CUSTOMISED SCIENCE AS A REFLECTION OF 'PROTSCIENCE'[1]

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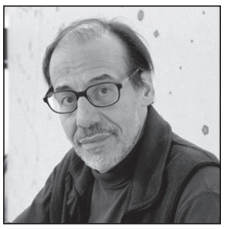
This article is concerned with two concepts. The first is a coinage of the author, 'Protscience', a contracted form of 'Protestant science', made in reference to the 16th—17th century Protestant Reformation, when the members of Western Christendom took their religion into their hands, specifically by reading the Bible for themselves and interpreting its relevance for their lives. Today we witness a similar tendency with regard to the dominant epistemic authority, science, whose 'reformation' often portrayed as 'democratisation'. However, a more exact understanding draws on the article's second key concept, the distinction drawn in marketing between 'customer' and 'consumer'. The former purchases to sell (i.e. a retailer), whereas the latter purchases to use. Many of the so-called 'anti-science' movements of recent times can be explained as a rise in 'science customisation', whereby people who have acquainted themselves with the latest science adopt a discretionary attitude towards what they will and will not believe of what they have learned.
Key words: anticipatory governance, democracy, New Age, placebo effect, Protestant Reformation, Protscience, science customisation.

КЛИЕНТСКАЯ НАУКА КАК ВЫРАЖЕНИЕ НАУЧНОГО ПЛЮРАЛИЗМА



В статье рассматриваются два понятия. Первое – "protscience" (краткая форма от "protestant science" – «протестантская наука») – разработано автором и отсылает нас к эпохе Реформации (XVI–XVII вв.), когда представители западного христианства решили «взять религию в свои руки». Сегодня мы наблюдаем похожую тенденцию в отношении главного эпистемического авторитета – науки, «реформацию» которой часто описывает как «демократизацию». Между тем более точному пониманию проблемы способствует второе ключевое понятие – различие, проводимое в маркетинге между «клиентом» (customer) и «потребителем» (consumer). Первый покупает, чтобы продать; второй – чтобы использовать. Многие из так называемых антинаучных движений последнего времени могут быть объяснены как выражающие тенденцию к «клиентизации (customisation) науки», когда люди, получившие некоторое представление о современной науке, вырабатывают избирательное отношение к тому, во что из того, что было ими изучено, следует верить.
Ключевые слова: упреждающее управление, демократия, Новое время, эффект плацебо, Протестантская Реформация, клиентизация науки.

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1. Setting the Stage: Taking Science Personally

We live in a time when taking science seriously means taking it personally. This change in attitude is arguably comparable to the shift that took place during the Protestant Reformation, the moment when Christianity ceased being a unified doctrine delivered with enormous mystique from on high. Thereafter it became a plurality of faiths, whose followers stake their lives on their own distinctive understandings of the Scriptures. In the case of science, I have dubbed this process *Protscience* [Fuller, 2010: chap. 4], by which I mean to include a pattern evident in the parallel ascendancies of, say, intelligent design theory, New Age medicine and Wikipedia.

Before delving more deeply into Protscience and the customisation of science that it entails, let us survey some contemporary signs of this sea change in the public's engagement with science:

(1) Science's increasing visibility in public affairs has coincided with the ability of people to access the entire storehouse of scientific knowledge from virtually any starting point on the internet. The result has led to a proliferation of what used to be called (sometimes derisively) 'New Age' science hybrids, some of which have breathed new life into movements previously thought defunct, including creationism and homoeopathy.

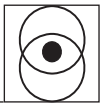
(2) The character of science journalism has also changed. Gone are the days of science journalists as scientists' press agents. The field has raised its public profile, while acquiring a perspective more independent of the scientific community. Two tendencies are worth noting. The first is explainable as a classic 'supply push' and 'demand pull' dynamic: that is, the surplus of scientifically trained people spilled over into journalism just when the public has come to think of itself less as spectators than consumers of science. Thus, they wish to know from the science journalist whether the scientists' products are worth buying. Consider the case of Ben Goldacre. Despite being an Oxford-trained medical doctor and self-avowed scourge of 'Bad Science' (the name of his weekly column in the *Guardian*), his *modus operandi* involves subjecting scientific papers to statistical and other research design tests, which end up uncovering flaws even in papers that have passed the peer review process. Most recently Goldacre's campaign has taken him to the doorstep of 'Bad Pharma' [Goldacre, 2012]. One recalls here Ralph Nader's 'test-driving' cars rolling off the Detroit assembly lines in the 1960s to see if they lived up to manufacturers' claims, which sparked the original consumer movement. The second tendency is exemplified by Evgeny Morozov, perhaps the world's leading critic of Silicon Valley hype, according to which every problem might be solved by improved information technology, a doctrine that he has dubbed 'solutionism' [Morozov, 2013]. A Belarus native now ensconced in the Valley, Morozov is a young beneficiary of George Soros' Open Society Foundation, which

