

# ON ‘TWO CULTURES’ AND TACKLING THE ‘WRITING VERSUS MATHEMATICS’ DICHOTOMY

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**Abstract** While for many it is a timeless norm with no hope of resolution, not everyone accepts that mathematics and writing appear to have an unbridgeable gulf between them.

*“The basic problem in writing mathematics is the same as in writing biology, writing a novel, or writing directions for assembling a harpsichord: the problem is to communicate an idea. To do so, and to do it clearly, you must have something to say, and you must have someone to say it to, you must organize what you want to say, and you must arrange it in the order you want it said in, you must write it, rewrite it, and re-rewrite it several times, and you must be willing to think hard about and work hard on mechanical details such as diction, notation, and punctuation.*

*That’s all there is to it.”*

Paul R. Halmos (mathematician and expositor)

## 1 Opening Thoughts

It is well known that research mathematicians repeatedly require personal qualities such as determination, courage and tenacity, as well as ingenuity, in order to function successfully. Less obvious, perhaps, is a school of thought that these and related attributes—when transferred into writing (novels, short stories, poems, critiques)—bode well for the resulting narrative in all sorts of ways (in sentence formation, plot depth and complexity, text pace/metre/rhythm, and so on) as syntactic and semantic models are deployed, alongside other standard linguistic devices, with full rein afforded to idiosyncrasies and character traits intimately connected to the discipline of mathematics. Fundamental laws of prose/poetry mirror, in some sense, mathematical rules in permitting certain operations and not others. More importantly, higher order competences which underpin mathematical research—associated with inventiveness, risk-taking, imagination, originality and innovation—commute across as well. Long gone are the days of the catholic scholar who could quote Pindar or Tennyson and discuss Newton or Gauss with ease, but writers (and poets) who have a reasonable mathematical education still have much from which to draw, at times almost mimicking the mathematician who, in a state of elevated concentration or hyperfocus, surrenders him(her)self to the very moment so as to tap into an intensity of perception and awareness. As the mathematician tends to the necessary accuracy of a proof or formulation after revelation, so also the writer sets right the pattern of words in response to an idea or moment of understanding; inspiration may come suddenly as a sharp burst of illumination, or emerge slowly from the shadows of the mind, often leaving the pleasing sensation of remembering something one didn’t know one knew—a retrospective reconciliation, after the act.

Undoubtedly, a majority of novelists, essayists, and the like, consider mathematics to be a subject at once beguiling yet far from reach, however those who are able to journey meaningfully into its domain are exposed to new ways of thinking that can be applied subtly, pragmatically and expediently. There are also rewards to be reaped by mathematicians who, making a deliberate decision to expand their horizons, engage in non-mathematical writing, or else expository type writing for their own community or the populace at large (which is, on the one hand, part

and parcel of the ways in which research within a field can be disseminated and objectively assessed, while on the other some of its more accessible elements can be shared with the wider world of mathematical laymen). These may also serve as a break from the relentless and exhausting mental demands of research, though wearing two very different creative hats is still a big ask (the dualism of Russian mathematician Sónya Kovalévsky, noted in the short piece [3], is an example of someone following writing pursuits well away from mathematics, albeit with a struggle; French mathematician and physicist Marie-Sophie Germain also studied philosophy and psychology, on which latter she published).

