs. relative risk**, below). In order to compare the likelihood of events in different localities, other factors being equal, reporters should always look at the number of times that event has happened (the quantity) divided by the number of people the event could have happened to (the population). But when writing up a story, journalists want to present the numbers in a more intuitive way. Not only is the rate of 0.01 quite inelegant, it is also only an approximation to the true figure of 0.009-and-a-bit. A better way of expressing the rate would be as 'about nine people in a thousand'. The rate for Village 2 is about 35 people in a thousand. This way of expressing the numbers also makes it easier for readers to compare them. Of course, such a story about rates should also give some context - has the rate for Village 2 changed much over the past 10 years? It may turn out that what appears to be a drop in the 2000s to 22 hit-and-runs merely reflected the smaller population at that period (625), and the rate is exactly the same. Chance also plays a role here, as any rate associated with populations (whether connected with traffic, health, education, mortality or spending) is subject to random fluctuations. Data gathered over a reasonably long period are less likely to be affected by randomness.

How big?

Without a sense of scale, numbers tell us very little. Political pledges to spend millions (or even billions) on the NHS, for instance, are meant to sound impressive but delve into the detail and a less munificent picture emerges. Take for instance the £2bn increase in mental health funding that then Chancellor Philip Hammond announced in October 2018 (Sparrow,

2018) - albeit this level of spending would not be reached until 2023-4 and even then was contingent on the UK securing a favourable withdrawal agreement from the EU. The UK's population is around 67m, so the £2bn equates to a spending per person of just over 16p per day, which sounds far less generous. Of course, not everyone in the UK requires mental health services, but by expressing funding in terms of a different scale (daily spending per person as opposed to an absolute number), an entirely different picture emerges. When it comes to the NHS, funding is only half the equation; if expenditure exceeds funding , then – in the words of Dickens' Mr Micawber – "result: misery". Health spending plans announced by the Conservatives in 2018 pledged a real-terms increase of 3.4 per cent for the NHS, yet analysis by the Health Foundation calculated an increase of at least 4 per cent was required, so the announcement still amounted to an under-funding (Full Fact, 2018). To take a different example: the claim in a courtroom that an accused person's DNA was found at the scene of a crime and the chance of it coming from someone else was 100,000-1 sounds highly convincing. If there is only one chance in 100,000 (a big number) that someone is innocent, then what jury would acquit? But looked at from a different scale, the picture is quite different; instead of asking for the odds of the accused being innocent, what if we asked for the odds of them being guilty? In other words, given that DNA was found which matches one person in every 100,000, how many potential suspects does that result in? The answer is 670 (very roughly of course, as this is based on a total UK population of around 67m; we would want to exclude the very young, for instance, from our calculation), which now means the chance of the accused being guilty is only one in 670, not quite such an overwhelming figure on which to convict (and we are not even taking into account practical questions of opportunity, context or contamination). If that sounds a highly artificial example, it is based on real world cases. Most notoriously, in 1990 a man named Andrew Deen was convicted of rape, mainly due to DNA evidence:

> At the trial, the forensic scientist presenting the DNA and blood-typing evidence said that the match was so good that the probability of the samples having come from someone other than Deen was 1 in 3,000,000. In his summing up, the judge told the jury that so large a figure, if correct, 'approximates pretty well to certainty' (Matthews, 1994).

However, the prosecutor and judge had confused the probability of the match coming from a random member of the population with the probability that Deen was innocent: "to assess the evidence properly the jury would have needed to know the probability of Deen's guilt before the forensic evidence was given. If that prior probability of guilt was small … then even the

impressive probabilities of genetic fingerprinting can be dramatically diminished" (ibid.). The Deen case was one of those featured in an influential review into the practice of DNA profiling in criminal cases (Foreman et al., 2003), where the authors observed that "the Court of Appeal ordered a retrial because it realized that the prosecution's expert testimony may have led the jury to confuse a one in three million match probability with a one in three million probability that the accused had not committed the rape" (op. cit., 475).

Averages

In addition to rates and percentages, another common pitfall for reporters is averages. Most journalists do seem aware that there is more than one sort of average, although they can be a little fuzzy on what exactly these are. The important point is to be wary of any report or press release quoting 'average' figures - as well as 'average' having at least three distinct definitions (mean, median and mode), the cunning selection of timeframes and of what to compare can completely distort the true picture. 'Average house prices fall 15 per cent' - not only should you want to know which average is being used, but also what time period(s), which parts of the country and what housing stock have been selected, as well as the source for the underlying figures. By choosing a different average and varying the timeframe, it is quite possible to show average house prices have actually risen 15 per cent. Big businesses who want to disguise wage discrepancies between senior management and factory floor workers may report that the average salary for executives is £25,000, that being the mode (most common value), ignoring the fact the chief executive pocketed ten times that amount. The advice to reporters investigating such stories is not to be wrong-footed by the lazy option of taking averages on face value - always challenge the use of averages until you know what it includes, and (just as importantly) what it excludes. In effect, it is a question of deciding what questions to ask of the numbers, and how to report the answers. Nothing beats the time-tested journalistic combination of curiosity, accuracy and credibility.

Percentage or percentage point?

A local politician has announced a major new policy initiative and her approval rating, previously at 50%, increases to 75%. How to describe the rise? It may be tempting to call it an increase of 25%; but a quarter (25%) of 50 is 12.5, so an increase of 25% would only take her rating to 62.5%. It is either an increase of 25 **percentage points** or a 50% increase. The

former is preferable as otherwise the repetition of "50%" may be confusing. Similarly with financial market indices – if the FTSE slides from 4500 to 4200, that is a fall of 300 points but only 6.7% (approximately). Percentage change is easy enough to work out (see below), but mistakes can be made when writing up the story. For instance, the omission of the time frame over which the change is measured makes the figure meaningless – a story about a reduction of 50% (better described as a halving) in crime rates take on entirely different significance depending on whether the fall occurred over a period of a month, a year or a century. Percentage change has traditionally been an Achilles' heel of journalism. Perhaps because of this, the current research project and that of Maier (2002) both found few if any examples of this type of error, reflecting a renewed emphasis placed on getting this calculation right. The formula to calculate percentage change is simple enough (the difference between old and new quantities divided by the old quantity and multiplied by 100), but its expression can trip up the unwary. For example, if the price of a commodity increases from £1 to £3, this can be described as "a tripling" or "a 200pc increase", but to refer to a "a three-fold increase" is incorrect as that states that the increase, rather than the new price, is £3.