aims to spread liberal democracy in former Communist regimes. But Morozov's stands out for having updated the proverbial armchair critic, a well-read and fluent humanist who cannot programme a computer but whose endless scouring of cyberspace enables him to show how Silicon Valley dreams are not borne out by reality. He does this typically by citing (or spinning) text against text. In effect, Morozov is the 'evil twin' of a dedicated Apple user — that is, someone who takes the hype literally only to be endlessly disappointed. Morozov's large following vindicates one of his basic points, namely, that despite the hype surrounding 'open access' in the world of information technology, most people are as techno-illiterate as Morozov who depend on programmers being held externally accountable for their claims.

(3) At a still more basic level, and sometimes with less scientific training, the public is turning to 'Freedom of Information' legislation to obtain scientific communications and even raw data in order to assess the quality of scientific research for itself. This has had some explosive consequences, most notably for the University of East Anglia's Climatic Research Unit, whose research network was shown to have negotiated the presentation of findings to avoid providing comfort to global warming sceptics. While the scientists involved were cleared of any wrongdoing, the entire episode left questions as to whether scientists can be trusted to provide a disinterested interpretation of their own findings.

What matters here is not the distrust of scientists but the public's interest in what scientists are doing and their willingness to try to make sense of it on their own, regardless of what the scientific establishment concludes. For the UK science communication researcher Alice Bell (2010), this suggests the need for another species of science journalism, called 'upstream', which would report on ongoing research before it reaches the publication stage. While this prospect might strike, say, the Climatic Research Unit as a nuisance, nevertheless it provides an opportunity for the public to develop personal stakes in the research outcomes. To many practising scientists, this sounds like opening the door to science being cherry-picked to suit particular world-views. However, a mature secular democracy is capable of respecting even those who wish to embody in their lives hypotheses that scientists have dismissed. I have no doubt that in such a tolerant environment people would continue to fund and consult scientific research. But the conclusions they draw from it would be their own, for better or worse. Taking science personally ultimately means turning oneself into a living laboratory.

2. The Science Customer Who Need Not Be a Science Consumer



The marketing literature draws a usefully sharp distinction between *customer* and *consumer*. The customer is, strictly speaking, the client, someone who purchases a good or service. The consumer actually uses it. While customers and consumers are very often one and the same, it is possible to be one without being the other. A 'science customer' may purchase some epistemic goods and services without necessarily consuming them. For example, she may learn all about the Neo-Darwinian account of evolution and even pass along its content to others without ever believing the account herself. This is just like the retailer who purchases a good to sell someone else without ever consuming the good herself. Conversely, a 'science consumer' may never have intended to ingest the genetically modified organisms that are already contained in most of the foods she eats. Indeed, she may even believe that such organisms are harmful or unnatural. And while her own consumption patterns — especially if she remains healthy — testify against her beliefs, she may nevertheless have legal grounds to sue the relevant food providers for having failed to secure her custom.

Formalising the distinction between customer and consumer could have avoided the unfortunate situation that befell the six Italian seismologists who (with one politician) were sentenced to six years in prison in October 2012 for manslaughter based on what turned out to be false assurances about an earthquake that left over 300 people dead, 1600 injured and 65,000 people homeless in L'Aquila, a district that is normally home to 100,000. To be sure, the scientists stated quite clearly — and accurately, given the best evidence available — that the earthquake was highly improbable. But of course, it is in the nature of improbable events that they happen every so often. Rather more damningly, the experts appeared to have spun this improbability as a counsel of complacency. The judge, whose verdict reflected public opinion, stressed that the severity of the punishment stemmed only from this counsel and not the original probability estimate.

The scientific community was quick to express outrage, with *Nature* leading the charge by claiming that henceforth scientists would be reluctant to speak their minds freely in public settings, especially ones that might bear on policy. Italy's relatively poor track record in research funding was brandished as a symptom of science's low national esteem, which in turn made the seismologists an easy target for populist rage. However, this analysis itself is a bit too easy, even though ultimately I agree that the fault lies more squarely with the public. But my reasoning differs radically from that of the editors of *Nature*.