## 2 Historical Backdrop

Some people train as a mathematician and then enter the writing circle (in)formally, while for others the order is reversed; occasionally someone will keep each *métier* running in parallel.<sup>1</sup> In our internet age opportunities to publicise interesting mathematical facts, results and curiosities via the YouTube channel *Numberphile* have been taken up by a variety of mathematicians who work at different grades—most either publish lower end to medium expository works or are hardcore researchers—and use the additional vehicle(s) of print and/or blogging platforms as a means to get their messages out. Likewise, writers take advantage of the web to publish, self-promote and advertise/sell their metaphorical wares, and it would be fascinating to undertake a neurological analysis to ascertain if participants (with aptitude) in both areas display differences in brain functionality compared to those that do not engage. Certainly, the mixture of these apparently disparate occupations benefits the individual in particular, and society as a whole, a perspective voiced strongly over sixty years ago by physical chemist turned author C.P. Snow [6] who—deploring, *inter alia*, the happy mathematical and scientific ignorance of those working in the arts and humanities (echoing predecessors H.G. Wells and A.L. Huxley)—later sparked a very public rebuke from influential academic and critic of English literature F.R. Leavis which is not forgotten even today such was its ferocity (the same underlying tensions persist, though not to the extent that such a vitriolic spectacle could transpire so openly again one feels). Snow was in a minority, though he stuck to his guns in calling out an unhealthy educational imbalance which had, he said, favoured the arts and humanities over the sciences and in consequence fashioned a barrier to the growth, enrichment, stature and stability of any post war western society—a postulate refuted by Leavis with allegiances sitting elsewhere and no desire for an *entente cordiale*.

At the time of the Snow/Leavis controversy the discernible gap between scientists and so called 'literary intellectuals' was growing as technology began to be described through a new kind of specialised discourse in which the latter group couldn't or wouldn't participate (and it is primarily the language of mathematics that has always wrapped it in a thick cloak of semiotic impenetrability and abstruseness, causing people to shy away from it as a triggered reaction). There was also the feeling among advocates and drivers of ongoing industrial and scientific advances that 'traditional culture' would, inevitably and quite rightly, be reduced to a mainly decorative role, its influence and relevance to solving some of society's practical problems ever diminished. This has, rather unfortunately, been the take of swathes of mathematicians who regard writing as a somewhat superficial pastime that lacks the depth, rigour and reliability of mathematics—in other words, its authenticity.<sup>2</sup> Leavis countered (I am here paraphrasing Cambridge professor

<sup>1</sup>People such as Lewis Carroll, Thomas Pynchon, Marion Cohen, Charles Seife, Leila Schneps, Guillermo Martínez, Abraham Boyarsky, Aner Shalev, David Foster Wallace, Alex Bellos, Douglas Hofstadter and JoAnne Growney, to name a selection of past and present mathematical-literary figures, bear testimony to career trajectories of pertinence.

<sup>2</sup>It is worth adding further context here, seeing as the affliction of which Snow spoke is what helps sustain a pronounced distance between mathematics and writing for all but an auspicious few. The talk 'Two Cultures' (based on a *New Statesman* article of 1956) was delivered at Cambridge University as the 1959 Rede Lecture. Early on Snow sets the scene for, and strikes the tone of, his address:

"There have been plenty of days when I have spent the working hours with scientists and then gone off at night with some literary colleagues. I mean that literally. I have had, of course, intimate friends among both scientists and writers. It was through living among these groups and much more, I think, through moving regularly from one to the other and back again that I got occupied with the problem of what, long before I put it on paper, I christened to myself as the 'two cultures'. For constantly I 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, . . ." [6, p. 2],

adding (p. 4) "They have a curious [skewed] image of each other. Their attitudes are so different that, even on the level of emotion, they can't find much common ground."

Stephan Collini who has appraised the standoff in depth<sup>3</sup>) that there was a tangible absence of an effective “educated public” in contemporary Britain—evidenced by a facile, vogueish treatment of literary and cultural matters in newspapers and smart weeklies that gave room for the rise of people like Snow as consecrated (though in Leavis’ eyes unqualified and false) doyens of cultural authority—beyond which his target was, centrally, the axiomatic status accorded to economic prosperity as the sole or overriding goal of all social/governmental action and stratagems; this Leavisian outlook wins out in some quarters today, sharpened by the recently raised profile of S.T.E.M. (Science, Technology, Engineering and Mathematics) subjects that leaves some of the arts, humanities and social sciences cognoscenti tinged with jealousy and looking on askance at a group whose constituent elements would appear to have formed a quasi-hegemonic collective with a bright tomorrow assured.