Randomness

Humans seem genetically predisposed to pick out a pattern from background noise, even when there is not one there (a principle exploited to great effect by one Dr Rorschach). There may have been sound evolutionary reasons for this, back when it was preferable to incorrectly identify predators lurking in the undergrowth than to be eaten, but its effect today is to make us pretty poor at dealing with randomness. Typically, either (1) we see order when there is actually disorder (such as falsely identifying clusters of incidents), or (2) we fail to acknowledge that random processes can be responsible for apparently ordered events (such as short-term economic trends).

1: Clustering is a familiar concept in epidemiology, where the concentration of disease in a particular area may correctly suggest a common cause (such as the nineteenth century Soho water pump which spread cholera among surrounding households), but which can also arise randomly. What appears to be a spike in cancer rates within a locality, for example, may simply reflect the random distribution of such cases, which can cruelly spring up in close proximity – the truly astonishing case would be if such diseases were uniformly distributed

across the entire country. Since uniformity is the exception, clustering is to be expected. But the public, including journalists, tend to underestimate how frequently clusters arise, and their likely size. A greater awareness would lead to less distressing, and potentially less harmful, reporting about non-existent dangers and their necessarily ineffective remedies.

2: We find it difficult to accept that sometimes change simply happens. Instead, we want to attribute it to a definite cause. Economic indicators, for example, fluctuate over the short-term for what are effectively random reasons (random because they are the result of complex interactions between a myriad of factors which are in practice unanalysable), yet governments are quick to take the credit when movements are favourable (a fall in unemployment; a rise in GDP). Of course, policy may have been the cause of high employment or a more prosperous economy, but that can rarely be demonstrated over the short term. Blastland and Dilnot (2008) point to the example of speed cameras. These initially reduce accident rates, but this is because cameras tend to be placed whenever there has been a rise in the number of accidents; regression to the mean suggests that following a run of higher-than-average accident rates, the rate would naturally tend to decrease anyway, whether cameras were there or not. The point is not that speed cameras do not work, but that we need to be cautious when reporting claims that they do. In general, an understanding of the superficial patterns inherent in disorder can help journalists avoid reading regularities into the random.

Relative vs. absolute risk

Stories concerning health abound in statistics – eating this food increases the risk of heart attacks by 20%, or exercising in a certain way decreases it by 10%. But these percentages by themselves provide a partial and often misleading picture since all they tell us is the risk of an activity compared with not undertaking that activity, which is a relative relationship – they tell us nothing about the actual risk. A text-book example of such a story appeared in the *Daily Mail* early in 2019. The report, written by the newspaper's medial correspondent, concerned the risks of blood clots associated with taking HRT in tablet form. Headlined "Taking HRT pills to cope with the menopause 'DOUBLES the risk of suffering dangerous blood clots'", the story began: "Taking HRT pills to cope with the menopause doubles the risk of suffering dangerous blood clots, research suggests" (*Daily Mail*, 2019). The insistence on the doubling of the level of risk is highly alarming, as no doubt the newspaper intended it

to be, especially as the following paragraphs put the number of women in the UK who take HRT in tablet form at around 800,000. It would appear from the report's opening sentences that the medication is highly risky and one could forgive readers from rushing to flush their pills down the nearest sink. It is only when one reaches the 12th paragraph that the key phrase appears: "Although the risk of blood clots double for women who take HRT tablets, the absolute risk remains small". In fact, the research on which the article was based calculated that for every 10,000 women who take HRT tablets, an additional nine cases of blood clots were found. And buried even further in the article is a quote from the chair of the Royal College of GPs, who pointed out the findings did not prove that tablets cause more blood clots than patches, just that there was an association. This is far from an isolated instance of such reporting; back in 2017, the same newspaper reported on a study into the risk of stroke associated with taking HRT tablets, and claimed in the first sentence that women who switched from taking HRT in tablet form to gel or skin patches could "slash" their risk of a stroke (*Daily Mail*, 2017). Yet the relative risk associated with the tablets was revealed further on in the article to be 16%, described by consultant gynaecologist a in the final paragraph as a "slight increase". The absolute risk was not given in the article, although the study itself showed that around 5.7% of women who took some form of HRT developed stroke (Løkkegaard et al., 2017). It is apparent that the newspaper presented the data in the most dramatic terms in order to sensationalise the story and only gave the true figures towards the end of the articles, if at all.

Rounding

Rounding is one way of avoiding spurious precision (whereby a figure is given to a degree of accuracy which is not justified by the accuracy of the underlying data). It can often occur when dealing with the arithmetic mean. For example, suppose seven local recycling centres give their monthly quantity of non-recyclable waste as 52kg, 35kg, 101kg, 87kg, 116kg, 185kg and 44kg. Clearly these are figures rounded to the nearest 1kg, and so no figure which is generated through calculations involving this data can be accurate to more than the nearest 1kg. It would therefore be wrong to claim in a news story that the average is 88.5714kg a month, since this involves an accuracy to far more decimal places than the data support; it could be written as "about 88kg" or "just under 89kg", which respect the degree of precision in the original data. The different types of rounding are rounding up, rounding down and rounding off. Rounding up means taking the next highest valid value; rounding down means

taking the next lowest; and rounding off means rounding up when the greatest non-significant digit is five or higher, and rounding down when it is lower than five, so that when dealing with whole numbers, “91.4998” becomes “91” and “103.5001” becomes “104”. It is rare that general news reports will require rounding to more than two decimal places (where justified by the data).

Estimates

The eminent physicist John Wheeler remarked that he never carried out a mathematical calculation without knowing the answer beforehand; he tongue-in-cheek dubbed it “Wheeler’s first moral principle” (Taylor and Wheeler, 1966: 60). What he meant, of course, was that he would first estimate the answer and then check his result against the estimate; a large discrepancy could suggest a mistake in the calculation or, more excitingly, show that a previously-held assumption on which the estimate was based was wrong. The practice of estimating an answer is second nature to those, like the current researcher, who are old enough to have used slide rules in the school classroom, since this method only gives the significant figures (the mantissa), not the powers of ten (exponent) – without knowing roughly what the answer should be, anyone calculating with a slide rule could easily get it wrong by several factors of ten. The practice of estimating is less common among journalists but should be encouraged as it acts as a sense-check as well as helping ensure any quantity is expressed in the correct units (if one is engrossed in the mechanics of a calculation, one can lose sight of what is being calculated, so that an area may inadvertently be expressed in metres, or an acceleration in metres per second; knowing in advance that the answer should be, say, roughly 8 sq metres or an acceleration of about 6 metres per second per second should protect against such slips).

