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Contesting Democracy: Science Popularisation and Public Choice

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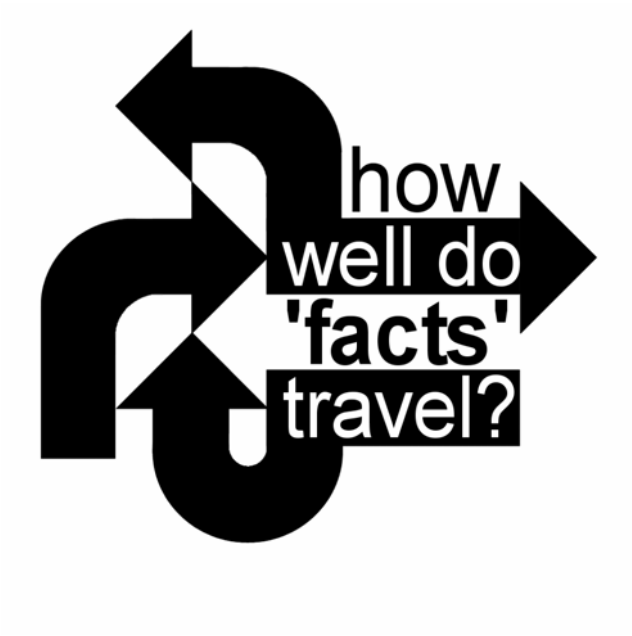

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Contesting Democracy: Science Popularisation and Public Choice

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Abstract

During the same period in which political decisions became increasingly indistinguishable from decisions about science and technology, science and technology became increasingly incomprehensible to all but a few specialists. Maintaining a healthy participatory democracy under such conditions meant keeping the voting public involved – and science popularisation presented itself a means of doing just that. Science popularisation was to enable voters to make sensible decisions about policies relevant to science and technology. But could popularisations really supply sufficient information to validate those decisions? And what if the voters didn't agree with the experts? The formation of Science Service in the 1920s is taken as an exemplary case where the unproblematic dissemination of scientific facts is revealed to be inextricably bound up with more problematic issues about regulating the scope of public choice.

Introduction

In the early years of the twentieth century, as science and its attendant technologies became increasingly central to modern life, a manner of thinking emerged that considered access to scientific knowledge to be part of the citizen's political inheritance. The dissemination of scientific knowledge to as broad an audience as possible was not only an edifying intrinsic good, nor simply an advertisement to generate public interest in funding, but was (in addition to these things) also a vital component of a state's political health. Here is how Frank B. Jewett (president of Bell Telephone Labs) explained it in 1932:

> We are living in a mechanized age, […] For this reason it seems to me highly important that […] we who do know something of science ought to see to it that information

> concerning the fundamentals of science and of how it may affect the daily operation of our lives is both fully, accurately and widely disseminated. In no other way can we expect the great mass of human beings properly to understand that which is fundamental to their well-being or to act sanely on the basis of that understanding.[1]

Many foresaw a future where political decisions were increasingly indistinguishable from decisions about science and technology. As scientific progress outstripped scientific education, a laity at once increasingly reliant upon science and technology yet increasingly ignorant of their workings would suffer increasingly limited participation in the democratic process: fertile conditions indeed under which the type of government envisaged by *Brave New World* might plausibly emerge.

Aldous Huxley himself, writing in the 1940s, was typical in underlining the importance of science popularisation.

> Abbreviation is a necessary evil and the abbreviator's business is to make the best of a job which, though intrinsically bad, is still better than nothing. He must learn to simplify, but not to the point of falsification. He must learn to concentrate on the essentials of a situation, but without ignoring many of reality's qualifying side-issues. In this way he may be able to tell not indeed the whole truth (for the whole truth about almost any important subject is incompatible with brevity), but considerably more than the dangerous quarter-truths and half-truths which have always been the current coin of thought.[2]

The "abbreviator's business" was of no little importance: at stake was the freedom of society. Huxley's message was not that science and technology are bad, but that a society that narrows the channels of communication between those who produce technologies and those consume them risks chronic stratification.

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[1] "Science Service Conference" *Science* 76.1964 (August 19, 1932), pp. 151-158, p. 153

[2] Foreword, *Brave New World Revisited*, n.p.