### 3 A Different Mindset

When rigid propositions are aired frequently enough they acquire the status of the self-evident and the result is the type of unquestioned clichés that maintain divisions, producing philosophical silos—based on confusions and incomprehensions—into which people fall and become confined, tone deaf to others. This to me is strange when one considers that writers and poets often unconsciously make an appeal to strains of conception and abstraction found in mathematical thinking, while mathematicians can award themselves new liberties of articulation enjoyed by the former. Neither group actually have sole ownership of these things, sharing feelings of passion, pain, and loyalty to their crafts which surface in their outputs; each embarks on an exacting and admirable quest for a version of truth and beauty, the routes to which often tread paths of raw sentiments, both temporal and spiritual.

Mainstream culture continues to cast mathematical work and the industry of writing at opposite ends of a spectrum—bookended by rational/apodictic enquiry and artistic/aesthetic instinct—where they are conveniently stationed and stay polarised as mutually exclusive. It is difficult to envisage a much needed change of mindset on this topic, and one is brought to the conclusion that the earlier an efficacious dialogue is started the better. In this respect I refer the reader to an interesting article (aimed at undergraduate mathematical education students, but with some excellent points pertinent to all professional mathematicians) in which the University of Auckland’s Caroline Yoon—asserting that the generally accepted ‘writing versus mathematics’ disjunction is a profoundly unhelpful one—attempts to disassemble it by discussing analogies between the prosecution of (stylised/conventional) writing and standard mathematical endeavours (in fact she counsels, with some justification, that there is a moral and ethical imperative to unveil these observations for young minds). She offers three writing-mathematics metaphors that remove the disconnect: (i) writing as modelling, (ii) writing as problem-solving, and (iii) writing as proving, providing a Metaphor Mappings Table that lists both productive and unproductive beliefs/practices associated with each before offering a detailed discussion to which I am exposing classes as they take on assignments for myself. Yoon submits that students who identify more as mathematicians than writers be encouraged to recognise (and reject) stances/assumptions and physical actions that are negative, unprofitable and detrimental in the context of composition, and to instead replace them with more positive, constructive and useful ones that are rooted in familiar mathematical experiences:

“Mathematicians face some challenging stereotypes when it comes to writing. . . ., [which] is often seen as ephemeral, subjective and context-dependent, whereas mathematics is seen as enduring, universal, and context-free. Writing reflects self, mathematics transcends it: they are essentially unlike each other. This false dichotomy of writing versus mathematics can discourage mathematicians from writing, especially when combined with similarly coarse dichotomies such as *right brain/left brain*, *creativity/logic*, and *art/science*. Taken together, these dichotomies suggest that writing is outside the natural skillset of the mathematician, and that one’s mathematics training not only neglects one’s development as a writer, but also actively prevents it.” [8, p. 30].

<sup>3</sup>See the August 2013 *Guardian* commentary ‘Leavis v Snow: The Two-Cultures Bust-Up 50 Years On’.

The important point made here is that mathematicians—whether nascent, more established or older masters—should not by default consider themselves as starting with little or nothing to assist them when they produce academic writing (or prose, for that matter) of any kind. Rather, they can choose to build on competencies already honed (to whatever scale) through their involvement in mathematics—but which they may not have formerly appreciated as relevant or of any value—able to utilise reliable lapidary technical skills and logical cognitive processes in a different setting that receives them surprisingly readily (I have written previously about the overlapping mental/physical processes that arise in mathematical labours and those of painting, for instance [2], and tend to treat the technical papers I write a little like self-contained short stories, as strange as that might seem to some). Writing well is so much more than merely conveying information, and it can be as taxing, time-consuming, frustrating and arduous as mathematical problem solving when the bar is set high, as it were, with joys and triumphs to be found within each equally great—some of the illustrious commentators on all matters mathematics have realised this in grasping the chance to showcase their knowledge and wisdom, leaving a myriad of musings, advice, impressions, appraisals, insights, surveys and tales in print as bequests to a world that is impoverished without them. Familiar names such as Singh, Stewart, Gowers and du Sautoy are currently complemented by overseas contributors Krantz, Zeilberger, Knuth, Stanley, and others, while in the not too distant and more recent past we have had Hardy, Lang, Gardner, Conway, Pólya, Halmos, Hersh and Rota, all of them writing and speaking about mathematics, and exercising their commanding positions to do so (see, for example, [4]); they place themselves at a tough poker table, but play the cards they have been dealt very well indeed.