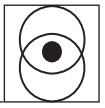
There is a 'plague on both your houses' character to this unfortunate turn of events. No doubt at work here was a paternalistic arrogance all too common among scientists that makes them forever susceptible to political manipulation. In this case, the scientists assumed that they knew best how to interpret the data and so, prodded by politicians, they stressed the lowness of the

probability of catastrophe to compensate for what they believed would have been otherwise an irrational public response. But is the public not entitled to draw their own conclusions and, if necessary, learn from their own mistakes? Indeed, arguably the lion's share of the blame for this incident belongs to the public, who had unreasonably expected scientists not simply to inform but also to instruct them. Clearly L'Aquila's residents had not taken the 'Protestant' turn in their engagement with science alluded to above.

Despite the lip service paid to the virtues of secular democracy, the extent to which the public trusts blindly in research scientists rivals medieval deference to priestly authority. Such trust does not normally extend to, say, meteorologists, economists or perhaps even physicians. In each of these cases, people understand, however vaguely, that there are alternative ways of interpreting the facts and theories on the basis of which the scientists base their judgements. Through repeated daily exposure, much of the jargon of these fields has become integrated with ordinary talk, albeit often in ways that make professionals squirm. The advent of the internet has only amplified this process, which in many respects reflects what happened five hundred years ago once the Bible was made available in languages understood by the populace, thereby enabling alternative sources of authority to proliferate [Wuthnow, 1989: Part I].

Unsurprisingly, just as Catholic theologians said of Protestant readings of the Bible during the Reformation, scientists have complained that this availability of information has only served to foster misunderstanding and charlatanry. Without wishing to deny that possibility, it is also true that the public appropriation of scientific facts and concepts, however wrongheaded or bizarre it may seem to professionals, results in a public more willing to take personal responsibility for the decisions they make about whether to carry an umbrella, invest in a company, undergo a treatment or, indeed, evacuate a town. This permits scientists to speak freely about their research without fear that they might be held liable for the consequences of what they say. In effect, the interpretive burden has been shifted to a presumptively engaged and intelligent audience.

I see this brave new world of 'Protscience' as the latest phase of secularisation, whereby science itself is now the target rather than the agent of secularisiation]Fuller 1997: chap. 4; 2000a: chap. 6; 2006: chap. 5]. Nowadays the Protestant Reformation of 16th and 17th century Europe is taught as an important episode in the history of Christianity, but it also marked the first concerted effort to democratise knowledge production in the West, specifically by devolving religious authority from the Church of Rome. Indeed, the formal separation of knowledge production from the reproduction of social order is perhaps secularisation's strongest institutional legacy,



which began with political separation of church and state. We are now entering the second period, consisting in the devolution of the dominant epistemic authority of our time — science — from the state-based institutional privilege that it has enjoyed, say, since the founding of the Royal Society.

In the age of Protscience, the public would continue to fund scientific research but not be bound by the scientists' own interpretation of their findings. They would be science customers without necessarily being science consumers. To be sure, interesting legal questions arise about exactly what scientists should be required to say so that people can draw reasoned conclusions. But in principle these questions are no trickier than those relating to any client-based transaction: The client pays simply to receive relevant information that he or she might not otherwise possess but is then free to decide what to make of it. Homeowners should be 'free' to ignore the advice of seismologists in exactly the same sense that patients are 'free' to ignore the advice of their physicians — and thrive or suffer accordingly. Once we reach that state of moral parity, then we can claim to live in an enlightened secular democracy in which scientists need not fear that they will be imprisoned for speaking the truth as they see it. That is the utopia envisaged by Protscience.

In this respect, the distinction between the science customer and the science consumer serves to drive a wedge in the still popular, philosophically rationalised inference *that the more science one knows, the more one's beliefs will conform to those of the relevant scientific experts*. In the science communication literature, this inference is often derided as the 'deficit model' for presuming that sheer ignorance — rather than a difference in the ends for which knowledge is sought — is the main problem with the 'public understanding of science' [Gregory and Miller, 2000]. Of course, scientists who work in an academic setting where professional advancement depends strongly on peer approval will be susceptible to a variety of incentives and pressures to conform to current expert judgement. Yet, even such institutionalised social control is not guaranteed to work, if, say, scientific deviants can find adequate alternative publication outlets. However, the full import of a science customer who is not necessarily a science consumer is best seen in the vast majority of people — including perhaps scientists outside their specialities — who take a much more 'pick and mix' attitude toward the knowledge claims they encounter in science. This includes the following practices:

(a) accepting the scientific facts as merely a sociological fact about the collective judgement of the relevant scientists, which is likely to change in the face of new evidence (assuming that the scientists are open to it);

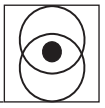
(b) accepting the scientific facts as they are (and unlikely to change soon) but not granting them the weight accorded to them by the relevant scientists;

(c) accepting the scientific facts and perhaps even granting their ultimate significance but concluding that they could be explained tolerably — if not equally — well by an alternative to the dominant scientific theory.