Data quality

This is probably the most challenging issue of all, since assessing the quality of data is as much to do with what is missing as it is to do with what is in front of you. But it is fundamental to carry out such an assessment because high-quality reporting requires high-quality data; as the acronym from the world of computer programming has it: GIGO (“Garbage In, Garbage Out”) – in other words, garbled data at the outset will result in garbled news reports at deadline. What, therefore, is meant by data quality? It includes the reliability

of the data, of course (how accurate it is), but also its transparency (who compiled it and why), its limitations (how the data set was defined, collected, recorded, transcribed and stored), its currency (are the assumptions behind its collection still valid?), its users (can only authorised users view the data? who can request amendments?), and its robustness (how often do errors creep in? are they of a consistent type and direction? what checks were in place to spot anomalies? how much does it cost to correct errors?). Much of this is highly technical and an entire industry has grown up around verifying large data sets (see chapters 10 and 11 in Johnson (ed.), 2006, pp120-146). But as the doyen of analytic journalism J. T. Johnson observed in the same volume, "there are some things approaching universal laws of database structure and quality measures. Novices in analytic journalism should be introduced to those quasi-laws and old timers should be reminded of them" (op. cit., 153). Johnson's preamble to this observation is illuminating as it highlights the perils of taking even government data at face value. Johnson was working on the *St Louis Post-Dispatch* in the late 1990s when a neighbouring state released its list of sex offenders under the so-called "Megan's Law". The list would have allowed concerned citizens to check whether any registered sex offenders lived near them. As the *Post-Dispatch* prepared to publish the list, one of the senior editors, in Johnson's words, cautioned: "Hey, maybe we better check this out **very** carefully" (op. cit., 3). The list was relatively small at around 300 records, so reporters were able to carry out checks on a large number of cases. The conclusion was that "the data was so dirty that even if the bureaucrats in Illinois were posting it online, no reputable news organization should or would" (ibid.). The thrust of the news story as published changed from the fact that the list was being made public to the fact that the official data was impossible to verify. A follow-up report published in May 1999 was headlined "About 700 sex offenders do not appear to live at the addresses listed on a St Louis registry" and gave the example of a house at 4119 Beethoven Avenue where a rapist was said to live. The actual resident, who had owned the house for 12 years, had never heard of the rapist and had been trying for weeks to have his address removed from the register (cited in Johnson (ed.), 2006: 185). An even more egregious example of inadequate data verification occurred during the 2000 US presidential election, when tens of thousands of voters were removed from the Florida electoral roll based on flawed records provided by a Republican-leaning security firm (Plast, G. 2006). While data analysis and cleaning is outside the area of expertise of most (if not all) journalists, they at least need to be aware of the types of questions they should ask of any data set and of possible limitations to its accuracy and reliability.

Make figures familiar

Whenever one reads about the destruction of rain forests, or the devastation caused by a freak storm, one comes across analogies such as "an area the size of Wales …" ("… has been destroyed/cut down/covered in mud"). While such phrases have become clichéd, the intention is laudable enough – helping readers to imagine quantities with which they are unfamiliar. Large figures, in particular, can be difficult to visualise. Readers may struggle to imagine 2.5m litres of wine, but that is how much liquid it takes to fill an Olympic size swimming pool (although even here, not is all as clear as it could be since Olympic pools must be a minimum depth of 2m but can be deeper, so that some Olympic pools hold as much as 3.1m litres). But the basic principle is a sound one – help readers by converting the unknown into the known. This only holds if two things are true: first, that the precise quantity is unimportant and, second, that the reader is familiar with the target of the analogy. For example, if residents of a suburban cul-de-sac learn of council plans to erect wind turbines nearby on land "about the size of a football pitch", they will almost certainly want to know the precise extent of the area under question[46], and where it is in relation to their homes; similarly, there would be little use in describing the quantity of bald car tyres dumped by an unscrupulous garage as the same height as a local landmark if the story were to be used in the national press.

Conventions in notation

There are a vast number of conventions in notation which can trip up the unwary reporter, and because these vary with context, the same symbol or string of symbols may mean different things when written in a science journal or a business's annual report. For example, on a company balance sheet, a figure placed within brackets indicates a negative value, while in other contexts a negative figure may be written in red or be prefixed with the "-" sign (and the news organisation's own conventional way of displaying the same information, also known as "house style", may be different again). In a different context, brackets signify information which is only of subsidiary interest, so the phrase "Jenny Smith (46) has been appointed chief executive of the retailer Next" does not suggest Jenny is aged minus 46 and hence nearly half a century away from being born. The crucial importance of understanding

[46] Like the capacity of an Olympic swimming pool, the area of a football pitch can also vary.

what conventions are in operation was forcibly driven home when a £100m NASA rover was reduced to a fireball in 1999 because engineers working in different sites used different units to calculate acceleration forces. Unbeknown to each other, engineers at Lockheed Martin used the UK imperial measure (feet, pounds), while the team at the Jet Propulsion Laboratory (JPL) used the metric SI system. The result was the destruction of the Mars Climate Orbiter in the Martian atmosphere, the victim of mix-up between the two conventions; the Lockheed engineers had calculated the force needed to bring the Orbiter into Mars orbit in terms of pounds (the convention used throughout the US launch industry), while the JPL engineers assumed the figure had been converted into newtons, the standard practice for space missions[47]. A reporter runs the risk of a similar fate unless they are aware of what conventions are in use. For example, does the expression "4/5" mean "four-fifths" or "between 4 and 5"? Does the number "7.000" mean "7 given to three decimal places", or "seven thousand" (where the full stop is used instead of a comma to mark the thousand unit)? As well as using a different separator for powers of 10^3, many countries also use a different radix character from that used in the UK (the radix character separates an integer from its fractional part) and so would express the number written in UK English "1,987,291.00" as "1.987.291,000". Knowing the difference between "one" and "one million" would clearly help the reporter covering a news story based on these figures.