#### 4 Moving Forward?

The premises on which Snow based his talk filtered through a good deal of policy direction for the next half-century as the tertiary sector, both in the U.K. and America, underwent curricula reforms and reviews in successive and ultimately fruitless attempts to dampen down an educational fault line at the core of the problem. The cracks have never been sealed, however, with fresh ones opening latterly as a clash of ideologies between those who see institutions of higher education as primarily serving the immediate career aspirations of students (giving a good medium-long term return on the financial investment made in taking a degree) and those who hold fast to the older tenet that education is of merit in itself (producing well rounded graduates prepared in conviction to contribute fittingly to broader aspects of society beyond mere employment). The 'two cultures' phenomenon raised by Snow has moved effortlessly into the 21st century—morphing as it does so—within which the 'writing versus mathematics' conflict quietly lives on as a long-standing issue that sits amongst some bigger concerns but is still no less deserving of scrutiny.<sup>4</sup> I contend that it is perpetuated as a distortion by the worn out lens through which it is viewed, and compounded by a laziness to replace the glass—or at least give it a good clean. Those who do not, or do not wish to, embrace the possibility of a communion between mathematicians and writers are holding up the 'currency value' of a hackneyed platitude akin to a coin that has been rubbed smooth by constant circulation and overuse, its once distinguishing edges lost as it is passed from person to person, one generation to another—it's not really fit for purpose, but no one has yet put their mind to designing a replacement piece that is. To me, the psychologies of mathematical and written ideation place themselves at the apex of the cerebral pyramid, each garnished with their own superordinancy and neither subordinate to the other. The vocations

<sup>4</sup>Snow excoriated the arts/humanities and valorised scientists, professing the moral superiority of the latter (as having "the future in their bones") and characterising the former as a collection of stodgy "Luddites", against which Leavis—defending his own circle vigorously while attacking the prevailing shallowness of reputation and public debate—pushed back viscerally and created the dissension and rancour that engulfed the main contentions of Snow's lecture. This war of words, however—taking place amid the framework of post Industrial Revolution Britain—did not originate with Snow and Leavis, for it was in a way simply an updated and highly charged version of an argument which chimes with that (more civilised one) between those members of the learned English elite Thomas Henry (T.H.) Huxley (biologist, anthropologist, and relentless propagator of evolutionary theory) and Matthew Arnold (poet, cultural critic, and arch-defender of culture) in the Victorian era. Although Huxley and Arnold have often functioned as an initial embodiment of the confrontation between the humanities and natural sciences, scholars have pointed out that both men were trying to revise and revamp the same educational system in light of a changing social configuration and that their efforts to do so cannot simply be understood as reciprocally antagonistic; academic aristocrats Snow and Leavis took the basis of this earlier difference of opinion into the 20th century—bringing the role of scientific technologies and contemporary lines of cultural thinking into play—but also rewrote ground rules for 'robust' discussion through a jarring collision whose ripples have never since ceased to be visible or felt.

they bring about and nurture are not immune to evolutionary paradigm shifts in which new hypotheses overturn and supersede old ones, they retain an autonomy without necessary recourse to commercial interests or principles of utility, and the lives of those involved are as real as any others and as honourable.