3. The Normative Character of Science Customisation

A lightning rod issue for science customisation is the 'placebo effect' in medicine [Evans, 2003]. Science customers are well aware of tradeoffs involved in relying on clinical trials: Their ability to determine the exact physical effects of novel drugs and treatments is offset by complexities in the likely contexts of actual use, where the patient's lifestyle, frame of mind and relationship to the attending physician may enhance, diminish or simply alter the predicted effects. Indeed, drugs and treatments that fail to be robust under variable real world usage have arguably done more harm than, say, homoeopathy and other forms of complementary medicine whose practices involve physically inert substances coupled with psychological uplift from the physician. Unsurprisingly, the sorts of invasive ('allopathic') treatments associated with 'scientific medicine' clearly start to outperform complementary medicine only in the final third of the 19th century. At that point, hospital clinics start to be regularly used as test sites for new treatments, resulting in a systematic record of successes and failures that could enable collective learning to occur in what had been heretofore a largely privatised medical profession [Wootton, 2006].

An adequate response to this history requires resisting a knee-jerk philosophical impulse to demonise such science customers as 'relativists' who *merely* appropriate science to bolster beliefs that they would already hold on other grounds. The likely source of this philosophical reflex is the prejudice that 'expert scientists' are concerned with a wider epistemic horizon than 'lay scientists'. In other words, the experts are concerned not merely with what suits personal interests but some larger, disinterested conception of truth. Here we need to disaggregate *space* and *time* when we speak of 'wide'. Let us grant space to the experts. In other words, experts very likely issue a measured judgement based on a snapshot of a broader range of perspectives than lay people. But this does not deny that the laity are quite practised in assessing their own long-term prospects, in terms of which scientific judgement can appear quite changeable. Consider someone like myself in his early 50s. In my lifetime, scientific predictions surrounding global climate change has veered from a freezing to a warming version of



the apocalypse, based on a combination of improved data, models and, not least, a geopolitical paradigm shift that has come to downplay the likelihood of a total nuclear war. Why, then, should I not expect a significant, if not comparable, alteration of collective scientific judgement in the rest of my lifetime?

To be sure, such a 'pessimistic meta-induction', as Hilary Putnam (1978) memorably called it, is not guaranteed. However, the historical precedent may serve to motivate people to participate in the scientific enterprise, especially if their interests would stand to gain by a paradigm shift. Thus, creationists who take seriously the idea of a 'young earth' reasonably study the radiometric techniques used to date events in geological and cosmological time, albeit for purposes of showing their flaws. Ideally the efficacy of such study will be borne out by research that impresses peers. Depending on the extent to which scientific authority devolves in the future, publication in other forums might serve equally well to sway the relevant minds.

Whatever else one might wish to say about 'science customers', they assume responsibility for their science-based decisions. They are not ignorant consumers, as demonstrated by their explicit yet circumscribed deviation from the scientific norm. Here it is worth acknowledging the various reasons why one might be a customer but not a consumer. Perhaps the oldest historical reason relates to the social integration of deviant classes and/or deviant practices. Here the process of abstracting goods from their normal contexts of use that characterises exchange relations — that is, the conversion of value to price — facilitates the comparison of the previously incommensurable. Thus, when offered a cow in trade, I need not evaluate it purely in terms of my personal use (e.g. do I like beef or milk?) but consider it as something that may be traded for something I really could use. Similarly, a creationist may invest in a science education because she can trade on that to promote her own world-view in some way or other (e.g. someone who becomes expert in radiometric geology and cosmology to overturn the status quo), but equally she might acquire a science degree simply to gain credibility in public debate.

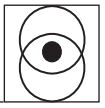
In addition, a sharp customer-consumer distinction also enables the individual to acquire epistemic authority by extending the range of choice enjoyed by others instead of imposing a particular world-view on them. In this respect, Max Weber's famous defence of free inquiry for both academics and students imputes to the lecturer the role of intellectual retailer who comes to be respected mainly for his range of attractively displayed epistemic offerings that entices students to make judgements about matters that they might not have otherwise thought about. Finally, the customer-consumer distinction creates opportunities for internal trials of faith,

the result of which should somehow leave the individual stronger. I say 'somehow' because diverse responses may follow, including these: (a) the customer is converted to a consumer (what in the past might have been considered the default position); (b) the customer is immunized against being a consumer (e.g. a creationist who accepts at least some of the evidence for evolution but manages to contain its effect on her world-view, if not give it a creationist spin); (c) the customer may acquire a clearer understanding of her refusal to consume (i.e. the cognitive import of resistance to temptation).