Constants and variables

By **convention**, when formulas and equations are written down, letters which appear at the start of the alphabet represent constants (they have a fixed value), whereas letters which appear towards the end of the alphabet represent variables (whose value varies). The reason for this is said to be due to Descartes' printer having a surfeit of the letter "x" (which does not appear often in French words) in his type-tray, and so when he came to print the *Geometry* - the work which founded analytic geometry, in which geometric relationships are represented by algebraic functions - the most convenient because most numerous character he lighted upon to represent the unknown quantity was "x". Other letters have their own value, depending on context – so "i" and "j" often represent the square root of minus one; "r" is Pearson's co-efficient; "n" often represents the size of a sample; "e" is the base of natural

[47] This, and other examples of near-disaster resulting from mis-conversion of units, can be found on the SimScale website (SimScale, 2017).

logarithms. Glyphs from other languages, notably Greek and Hebrew, are also used – pi, sigma and aleph being examples.

Jargon

A source of confusion related to **conventions** is that of jargon, where a word in common use has a specific meaning when used within a particular domain, such as the word "significance" in statistics, for instance. A study which is statistically significant may nevertheless still be socially frivolous. Similar words include "bias", "sample", "random", "confidence" and "normal". These are more likely to catch out the unprepared reporter than terms which clearly have a specialised meaning, such as "chi squared", "regression analysis" or "Gaussian", none of which tend to crop up in everyday speech. Press releases and scientific journals are a common source of jargon as the writers try to avoid ambiguity by using words in a technical sense, not always appreciating that this quest for linguistic precision can result in misunderstanding when the reader is not fluent in the required argot. As always, the best rule of thumb is for the reporter to re-phrase all press releases, journal articles and official announcements into their own words and check for sense, going back to the original **source** if necessary; if a reporter is struggling to understand what they have written, the reading public has no chance.

Fake data

Just as the term "fake news" has entered the public domain, journalists also need to keep a weather eye out for the associated issue of "fake data" – that is to say, false data presented by an actor who is aware of its falsity or indifferent to it. In 2018, the then prisons minister Rory Stewart told a Radio 5 Live interviewer in answer to a question about Theresa May's Brexit deal: "One of the advantages of this deal, to be honest, and the reason why 80 per cent of the British public support this deal, is because what it does …" (BBC, 2018). The definiteness of the figure "80 per cent" (as opposed to "a large number" or "many") suggests it was based on firm evidence and may have gone unchallenged. However, interviewer Emma Barnett immediately cut in to ask how the minister knew that figure was correct, to which he replied: "My sense is, sorry, let me, let me get the language right on that – my sense is that if we have an opportunity to explain this, the vast majority of the British public would support this deal … I'm producing a number to try to illustrate what I believe"; he went on to apologise for the

bogus statistic. In this instance, the information held by the interviewer (that the May deal did not have any great measure of support among voters) ensured that a figure which was presented as genuine was shown to be unsubstantiated. It is often the case that data presented on social media are false or exaggerated and special care should be taken when handling such stories, such as establishing the credibility of the social media account and always verifying the **source** of the data in those cases (admittedly, this can present a challenge as social media users are not always scrupulous in acknowledging the source of their data). Not all erroneous data is "fake", of course, as incorrect figures may be used in good faith or correct figures may be mis-communicated, but the same principle of healthy scepticism which underlies general news reporting needs to be applied to statements involving numbers.

Publishing on social media

Journalists increasingly use social media to publish or promote their news stories, and the nature of some platforms (Twitter in particular) means particular care must be taken when these stories involve numerical data. Among the factors to consider are lack of context and the corresponding difficulty of providing supporting detail; the lack of readers focus/concentration while reading social media posts; and the screen size of mobile devices. First, compared with a newspaper, social media posts lack the informational and navigational context provided by the material conditions of appearing within a newspaper, such as headline size (the larger the headline, the more important the story), page placement (is it a page lead or a filler?), position with the newspaper (front page splash or downpage on page 8?), and even the title of the originating news organisation (which may be lost when a story has been retweeted several times). The social media post itself necessarily lacks context because of its brevity and this is likely to lead to the omission of supplementary or qualificative detail, a situation compounded by the second factor, namely that social media posts tend to be read cursorily, without the same concentration one might employ in reading a newspaper article. Again, this tends to make the nuanced presentation of data more challenging. Finally, the relatively small screen size of mobile devices means there is a limit to how much information can be displayed within a graph or graphic, which can again hinder understanding of numerical data. Steps which reporters can take to address these issues include always posting from a verified account, keeping graphics simple, and linking to background data or important caveats. Links are the friend of the reporter using social media as a wealth of information can be linked to in even the briefest of posts.

Source

A common mistake journalism students (and some journalists) make is to accept second-hand data, either in the form of a summary report or data taken from another news organisation's report. Speed and convenience are obviously the main reasons for this, but it comes at the cost of lack of accuracy and even at the risk of news angles being overlooked. It happens, for example, when a news organisation commissions an opinion poll and reports the results, which are then picked up by other journalists who base their articles purely on the news report. Since the original data are normally published on the pollster's website, it is a relatively painless task to refer back to them. The advantage of doing so is that some information - such as sample size and margin of error - may be included in the original data but omitted from the initial news report, and of course there is no guarantee that the poll was reported correctly in the first place. Another common practice is to rely on the summaries provided by bodies such as the ONS to accompany their data releases. A recent example was the ONS annual report into deaths registered in England and Wales for 2018 (ONS, 2019). The "Main Points" of the summary are broken down into four headings, in the following order:

1. Mortality rates increased for women but decreased for men;
2. 2018 saw the highest number of deaths since 1999;
3. The North East had the highest and London the lowest mortality rates;
4. The fact that dementia remained the highest cause of death.

When the news story was reported in the *Guardian*, it was point (4) which became the main news angle ("Dementia is the biggest health crisis of our time …", the report began (Hill, 2019)), with point (2) being relegated to the end of the second paragraph. The other two points appeared nowhere in the *Guardian* report. The *Times* also led with the dementia angle (point 4), while point (2) appeared only in paragraph 12, followed by points (1) and (3) in the succeeding two paragraphs (Hurst, 2019). Hence we can see that summaries may capture the main news angles, but not always in the correct order, and some of the angles may not be appropriate to all news media. Since the summary reports are compiled by data professionals, they come hedged with appropriate caveats and methodological explanations, making it less likely that relevant information will be ignored. In this sense, it is a safer practice than merely relying on news reports published elsewhere. However, this approach still harbours dangers.