The wider the gap between public and expert knowledge becomes, the less opportunity the people (on the wrong side) will have to meaningfully participate in the democratic process, and the greater the risk that a society will emerge where the scientifically literate control the scientifically illiterate – whose ignorance they are then in a position to strategically maintain. The dystopian element in both *Brave New World* and (to an even greater extent) *1984* is facilitated by the manipulation of information. For Orwell, that information was political, and manipulated using primarily literary devices: rephrasing, rewriting, fictionalising. In *Brave New World*, the information is knowledge about science and technology, and manipulated through a hierarchically organised society and the mass dispensation of narcotics. In Orwell's future, journalism was the method of suppression. In Huxley's, it is eugenic and pharmaceutical. Orwell imagines a government able to control its people's thoughts; Huxley imagines one able to stop them thinking in the first place. Information is the currency in both cases.

Technologies and the scientific knowledge that underpinned them would be the tools by which a government so inclined could control its people. The way to keep future societies healthy and free was to ensure the widest possible dissemination of the scientific knowledge that underwrote the technologies that supported the conditions of modern life. *This* was the abbreviator's business, and so whilst Huxley was pessimistic about the possibilities for a popular understanding of science and technology, he was insistent that the project was both urgent and necessary. Although the technology was inevitable, perhaps the dystopia was not.

The Origins of Science Service

Huxley's assessment of the severity of our predicament might be written off as theatricalism – a means of keeping his fiction looking like prophecy.[3] But the notion that popular science really is an insulation between contemporary society and some dystopian future did not originate with Huxley, nor was it simply a provincial British concern. In the US, the Science Service – a not-for-profit agency for the promotion of quality science journalism – had been created with just such a role in mind. Right from its inception in 1921, the primary function of Science Service – "to aid in the dissemination of scientific information"[4] – had been animated by a concern that such dissemination would be beneficial to the (continued) political health of the country. In the opening lines of its founding statement, Science Service's first director, Edwin Slosson, had made this explicit: "In a democracy like ours it is particularly important that the people as a whole should so far as possible understand the aims and achievements of modern science" [5] Expressing the same sentiment, Slosson's employer, the publishing magnate E. W. Scripps, had been somewhat more direct: "'Damn it! If we have to have a democracy, let's have an intelligent one.'"[6]

It presumably wasn't the only time Scripps said something like this, for Watson Davis – who would later succeed Slosson as director of the Science Service – recalls an exchange between E. W. Scripps and oceanographer W. E. Ritter (another recipient of Scripps funding):

[3] That he was successful in this end is evinced by the way in which "brave new world" has settled into the vernacular idiom as a warning against the power of scientific knowledge.
[4] Slosson, Edwin E. "A New Agency for the Popularisation of Science." *Science* New Series 53.1371 (1921): 321-323, 321.
[5] Slosson, "A New Agency…", 321.
[6] Quoted in Ralph Coghlan, "The Need for Science Writing in the Press." *The Scientific Monthly*. 62.6 (June 1946): 538-540, 539.

> It is useless, E. W. argued, to think of making the world safe for democracy without thinking also of making democracy safe for itself. And both Scripps and Ritter were convinced that the only possible way of making democracy thus safe is to make it more intelligent. Since to be intelligent is utterly impossible without having much of the knowledge, method, and spirit of science, it followed that the only way to make democracy safe is to make it more scientific. And that is what they set out to do.[7]

The implication was clear: as it stood, democracy wasn't safe at all. The public were insufficiently educated to make informed choices about science and technology – and a government acting on the choices of an uninformed public would be every bit as dangerous as those governments Huxley had feared who wished to deprive the people of any choice at all. If the mob must rule, educate the mob. Meaningful public engagement with science demanded public understanding of the same, and as the century rolled on, public engagement would become especially pressing.

In the years immediately following the end of the Second World War, it was not difficult to make a case for the importance of public engagement in (at least) the direction of scientific research. For journalist Ralph Coghlan, writing in 1946 on the need to increase both the volume and quality of science in the press, the importance of good science popularisation had acquired a special urgency, and the practical import of scientific knowledge carried an ominous new significance: "I say the press has got to do these things because it *must* – Hiroshima and Nagasaki settled that. No matter how odious science is, the public must learn about it. The public must learn about it or else we will not be on the planet much longer."[8] The nuclear threat became the grounds for a new push for science popularisation. Not now as entertainment or diversion, but as a means of insuring the

[7] Davis, Watson. "The Rise of Scientific Understanding," *Science*, 108 (3 Sept 1948): 239-246, 241.
[8] Quoted in Coghlan, 539.

future against apocalypse, and – as the politics of the Cold War became the locus of public debate – of defining the distinctly open American society against the closed Orwellian society of the Soviets. The war had been won *with* science, and *for* democracy.