4. The Role of Customised Science in the Future of Democracy and the University

Science's customisation was made possible in the same way as science's universalization, namely, by the transfer of scientific authority from a specific body of people who acted as guild to an abstract method that could be deployed in principle by anyone to any end. Francis Bacon perhaps unwittingly triggered the process by envisaging a state-supported House of Solomon that would produce science for the public good. However, because Bacon was in no position to determine exactly who would constitute this House or how it would be institutionalised, he effectively defined science at a level of abstraction that permitted multiple realizations. What is reasonably clear from Bacon's own writings is that the pursuit of science was partly about rational psychiatry (what Descartes called 'rules for the direction of the mind') and partly about judicial review (what Carnap called 'criteria of testability'), all in the name of sublimating potentially endless metaphysically inspired disputes in a manner that would be binding for all parties. In this respect, the scientific method would provide a common currency for the transaction of otherwise incommensurable knowledge claims.

All of this requires that the method be neutral with respect to the knowledge claims that it assesses. For Bacon, the substantive ends to which the scientific method would be put would not come from the scientific community but from the politicians. This point is worth stressing, for while the Royal Society is normally presented as based on Baconian principles, its corporate charter made it completely independent of state control, perhaps reflecting its founders' scepticism about a sense of political sovereignty that is at once absolute and experimental in orientation. (Here recall Thomas Hobbes' career trajectory, starting as Bacon's private secretary and ending up as *persona non grata* at the Royal Society: Lynch 2001). Nevertheless, the logical positivists tried to turn Bacon's sense of neutrality to great effect by outlining various universal logics — both deductive and in-



ductive — of empirical assessment. Popper famously saw the matter in more idiographic terms, drawing specifically on Bacon's idea of a 'crucial experiment', whose sense of adjudicative neutrality rests on the construction of the ultimate trial, the outcome of which would clearly divide the fates of two rival hypotheses.

All of these developments in what philosophers call the 'demarcation' of science aided science's customisation by allowing people holding different world-views to see their relative public epistemic standing at any given moment, with an eye to improving it. However, the history is often not seen this way because the authoritative interpreters of the scientific method for roughly the last 150 years have normally constituted themselves as a professional scientific community, not a neutral judiciary. Indeed, given Bacon's generally derogatory attitude towards the Scholastics, it is unlikely that he would have welcomed the guild-like scientific disciplines that have captured control of science in the modern period. However, in Bacon's eyes, one redeeming feature of science's institutionalisation over the past two centuries would be the role of university teaching in dissipating the epistemic advantage accrued by academics steeped in original research or years of deep study.

This institutional innovation — associated with Wilhelm von Humboldt — was specifically designed to enable a new generation of inquirers to enter a discipline at a relatively level playing field by forcing expert practitioners to publicly justify (in the classroom) how their own work follows from pedagogically tractable 'first principles' in their discipline. I have likened this process to the Schumpeterian one of 'creative destruction' [Fuller, 2009: chap. 1]. In more contemporary terms, we might think of the Humboldtian emphasis on bringing research and scholarship into the classroom as a periodic rebooting of the academy's epistemic mainframe. It enforces a sense of *temporal democracy*, so that being born later does not constitute a structural disadvantage, which in the past had been handled either by simply repeating the classics of the past (as in the ancient Chinese civil service vis-a-vis the Confucian classics) or possessing the resources to recapitulate the historical trajectory of the relevant field of inquiry at one's leisure before making an original contribution (e.g. Charles Darwin). The one strategy arrested epistemic progress entirely, the other rendered it an accident of inherited privilege.

In contrast to these counter-productive means of advancing knowledge, the requirement that new insights be test-driven on a student audience provides a Baconian 'crucial experiment' for what — with a nod to the great postwar French political theorist Bertrand de Jouvenel — might be called their *futuribility*, which is the specifically temporal version of what

the philosopher of science Nelson Goodman (1955) originally called 'projectibility', namely, a wheat-and-chaff exercise that considers which features of today's knowledge are worth taking forward to serve as the starting point for the next generation — as opposed to mere artefacts of how the knowledge was originally discovered or is currently promoted. Thus, the 'futurible' may be seen as tracking truth in time.