In the case of the ONS mortality rates statistics, there is important information within the methodology section explaining that diseases which prior to 2011 which would have been coded as due to cerebrovascular disease were now coded as due to vascular dementia, and that since 2014 those which had been coded as due to chest infection or aspiration pneumonia were now also coded to dementia where dementia was mentioned on the death certificate. The overall effect of these methodological changes, of course, is to increase the number of deaths recorded as due to dementia but the fact was not mentioned in the *Guardian* report. The *Times* did include the sentence that "The Office for National Statistics (ONS) said that better understanding and diagnosis made dementia more likely than other conditions to be recorded on death certificates" but did not spell out that this represented a change in the method of recording deaths, nor explain how this would increase the number of deaths attributable to dementia. A further disadvantage of relying on summaries is that it assumes the summariser has correctly identified the main news angle; for regional news media, in particular, data may be available on a geographically granular basis even though this level of detail is not given in the summary. By always going back to the full dataset, a regional journalist can spot a news story that the high-level national figures fail to convey and all journalists can be sure they have squeezed as much news value out of the data as possible.

The Monty Hall twist

However, it is important to acknowledge that understanding numbers is not always a matter of common sense; there can sometimes be subtleties involved which can baffle even the most competent of mathematicians. Perhaps the most notorious instance of this is the so-called "Monty Hall" problem (named after the US quiz show on which the problem is in part based), as it illustrates how "common sense" reasoning can lead people astray. In essence, the problem is about a quiz show where there are three doors, behind one of which is hidden a sports car while the other two are empty. The objective for the contestant is to pick the door behind which the car is hidden and to avoid the empty doors. But here comes the twist – once the contestant has selected one of the doors, and before it is opened, the host (Monty Hall) throws open one of the other two doors to reveal that it is empty and asks whether the contestant would like to stick with their original choice, or to switch to the third, unopened door. Common sense says to stay put; the original odds of finding the car were one in three but as now there are only two doors to choose from, the odds must have improved to 50-50 so there is no point switching. Surprisingly, that is wrong - the contestant is always better to

swap. Such is common sense's revulsion at this claim that when the problem was most famously set (in *Parade* magazine in 1990, although it had originally been solved in *American Statistician* (Selvin, 1975)), an acrimonious correspondence ensued in which mathematicians of some repute argued for the common sense position that switching made no difference: "Of the critical letters … received, close to 1,000 carried signatures with Ph.D.'s, and many were on letterheads of mathematics and science departments" (Tierney, 1991). It has since been shown conclusively that the odds of winning the car increase to two-in-three if the contestant switches, and multiple computer simulations have proved this to be numerically correct (in the interest of completeness, it should be noted that the actual gameshow, called *Let's Make a Deal*, did not work as described. The host was not obliged to open a second door but could choose when to do so. With this important difference, the problem becomes insoluble in general since the *Let's Make a Deal* host will open another door only when it is in his interest to let the player switch).

So what is at issue in this game show example, and why is it important? It shows there are limits to what levels of numeracy we can reasonably expect from journalists; if even mathematicians stumble when faced with a counter-intuitive problem, then what chance do civilians have? However, what is required is the knowledge to know when one does not know something, rather than the blithe assumption that one does. In the former case, it is possible to call on outside expert assistance; in the latter, one blunders on in a state of blissful ignorance. The numerate journalist is confident in their ability to handle figures, but recognises when they are out of their depth and knows who to call on for assistance.

APPENDIX 2: Transcripts of conversations with experts

A) Prof. Kevin McConway

I'd agree with you that journalism courses ought to encourage more students with a science background. I certainly don't think it is the only way to address the problem of low numeracy skills, though, but I'm not sure what else would reliably work. Some of the best journalists that I know of in writing about numbers didn't come from a science background at all - for instance Michael Blastland, the co-inventor of and first producer of the BBC Radio 4 programme More or Less, is an English graduate if I recall right, and there are others. The thing that it would be interesting to look at is what successes there have been in training journalists-to-be who have the 'traditional' arts background to be able to deal with numbers, and not just run away from them in fear, as seems to happen too often. Plenty of journalists do get through this on specialized beats like business or even sport, but so many just seem not to do it.

Though I do think students with a science background should be encouraged to study journalism, I really haven't got any good thoughts on exactly how to do it. Many people that would describe themselves as data journalists (though far from all, of course) do seem to have some sort of a science background, or at least not the traditional sort of arts (e.g. they might come through computer science or something like that). Might be worth looking at how people like that are attracted to journalism.

Another thought is that it might get difficult to train science people, coming in to study journalism, in aspects that are maybe taken more for granted with people from arts. That might depend on whether you're talking about first degree level courses or graduate courses and training. People who graduated in the arts, if they were any good at their arts studies, will have experience in writing essays, constructing arguments, debating things (in writing or whatever), and so on, possibly directly in telling good stories. I know that isn't the same as writing journalism but it must help. Many science graduates are really not very good at that sort of thing so you would have to start at a lower base in training them in writing aspects. Depending on exactly what they studied, they may have written rather little in terms of connected prose, and perhaps a lot of what they have written will be in the style of formal scientific reports. (Or if they studied maths, they could well have done almost nothing like this.) The difference for people going onto first degrees won't be so different, but in arts A

levels you do have to write essays and the like, whereas there's not much of that in science A levels.

And the final thing that occurs to me (for now anyway) is that not everyone with a science background has particularly well developed numerical skills. Depending on which sciences they did, they will certainly have had some level of exposure to numerical and statistical ideas, but not necessarily all that much. Many people that I speak to, even if they are working as research scientists, tell me how difficult they found statistics when they studied it as an undergraduate, and say that there are still important aspects that they don't get. That is particularly true of people who studies some biological sciences (though others in that area are very good numerically). But I suppose they at least know what they don't know, and their level of not understanding is doubtless considerably higher than that of a typical English graduate.

Kevin McConway, Emeritus Professor of Applied Statistics The Open University
kevin.mcconway@open.ac.uk

B) Scott Kier.

National numeracy definition: to encourage good practice, not so much to point out bad practice. If I want to get people on side, you have to do it in a positive way. You can tell better stories by improving your understanding of stats. You can spike the bad but also get exclusives.

Classically, journalists not very numerate. I don’t have evidence of that. We did a report a couple of years ago looking at UG journalism courses (see Richard Kennemy, Significance). Not everyone who does journalism has a degree. We need a culture in journalism where having numerical nouse is important. I’ve seen some very good examples of journalists digging into the numbers and asking good questions. Money for school dinners of 9p per child which a journalist spotted [a story which broke during the 2016 election campaign].

May 24 - £60m for primary school kids would cost only 7p per pupil for breakfast. We’re living in the world of data. Bacon-easting stories still appear [food health safety]. The role of journalism is complex. We wnt to encourage them to tell stories better. One story about ….