The consolidation of the internet as a part of everyday life has altered the landscape of both literary and mathematical practices for sure, but at heart they possess some strong overlapping and traditionally hard-wired features if one is prepared to look long enough (I am reminded of the novelist Henry James who—in describing the internal states of mind and social dynamics of his characters—wrote like a philosopher using ambitious exactitude of expression with the kind of attention to detail observed by punctilious mathematicians). There have been, are, and will continue to be, some talented polymaths who have a foot in mathematics and writing, but quite how universities motivate mathematicians and mathematical students to explore other avenues of expression aside from mathematics—and to consider them as harmonious and symbiotic exploits—has no obvious answer. Nor is there an easily fostered environment that will produce a crop of writers who actively seek out a subjective essence of mathematics, and all that goes with it, in order to allow it to impact on and enhance their own work. A new energy for mental bilingualism—actioned by genuine dialectics and ridded of the sorts of fear, resentment and righteous indignation apparent in the ‘Two Cultures’ debacle—is perforce too much to hope for, as the narrowness of modern education has actually been with us for decades and, if anything, is becoming strengthened; forged by occurrences proffered by Snow that retain serious agency, it fuels internecine strife along the corridors of university campuses and amidst the learned everywhere:

“One is our fanatical belief in educational specialisation, which is much more deeply ingrained in [England] than in any country in the world, west or east. The other is our tendency to let our social forms crystallise. This tendency appears to get stronger, not weaker, the more we iron out economic inequalities: and this is especially true in education. It means that once anything like a cultural divide gets established, all the social forces operate to make it not less rigid, but more so.” [6, p. 17].

## 5 Closing Remarks

Having noted that mathematics is beyond most people of strong literary innateness, it is interesting to dwell, momentarily, on some words of American R.G. Ayoub as this short discussion closes. In a 2004 anthology of essays addressing topics labelled as broadly “humanistic” (and taken from “mathematicians acknowledged by their peers as outstanding creators whose work has added richly to the discipline”<sup>5</sup>), he wrote in his introductory remarks of a relative lack of expository narrative produced by mathematicians and gave thought as to why this might be the case:

“In view of its elusive and recondite nature, one might expect that mathematicians would rise to the challenge and write more extensively about their subject. This is, surprisingly, not the case. With some notable historical exceptions, . . . , mathematicians have been curiously reluctant to write on matters that lie outside the strict confines of mathematics proper and mathematical research. It is not easy to account for this reluctance but some contributing factors suggest themselves.

First, writing about mathematics and areas contiguous to it, is a somewhat daunting prospect, for it implies that we know what we are talking about. [The] nature of the subject is elusive, and this elusiveness has been widely recognized by mathematicians.

. . .

Second, mathematicians by their training and practice have become highly immersed in habits of precise thought and reasoning in their discipline. To write about other subjects—ethics, religion, politics—is a dismaying prospect, for these subjects are by their nature imprecise and a discourse requires a transition into different modes of

<sup>5</sup>Including works by notables Lévy, Wiener, Weil, von Neumann, Sylvester, Hilbert, Birkhoff, Morse, Weyl, Hardy, Hadamard, Poincaré and Cartwright, all published at various times during the last century.

thought, a transition that is not easy to make. Many mathematicians have, nevertheless, ventured very successfully into areas such as philosophy, and fiction.

There is another factor that influences this inhibition and reticence. This has to do with the culture of the mathematical community. The traditions of the past were somewhat rigid and these same traditions viewed the writing of textbooks or popular works on mathematics with a slight degree of scorn. . . .

As a result of these and other induced inhibitions, society has been largely deprived of the musings of first-rate mathematical minds—[something] that is unfortunate. Some few courageous souls however, possibly coming initially from different traditions, have set pen to paper and have left a worthwhile legacy.” [1, pp. xi–xii];