While teaching continues to perform as a Baconian filter, at least in universities still committed to the Humboldtian ideal, the rest of the Baconian state-science settlement is under increasing criticism in our age of Protscience. Scientific authority tends to be wielded in institutions that are unaccountable to those whom they would govern. I include here national academies of science and academic journals that marginalize, if not ignore, the views of the people whose lives would be regulated, while at the same time expecting automatic deference to their authority. It is worth stressing that this point applies, in the first instance, to the *scientists themselves* and only secondarily to the general public. As scientifically accredited advocates of homeopathy and intelligent design theory can all too easily testify, those who take an agreed body of scientific data in a theoretically proscribed direction are dismissed on exactly the same terms as someone without any specialist training who happened upon similar views on the internet: i.e. conformity is the primary marker of competence. This is perhaps the best evidence that Kuhn's (1970) authoritarian paradigm-driven vision of science continues to rule. Protscience aims to re-jig the balance of epistemic power, so that researchers can draw significantly different conclusions from facts that are agreed by their field's orthodoxy and doctors can treat their patients as clients who need to be sold a proposed treatment rather than be treated machines simply in need of repair.

5. The Problem of Scientists Exercising Their 'Political Prerogative': Beware of Geeks Bearing Gifts

Arguments about the political prerogatives of the scientific community have had a chequered history, no more so than now. In the modern West, scientists have mostly tried to protect the autonomy of their research. Claims to autonomy have extended to the topics they worked on, the methods they used, as well as whatever conclusions they might reach. Securing these claims usually meant a pact of mutual non-interference between scientists and politicians. This arrangement, as we have seen, was enshrined 350 years ago in the Charter of the Royal Society of London. However, in 1911, Germany established the first institution — the Kaiser Wilhelm Gesellschaft — that linked the fates of science, industry and government in

projects of mutual benefit. While the second half of the 20th century witnessed the spread of these so-called 'triple helix' arrangements, their original incarnation produced disaster. Germany's belligerent stance in the First World War had the full backing of what had become the world's premier scientific community. Perhaps unsurprisingly, in the aftermath of the nation's humiliating defeat, a profound anti-scientific cultural backlash set in, sowing the seeds of much of contemporary fundamentalism, racism, and irrationalism [Herf, 1984].

Reflecting on this history, some scientists have called for their taking an even stronger role in public affairs, but this time without being hamstrung by self-interested politicians and businesspeople. The roots of this idea are traceable to a Soviet-inspired 'scientific vanguard' that was developed and popularised in the West by the British Marxist physicist, John Desmond Bernal (1939). Nowadays it is presented in more democratic, sometimes even populist terms. Consider *The Geek Manifesto*, a widely discussed call to arms, penned by Mark Henderson (2012), head of public relations for the Wellcome Trust, Britain's largest science-based private foundation. Henderson, previously science editor for the *Times* of London, belongs to a new breed of activist science journalists who believe that the collective intelligence of democracy is raised by proportioning authority according to evidence, such that those who know more should be given a larger say in policy. Stated so baldly, the proposal sounds elitist. Yet that great 19th century liberal John Stuart Mill held just such a view. And the more that failures to follow 'proper' scientific advice can be presented as threats to the public interest, the more persuasive *The Geek Manifesto* appears.

However, as the slightly self-deprecating term 'geek' suggests, the manifesto's target audience is science's *petite bourgeoisie* — that is, the computer jocks who try to escape their day jobs by reading popular science and science fiction, which fuel their web-based interventions in a seemingly endless war against 'pseudo-science', which often includes encouraging the more extreme rhetoric of Richard Dawkins against religious believers. Whatever else one may wish to say about these people, who no doubt find their lives enriched by engaging in such cyber-wars, they are not front-line contributors to the research enterprise. This may help to explain why the leading scientific institutions have not signed up to *The Geek Manifesto*. Indeed, this scientific call to arms may ultimately express a wish that is best left unfulfilled.

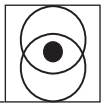
One aspect of politics that tends to be neglected in discussions of *The Geek Manifesto* is what should happen in the event that Henderson's newly empowered scientists get things horribly wrong, as in the recent L'Aquila earthquake case, discussed above. As we saw, the verdict has come under

heavy fire from the world's scientific community. Yet, such outrage suggests that scientists have yet to grasp fully an elementary lesson of democratic politics — that with power comes responsibility. The Italian judiciary portrayed the scientists as having abused the trust of the affected residents. And if people are meant to trust blindly scientists speaking from their expertise, then that is a fair reading of the situation. This is why, to avoid similar situations in the future, the public should adopt the stance of clients for science, customers who need not be consumers. Such an arrangement may not minimise the likelihood of risky judgements about the world but it would certainly minimise the risk that scientists and the public pose to each other, as each is formally apportioned their own share of responsibility for whatever happens.