Spiked. BBC employment up 60,000 but the confidence interval was 79,000 so there was really no story.

It is all about being able to ask questions and we want to encourage that. There are still questions that can't be asked without doing the maths. Fact checking is becoming more important. Holding stats to account is a role journalists can do.

In the long term … encouraging journalists to understand stats and present them in appropriate ways. The ecosystem needs to be changed – jouros, graphic artists, subs – all need to be able to ensure across the story cycle, that numerical angles are handled properly. That all leads to better/different stories. I would like to see J-schools helping students improve their numerical skills. I hope education up to 18 there would be an improvement there as that would help the pipeline earlier.

[Quotes from a talk at RSS Conference 2016]: Half of working age adults don't have more than primary school maths and one-fifth even lower. Accrediting bodies are resistant to include statistical literacy within criteria. Most journalists have seen algebra but not calculus. Most journalists have not had a course of statistics. Language is the area of expertise for journalists.

Scott Kier, Royal Statistical Society, Head of education and statistical literacy.

C) Prof. John Allen Paulos

Q: Do you believe journalists are sufficiently numerate to perform their jobs effectively?

A: Of course, that depends on the kind of story being covered, but for many numerically flavored stories (and other kinds), the answer is No. Innumeracy is certainly still a problem, but it is compounded by political/cultural constraints as well, and it is sometimes hard to separate innumeracy from the latter. Gullibility and a lack of critical perspective further exacerbate journalists' innumeracy.

Q: Do you believe journalists have become more, or less, numerate over the past 20 years, or has that remained about constant? (If there has been a change, why do you think that may be?)

A: Science and business journalists are usually quite numerate, but I haven't noticed a big change among general beat reporters. The same sorts of errors and omissions of context occur constantly in news stories.

Q: What, if anything, could or should be done to improve the numeracy of journalists?

A: I once was recruited to teach a course in quantitative literacy at the Columbia School of Journalism. 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 then were not numerically savvy, to put it kindly. Nevertheless I thought the course was a success and was therefore disappointed when it wasn't made a requirement, which led to its being dropped by the administration at the time (mid-90s). I think such a course should be offered at schools of journalism and, for those students who don't pass a numeracy pre-test, it should be required.

Prof. John Allen Paulos, Dept of Math, Temple Univ., Philadelphia, PA 19122; J.A. Paulos <math233@gmail.com>

D) Alex Bellos.

(Oxford, 87-90) Maths was always my best subject and .. but I was also interested in lots of other things. Like … and had the idea to study for a career. Perfect mix. Most fascinated by the philosophy behind maths. The teaching was atrocious, the system worked well for some but terribly for others. The maths modules were quite specific. I was always involved in social activities and started working at freshers week.

My largest social group was all around newspapers. Milkround of traineeships and got on the Brighton Argus then freelanced in London. Indirectly, it came up at work because I was more of a mathematician than a writer; maths is all about structure. Maths is really just a structure.

Understand press releases. You never really talked about it [maths, at work]. One moment was the roads incident [from intro to book]. People were les numerate for practical reasons. Arrived in last days of hot metal. Not been in a newsroom for 20 years now. There’s a lack

of grasp of some basic things in statistics. Lots of people don't really understand the weather forecast.

Over the last 5-10 years, there's a kind of resurgence of people talking about data misinterpreted in the media. The level of statistical awareness is much better. Newspapers don't have any money so journalists aren't being trained so there's a lack of sound statistical background. It is easy to misuse statistics. Too often, the *Daily Mail* deliberately misinterprets things.

Alex Bellos, Journalist and author.

APPENDIX 3: Raw data for newspaper audit

Page number	Headline	Section	No of pag	Date	Notes	(Original)	Error type
25	*Zoo attraction will add animal magic*	*News*		*11/03/2015*	*Not clear if weight and capacity refer to all 14 boats or individual boats*		
26	*Smokers put families' health at risk*	*News*		*11/03/2015*	*No margin of error given for survey although sample size is given*		
18	*Hicks puts £90m home up for sale*	*News*		*09/03/2015*	*Dimensions of property not put in context*		
14	190 jobs go in £50m cuts	News		06/03/2015	OK		
30	2,200 homes bought by Help-to-Buy	News		06/03/2015	OK		
33	Passenger figures on the rise at Easyjet	Business	60	06/03/2015	OK		
8	Hospitals set to ban smoking	News	48	07/03/2015	Figure of 9	7	3
4	City - council tax will rise by 1.9%	News		05/03/2015	Percentage	1	2
20	"We must act now to tackle housing shortage"	News	80	05/03/2015	OK		
21	Unique scheme helped me buy a home	News		05/03/2015	OK		
BW7	Sector sees jobs surge	Business		05/03/2015	OK		
BW8	Boom in "DISCO" scene raises fear for UK economy	Business		05/03/2015	Survey doe	7	3
4	Universities' flight costs revealed	News	72	04/03/2015	OK		
8	Councils to plan new budgets	News		04/03/2015	Incorrect c	1	2
24	Anger over councillor's trip to USA	News		04/03/2015	OK		
42	Profits rise at Johnson Service group	Business		04/03/2015	OK		
42	City advisors work on £3.16bn of deals	Business		04/03/2015	Percenatge in/decreases correctly calculated		
24	MP Field calls benefits "yellow"	News	52	02/03/2015	Sanction fi	7	3
31	Olympic star in saddle for record bid	News		02/03/2015	"35 times r	8	4
4	The Reds are back in the black	News	56	03/03/2015	OK		
32	Trinity sees rise in digital revenues	Business		03/03/2015	OK		