too few, without question. To continue Ayoub’s line of thinking, perhaps the greatest obstacle does indeed lie within the proverbial mathematical mentality. Rebecca Lea Morris notes that the specialised language of mathematics, especially in subfields, militates against perspicuity—even amongst mathematicians themselves—and regards exposition as a way to facilitate accessibility to aspects of the discipline (that is, to research results and higher level topics found in teaching). The relatively low standing of exposition, however, offers little or no incentive to write in this way, and she calls for it to be more highly valued—by being granted greater prestige within professional societies, funding agencies and mathematics departments—alongside a re-appraisal of the incumbent reward system (based on so called ‘theorem credits’) that has dominated mathematics for so long and is embedded in our culture [5]. Finally, we can add some words from American mathematician Raymond L. Wilder (he developed a strong interest in throwing light on the nature and evolution of mathematics, and its relations to society from the standpoint of cultural anthropology) who wrote, at the outset of his thesis, of introversion and modesty towards which—if not an inbuilt trait already—many mathematicians gravitate:

“Contrary to much general opinion, the modern mathematician is not just a narrow specialist unaware of the intellectual life about him. His love of, and oftentimes skill in, music is generally known; . . . Love of the arts generally, and interest in the humanities as well as social and political affairs, are common among mathematicians. Usually scornful of display, and often lacking in forensic ability, the mathematician has been content to hide his extracurricular talents even from his fellows in mathematics. Only in mathematics itself does he depart, as a rule, from this custom, and here his creativity he does not seek to conceal.” [7, p. 1].<sup>6</sup>

So, are we at the dawn of a new era of enlightenment? Probably not. Conquering one discipline with proficiency sufficient to provide a living wage is no small feat *per se*, so why bother to alter one’s compass of knowledge just for the sake of it when today’s educational mantra is, in a nutshell, ‘*Stick to what you know*’? The kind of education devoured by American theoretical physicist J. Robert Oppenheimer (World War 2 head of the Los Alamos Laboratory that developed the first atomic bomb), to name but one—who at Harvard University studied history, english and french literature, eastern and western philosophy, physics, chemistry and mathematics (also writing stories and poems)—seems far removed from the diet available to today’s undergraduates. The demise of a formative liberal curriculum appealing to core themes from across the sciences, humanities and arts—once embedded in diffuse, enlightened and holistic early 20th century U.K. degrees (and alive in the U.S.A. and throughout Europe later still), but sacrificed to the pull of restructuring forces inside a university sector that regards itself as a barometer for the educational requirements of the moment and future demands of society—looks to be a permanent one, having been replaced in large measure by a creeping range of more discipline-specific, serviceable and niche programmes. There is a price to pay for this (compounded for academics governed by constraining criteria set up to judge scholarly efforts by way of rather meaningless metrics), in that the status quo will, if preserved, continue to oversee a realisation of pluripotentiality snuffed out—writers will continue to be oblivious to even low hanging fruit on

<sup>6</sup>He regarded 20th century mathematics as a “subculture” of wider culture at large, but also a “cultural system” in its own right whose constant revision “has formed a cultural stream, tenuous at times but nonetheless always resuming its flow, from which the individual mathematician chooses an area or areas of interest from among those existing at the time, and makes his contributions—after which the stream flows on to his successors.” (pp. 162–163); the same can be said of those who write, located within different cultural currents that join others to feed deeper rivers and oceans in both forming and informing any society.

the vast tree of mathematics, while for the most part mathematicians will interpret exposition and writing as things for ‘others’ (and the same old distinctions internal to each group—‘fictional’ and ‘non-fictional’ for writers, ‘serious’ and ‘popular’ for poets/artists, ‘theory builders’ and ‘problem solvers’ for mathematicians—will reside unmoved as tired tags). Those within the academy and elsewhere who are able to adopt an alternative posture—swimming against a tide of monoglotical one-dimensionality by embracing both enterprises willingly, adeptly and with enthusiasm—must, it seems, endure as members of a small band of outliers, such is the way of things.

*“It is usual to exaggerate rather grossly the differences between the mental processes of mathematicians and other people, but it is undeniable that a gift for mathematics is one of the most specialized talents, and that mathematicians as a class are not particularly distinguished for general ability or versatility.”*

G.H. Hardy (mathematician and expositor)

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