6. Historical Precedents and Future Prospects for an Adequate Scientific Response to Customised Science

It would be a mistake to think that the rise of customised science is without precedent. When the state has not been the dominant shareholder in science, scientists have seen salesmanship as an essential feature of their work. Thus, it is no accident that public engagement with science is probably more developed in the UK than in any other scientifically advanced nation [Knight, 2006]. This is partly the historical legacy of the state's hands-off policy to the conduct of science in response to the Royal Society's chartered promise for its fellows not to meddle in matters of state. Moreover, compared with other scientifically advanced nations, British scientists only relatively recently came to rely on a steady stream of state funding — which is now 'consolidating', if not outright drying up. The result is a research culture that is used to 'sing for its supper'. Since the 19th century, this imperative has been especially felt by those for whom science has been a vehicle of upward social mobility, perhaps most famously Michael Faraday and Thomas Henry Huxley, the two poor boys who still set the gold standard for science communication in, respectively, its demonstrative and argumentative modes. In this vein, until the end of the Cold War, science was probably sold more as a secular religion — with the likes of Faraday and Huxley functioning as celebrants — than a species of venture capitalism.

However, the market for science began to take a more business-like turn once the costs of doing science — ranging from the human and material entry costs to more downstream effects on society and the environment — had got so high that science had greater need for investors and stakeholders than outright practitioners. This shift began in earnest — that is,



across all fields of science — with the end of the Cold War. At that point, science was thrown open to an unprotected market environment, in which science's 'value for money' could not be taken for granted. In this respect, the Cold War was the Golden Age for science policy because everyone on all sides were in agreement that science was necessary for the future of our survival — in terms of securing the physical spaces in which we conduct our lives. The threat of nuclear holocaust kept the global mind focused on the value of science. Once that threat was thought to have been removed, science had to be sold to various constituencies, each on its own terms. Unsurprisingly perhaps, philosophers have followed the money, and so the unified vision of physics has yielded to biology's pluralism as science's paradigmatic disciplinary formation [e.g. Dupré, 1993].

The upshot is that science needs to devote an increase amount of its own resources to proactive marketing, or *pro-marketing*. It is the third of three phases in science-led initiatives relating to the 'public understanding of science' that have occurred in the aftermath of the Cold War. The three phases are as follows:

(1) In keeping with the 'deficit model' discussed above, in the final decade of the 20th century, scientists were urged to do their own press releases to ensure that the public is given a clear sense of their work without what scientists regarded as journalistic misrepresentation. This practice is still promoted — and even rewarded (e.g. the recent knighthood of Fiona Fox, head of London's Science Media Centre) — but is no longer seen as the dominant solution.

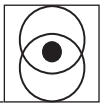
(2) At the dawn of the current century, public understanding of science took a radically prospective turn, which often goes by the name of 'anticipatory governance'. The US National Science Foundation (and later the European Union) hired science and technology studies researchers to conduct market research on what people hoped and feared from what the NSF was promoting as an imminent 'convergence' of nano-, bio-, info- and cogno- sciences and technologies (Barben et al. 2008). The scenarios presented in the focus groups and wiki-media were speculative, but the responses provided valuable information about how to present such developments so as not to alienate the public. From a social psychological standpoint, these exercises also served to immunise the public against any 'future shock', given that discoveries tend to happen rather unexpectedly. Today's science fiction scenario may turn out to be science fact tomorrow — and one would not wish a public backlash based on what George W. Bush's bioethics tsar, Leon Kass (1997), euphemistically called 'the wisdom of repugnance'.

(3) But in the emerging world of science pro-marketing, one should not merely create receptive publics for new science and technology but, to put it bluntly, make people *want* to see such innovations as integral

to their own self-development. The precedent for such proactive marketing comes from the great psychologist of self-actualisation, Abraham Maslow (1988), who towards the end of his life in the late 1960s proposed 'Theory Z', which — again put bluntly — encouraged people to associate their individuality from, if not superiority to, others in terms of consumption patterns based on a sophisticated knowledge of differences between goods that *prima facie* may not seem so different. When people fuss over whether their food has been genetically modified or their clothes were manufactured in third world sweatshops, Theory Z is in effect. The consumption patterns of such people are, as Thorstein Veblen might say, 'conspicuous' — but in this case, not to show off how rich they are but how clever they are. (Maslow's euphemism was 'transcenders'.) Of course, in the long term, these people may be shown to have been fools for having paid more for goods based on a false vision of how the world works, but in the meanwhile their expenditure will have served to push that vision as far as it could go.