Note: Titles in italic outside date range

Figure 15: Liverpool Echo 2015

Page numl	Headline	Section	No of page	Date	Notes	(Original) I	Error type
41	Ageing population brings grave problems	Business	80	25/06/2007	OK		
40	Besieged buyout firms make £2bn by linking AA and Saga	Business	80	26/06/2017	Claim that	1	2
45	LSE secures crucial backing on Borsa from big investors	Business	80	26/06/2017	OK		
49	Magic wand lifts Nintendo above Sony	Business	80	26/06/2017	OK		
57	Sale of the Gherkin throws spotlight in commercial yields	Business	80	26/06/2017	OK		
48	US Justice Dept to scrutinise BAE's Saudi deals	Business	96	27/06/2007	OK		
49	Pact opens way for News Corp takeover of Dow Jones	Business	96	27/06/2007	OK		
52	Bank chief defends pay awards of the City's "Premiership"	Business	96	27/06/2007	OK		
53	Dutch advice boosts Barclays in ABN bid	Business	96	27/06/2007	OK		
54	Tesco shareholders urged to oppose its "excessive" rewards	Business	96	27/06/2007	Reference	7	3
55	Building a bypass for internet	Business	96	27/06/2007	OK		
57	Japanese at front of grid in race to save the environment	Business	96	27/06/2007	OK		
59	Housebuilder takes big hit as sub-prime woes deepen in US	Business	96	27/06/2007	OK		
56	Buffett blasts system that lets him pay less tax ...	Business	112	28/06/2007	OK		
56	Ranks of rich grow faster in Britain ...	Business	112	28/06/2007	OK		
57	Still room at the top at Sports Direct	Business	112	28/06/2007	OK		
62	Merging housebuilders fear more pain	Business	112	28/06/2007	OK		
63	*Graphic on mortgages interest rates rise*	Business	112	28/06/2007	Four graph	4	4
63	Spending eases as interest rate rises hit home	Business	112	28/06/2007	OK		
64	SMG gives second profit warning in a year	Business	112	28/06/2007	OK		
67	American mortgage crisis forces buyout firms to pull debt offering	Business	112	28/06/2007	OK		
69	Aeroflot cites data gap ...	Business	112	28/06/2007	OK		
70	O'Reilly dips into his own pocket to reshape Wedgwood	Business	112	28/06/2007	OK		
70	Suex refuses to sell key assets ...	Business	112	28/06/2007	OK		
71	My new gizmo has gone up in smoke	Business	112	28/06/2007	OK		
56	*Mobile future: The market graphic*	Business	112	29/06/2007	OK		
59	HMV profits down 73% ...	Business	112	29/06/2007	Shares fell	3	2
60	Surprise surge in house prices	Business	112	29/06/2007	OK		
60	Battle line drawn for what will be a close-run thing	Business	112	29/06/2007	OK		
64	Heathrow's £1.5bn upgrade ...	Business	112	29/06/2007	OK		
64	Caution sounded as buyouts force up ...	Business	112	29/06/2007	OK		
65	Sports Direct agrees $168m deal	Business	112	29/06/2007	OK		

Figure 16: Times 2007

Page numl	Headline	Section	No of page	Date	Notes	Error type
18	BA shelves decision ...	Business	32	03/08/1987	OK	
21	Steady pound is priority for business ...	Business	32	03/08/1987	OK	
21	Workers' co-ops up by 20%	Business	32	03/08/1987	OK	
19	Gulf tensions hits shares	Business	38	04/08/1987	OK	
19	Trafalgar lifts bid ...	Business	38	04/08/1987	OK	
19	Job agencies in bid fight	Business	42	05/08/1987	OK	
19	Fizz returns to champagne	Business	42	05/08/1987	Reference	3
19	Rise in oil price 'will help BP'	Business	42	05/08/1987	OK	
21	Bonn pours more into research	Business	42	05/08/1987	OK	
22	Big salary bonus for the new accountant	Business	42	05/08/1987	OK	
19	US expansion by NatWest	Business	38	06/08/1987	OK	
19	BA on reovery course ...	Business	38	06/08/1987	OK	
19	Lost' stock hits Tip Top	Business	38	06/08/1987	Claims £8l	2
19	Interims fall 10pc ...	Business	38	06/08/1987	OK	
20	Tourist spending in UK rises to record ...	Business	38	06/08/1987	Confusion	1
20	Jolliffe to pay £32m ...	Business	38	06/08/1987	OK	
19	Bank defends rise in interest rates	Business	34	07/08/1987	Graphs ha	6
19	Leasing market beats tax fears	Business	34	07/08/1987	Reference	1
3	BT may be forced to increase fares	News	32	03/08/1987	Percentag	3
3	New look at vanity plates	News	32	03/08/1987	OK	
3	Children reveal bad drivers	News	32	03/08/1987	Survey res	3
3	Microwave power aircraft takes off	News	32	03/08/1987	Relationsh	3
4	Nuclear submarine parts to be buried ...	News	32	03/08/1987	Mixes met	5
5	Man who will define map of future ...	News	32	03/08/1987	OK	
5	Too many historic homes need help	News	32	03/08/1987	OK	
6	Leader of Tamil Tigers agrees ...	News	32	03/08/1987	OK	
7	Bitter road to bloody riot ...	News	32	03/08/1987	OK	
1	Safety study after 112 light aircraft ...	News	38	04/08/1987	OK	
3	Germ warfare island ...	News	38	04/08/1987	OK	
4	Queens' surges to top of Cambridge ...	News	38	04/08/1987	OK	
4	Watchdog warning on gas prices	News	38	04/08/1987	Reference	3
7	Japanese reliant on Mideast oil	News	38	04/08/1987	OK	

Figure 17: Times 1987

Page numl	Headline	Section	No of page	Date	Notes	Error type
38	Analysts' winners turn out to be losers ...	Business	60	22/01/2018	OK	
37	House prices likely to stay flat in 2018 ...	Business	68	23/01/2018	OK	
37	Kodak defends bosses' share windfall	Business	68	23/01/2018	OK	
39	Netflix tops $100bn valuation ...	Business	68	23/01/2018	OK	
38	Bookies may sue ...	Business	68	23/01/2018	OK	
38	Smaller companies make keeping staff top priority	Business	68	23/01/2018	OK	
40	Bullish bosses have great hopes ...	Business	68	23/01/2018	OK	
45	Dixons unveils sales upturn ...	Business	68	23/01/2018	OK	
45	Ocado delivers again for investors	Business	68	23/01/2018	OK	
42	Watchdog lights way to Sky takeover	Business	72	24/01/2018	OK	
45	Order books are filling up at busy factories	Business	72	24/01/2018	OK	
45	Owners push equity release to record	Business	72	24/01/2018	OK	
47	Elon Musk puts $45bn gamble ...	Business	72	24/01/2018	OK	
51	Pets are gift that keep on giving	Business	72	24/01/2018	OK	
37	Sterling surges against dollar ...	Business	72	25/01/2018	OK	
40	New homes fall well short of target	Business	72	25/01/2018	OK	
40	Countrywide chief heads for door ...	Business	72	25/01/2018	OK	
43	Sssh! Fevertree fizzes ...	Business	72	25/01/2018	OK	
43	WH Smith misses support of Famous Five	Business	72	25/01/2018	OK	
45	Spending back on agenda ...	Business	72	25/01/2018	OK	
45	Speak out on sexism and bias in the workplace ...	Business	72	25/01/2018	OK	
51	Raging bull set to be pulled in by the horns	Business	84	27/01/2018	OK	
55	First-time buyer numbers reach a ten-yea high	Business	84	27/01/2018	Spurious a	8
55	Kwek loses fight ...	Business	84	27/01/2018	OK	
40	Foxtons suffers as London sales stall	Business	76	26/01/2018	OK	
40	Home ownership among the under-45s plummets	Business	76	26/01/2018	"Average"i	3
42	Retail curbed by cautious households	Business	76	26/01/2018	OK	
45	Freight recovery is light at end of tunnel for Getlink	Business	76	26/01/2018	OK	
45	Kier update eases fears ...	Business	76	26/01/2018	OK	
45	TV news no longer Sky's headline act	Business	76	26/01/2018	OK	
1	Trust in social media hits record low ...	News	60	22/01/2018	Survey rep	3
3	Bitcoin investors seek refuge ...	News	60	22/01/2018	Bitcoin val	1