The problem to which Maslow's Theory Z provides science with a pro-marketing solution is how to increase the public's personal and material investment in science without necessarily expecting them to become — or even agree with — professional scientists. In short: *How can science build its customer base?* Even today, it is common to measure the impact of public understanding of science campaigns by the number of new recruits to science degree programmes, despite the fact that many if not all sciences — physics most notably — would be better served by fewer recruits but more funding to secure the time, space and materials needed to settle long-standing theoretical questions for which there are now a surfeit of alternative models [Smolin, 2006]. To this we might add, perhaps causing more distress to professional scientists, the need for people to integrate science into their daily lives, including 'metaphorical' extensions of core scientific concepts and findings. In the history of modern market research, Maslow is credited with showing how seemingly other-worldly 'New Age' types with few traditional commitments but much disposable income and highly discriminating tastes could be a steady profit-maker for business — a latter-day descendant of which is the 'long tail' niche marketing strategy [Anderson, 2006]. Perhaps now it is time for science itself to cash in, even if that means cultivating some of the very people who would normally make them cringe. What follows is a proposal in this spirit

Consider the more down-to-earth successor of Carl Sagan who is now the telegenic face of UK cosmology, Brian Cox, some of whose million-strong twitter followers have tried (largely unsuccessfully) to swell the physics degree programmes at his home base, the University of Manchester. When Cox is not doing a film shoot or researching at CERN, he actively lobbies for more physics funding [Jeffries, 2011]. But these pursuits need not remain distinct. Cox flirts with New Age themes on television,



such as alluding to astrology's early formative role in getting people to imagine that things happening in remote times and places might directly bear on who and what they are — the basisn for science as a quest for the 'grand unified theory of everything'. In that case, why not team up with the San Diego-based best-selling physician Deepak Chopra (1989), who promotes 'quantum medicine' as a personalised version of this general vision? To be sure, Chopra has been denounced for practicing what the physicist Richard Feynman (1974) originally called 'cargo cult science', an allusion to the natives of Southern Pacific Islands who during and after the Second World War built life-sized cardboard replicas of the airplanes that brought them food and supplies from the US and Japan, purportedly to keep the planes coming. By extension, advocates of 'quantum healing' are equally deluded to think that by enthusing about — or simply talking — quantum mechanics, their health will be improved, as if insights from that field of physics had direct implications for medicine.

Stated so baldly, of course, knowledge claims made on behalf of quantum healing look very dubious. However, with some hermeneutical charity, one can see an indirect route to the sorts of connections that Chopra wishes to make between physics and medicine through, say, the 'quantum decoherence' theory that the mathematical physicist Roger Penrose has proposed that would effectively explain consciousness as quantum effects that are made possible by the size and structure of neural pathways in the brain. While this theory remains quite speculative, it is sufficiently well-articulated to attract the attention of other professional scientists interested in the prospects for spiritual life within the parameters of contemporary physical cosmology [e.g. Kauffman, 2008: chap. 13]. Science customisation encourages just this sort of unconventional theory construction, the end result of which may be to get the supporters of Brian Cox and Deepak Chopra to see themselves as much more joined in common cause than they might first suppose. But such moves will only happen once more conventional supporters of science prioritise promoting science over simply protecting it.

7. Conclusion: Configuring the Science Customer of Tomorrow

In marketing, the distinction between customer and consumer belongs to the stages in the supply chain, where 'custom' refers specifically to the exchange between a manufacturer and a retailer. Here too there is relevance to science. In particular, the image of science as an abstract manufacturing industry that converts raw material (empirical data) into usable knowledge products (laws, solutions, predictions, etc.) has been strong throughout the history of science, most recently in the form of

'computational scientific discovery' [Langley et al., 1987], which aims to produce the widest range of known scientific findings from the fewest number of inference rules. This body of knowledge and reasoning would then serve as a platform — or 'fixed capital', as economists would put it — to project an indefinite range of future findings, only a fraction of which could be ever surveyed, let alone adequately pursued by human beings. Philosopher of science Paul Humphreys (2004) has gone so far as to argue that science might be more efficiently done by such machines, thereby confining humans to the status of science customers and consumers. This is not to say that humans would be offloading their brains to machines. Rather, different cognitive capacities are required of the science customer and consumer than that of the producer. These are closer to art connoisseurship, an analogy that Thomas Kuhn's mentor, James Bryant Conant, explicitly drew to explain the sense in which non-scientists should have an 'understanding' of the nature of science [Fuller, 2000b: chap. 4]. Moreover, this sensibility is not so different from what the Nobel-Prize winning chemist Walter Gilbert (1991) projected for bioinformatics over twenty years ago, in which amidst the array of DNA strings, some specific ones would stand out to the canny prospector as worth investing At the same time, it would effectively turn the classic concern of the 'scientific method' as a vehicle for disciplining the human mind — *a la* Bacon or Descartes — into advocacy for traditional craftsmanship in a world of automated production.

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