Figure 18: Times 2018

Page numl	Headline	Section	No of page	Date	Notes	Error type
22	New ook s	Business	52	25/06/2007	OK	
			52	26/06/2007		
9	Merseysid	News	56	27/06/2007	False com	4
2	Water you	News	76	28/06/2007	OK	
			56	29/06/2007		
			48	30/06/2007		

Figure 19: Echo 2007

Page numl	Headline	Section	No of pages	Date	Notes	Error type
1	Jitters by t	News	32	03/08/1987	OK	
12	Stores bat	Business	32	03/08/1987	OK	
4	City set fo	News	32	04/08/1987	OK	
4	Rover slasl	News	36	05/08/1987	OK	
8	For butter,	News	36	05/08/1987	Compariso	4
9	Copter firr	News	36	05/08/1987	OK	
22	Drivers are	News	36	05/08/1987	Year 2000	1
2	Why the b	News	48	06/08/1987	OK	
4	Bank signa	News	48	06/08/1987	OK	
5	SDP snubs	News	48	06/08/1987	OK	
2	£11bn pan	News	52	07/08/1987	OK	
2	Owen is de	News	52	07/08/1987	Subtractio	2
4	B-test 'hav	News	28	08/08/1987	OK	

Figure 20: Echo 1987

APPENDIX 4: Ethical approval

Ethical approval for this research project was granted in January 2016:

From: Williams, Mandy
To: Harrison, Steve
Cc: Frost, Chris
Subject: Ethical Approval
Date: 05 January 2016 14:01:17
Importance: High

Dear Steve

With reference to your application for Ethical approval

16/LSS/001 - Steve Harrison, PGR - Are journalists and journalism students sufficiently numerate?

Liverpool John Moores University Research Ethics Committee (REC) has reviewed the above application and I am pleased to inform you that ethical approval has been granted and the study can now commence.

Noted: Please include supervisor's name and contact details on the PI sheet.

Approval is given on the understanding that:

- any adverse reactions/events which take place during the course of the project are reported to the Committee immediately;
- any unforeseen ethical issues arising during the course of the project will be reported to the Committee immediately;
- the LJMU logo is used for all documentation relating to participant recruitment and participation eg poster, information sheets, consent forms, questionnaires. The LJMU logo can be accessed at http://www2.ljmu.ac.uk/corporatecommunications/60486.htm

Where any substantive amendments are proposed to the protocol or study procedures further ethical approval must be sought.

Applicants should note that where relevant appropriate gatekeeper / management permission must be obtained prior to the study commencing at the study site concerned.

For details on how to report adverse events or request ethical approval of major amendments please refer to the information provided at https://www2.ljmu.ac.uk/RGSO/93130.htm

Please note that ethical approval is given for a period of five years from the date granted and therefore the expiry date for this project will be January 2021. An application for extension of approval must be submitted if the project continues after this date.

LIVERPOOL JOHN MOORES UNIVERSITY

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LIVERPOOL JOHN MOORES UNIVERSITY PARTICIPANT INFORMATION SHEET

Title of Project *Are journalists and journalism students sufficiently numerate?*

Steve Harrison, Liverpool Screen School

You are being invited to take part in a research study. Before you decide it is important that you understand why the research is being done and what it involves. Please take time to read the following information. Ask me if there is anything that is not clear or if you would like more information. Take time to decide if you want to take part or not.

Purpose of the study

There is a view that journalists are not very good at writing stories that involve figures or reasoning with numbers. The purpose of this study is to explore whether that's true and, if it is, what can be done about it. The aim is to establish whether there is an issue around numeracy and to propose remedial action if this is the case.

1. What will happen if I agree to take part?

You will be invited to be interviewed, at a venue and time to suit you, about your views on the research topic. The interview will last around 45 minutes. You may withdraw from the project at any time, up to the point at which the research is published.

2. **Are there any risks / benefits involved?**

No immediate benefits, although it is intended that the research will be of long-term benefit to the profession by leading to improved numeracy capability for journalists. There are no risks.

3. **Will my taking part in the study be kept anonymous/confidential?**

You can chose for your responses to be kept anonymous, so no details will be kept which could identify you, other than the sector in which you work (eg, regional or national press).

If you do not wish to be anonymous, your name and that of the organisation for which you work may appear in a dissertation, a conference presentation or a peer-reviewed academic journal.

In either event, your responses be securely stored in accordance with the LJMU Code of Practice for Research, and not used for any other purpose than that outlined above.

Contact Details of Researcher

Steve Harrison.

Tel: 0151 231 4842, email S.Harrison1@ljmu.ac.uk

This study has received ethical approval from LJMU's Research Ethics Committee on January 15 2016, ref 16/LSS/001

If you any concerns regarding your involvement in this research, please discuss these with the researcher in the first instance. If you wish to make a complaint, please contact researchethics@ljmu.ac.uk and your communication will be re-directed to an independent person as appropriate.

LIVERPOOL JOHN MOORES UNIVERSITY
CONSENT FORM

Are journalists and journalism students sufficiently numerate?

Conducted by Steve Harrison, Liverpool Screen School

By providing my name and date in the space below, I agree to the following statements:

1. I confirm that I have read and understand the information provided for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and that this will not affect my legal rights.
3. I agree to take part in the above study

Name of Participant Date

Name of Researcher	Date
Steve Harrison	January 2016

Note: When completed 1 copy for participant and 1 copy for researcher