By those whose business consisted in the promotion of science and science education, that linkage was taken as significant. Watson Davis, who had assumed the directorship of Science Service by the time Coghlan's piece appeared, revised the formulation Slosson originally composed so as to place added emphasis on the practical value of scientific knowledge for the American people. The "mere implanting of scientific facts into the minds of laymen"[9] will no longer be enough: "Science reporting and interpretation does not accomplish its purpose – the principal purpose of science popularisation – if it does not bring about an appreciation and a utilization of the method of science in everyday life." [10] And the end of that "principal purpose" is, of course, the reinforcement of democracy:

> So many of the ideals we cherish, such as liberty, opportunity, the pursuit of happiness, freedom, democracy, are achievable by the utilization of scientific methods. The ways of science and democracy may at times seem roundabout and slow, but they are usually more sure and safer. The mistakes of science and democracy are best corrected by the methods of science and democracy. [11]

The difference between the scientific method and the democratic process is elided, to the point where they are made to seem inseparable. Democracy is the American way, science is the future, so working toward a democratic science is obligatory. It all looks simple: good science popularisation will help the voting public ensure a safe

[9] Davis, Watson. "The Rise of Scientific Understanding," *Science*, 108 (3 Sept 1948): 239-246, 241.
[10] Davis, 241.
[11] Davis, 241.

democratic future. Yet the production of "good popularisation of science" able to do useful democratic work was problematic. Not only were there problems with the translation of increasingly sophisticated scientific information into an accessible form, but when Slosson first began work at Science Service's Washington offices, science popularisation itself was in a poor state.

Rescuing Popular Science From Popular Taste

A professional dismay with the low standards of existing popularisation during Science Service's first years is evident from contemporary reports. In a letter to *Science* in 1922, one disgruntled scientist (E. T. Brewster, to whom we will shortly return) writes to complain that "the world just now is being drowned in a vast wave of superstition, that is bringing in every sort of pre-scientific opinion that the nineteenth century thought disposed of for good and all."[12] It is a charge corroborated by the work of historian John C. Burnham, who holds the quality of science popularisation to be inversely proportional to the complexity of the science being popularised; a situation that leads to an inevitable decline in the quality of science popularisation as the sciences become ever more complex. As told in his 1986 book, *How Superstition Won and Science Lost*, Burnham's decline-and-fall story sees the history of science popularisation as party to a general deterioration in the accuracy and quality of journalism as a whole. Science popularisation was swept up in the wider commodification of journalism at the hands of profit-driven and increasingly unscrupulous media tycoons. Un-tethered from direct contributions by professional scientists, and buffeted now by market forces indifferent to the educational quality of the material, science popularisation gradually

[12] E. T. Brewster, letter to *Science* 55.1432 (9 June 1922): 622.

drifted away from its Victorian origins as a means of public betterment. And, as science popularisation became increasingly remote, so the "forces of superstition" were able to seize their chance, and flood the enfeebled American mind with magical thinking and nonsense. The language of biblical deluge is not accidental: Burnham really does describe the story of science popularisation in terms of an epic moral loss; reiterating what Andrew Ross once called "the myth of scientists […] standing firm against a tide of superstitions."[13] That is, rather than party to the inevitable and benign drift of taste and modes of presentation, Burnham sees the changes in science writing as evidential of rationality's weakening purchase on an increasingly infantilised public. Though the thoroughness of Burnham's scholarship is unsurpassed here, the tone of his grumblings is surprisingly commonplace: seemingly continuous with the history of science popularisation is the history of complaints about science popularisation.

In 1922, replying to Slosson's article on the formation of Science Service, W. E. Allen wrote to *Science* to complain about "the malodorous condition of the popular science field which for some time has been so largely and so conspicuously occupied by fabricators, exaggeraters [sic], emotionalists, ignoramuses and exploiters that many people of training hesitate to enter."[14] He went on to add: "I am fully in sympathy with the man who hesitates to try popular science writing because of its unsavoury reputation. I sometimes have a distinct feeling of disgust when I find an article which I have tried to compose accurately and which I have taken especial pains to verify, printed in close proximity to one of the florid, vacuous, or untruthful type."[15] This

[13] Andrew Ross, ed. and intro. *Science Wars* (Durham, NC: Duke UP, 1996), 9.
[14] Allen, W. E. "Popular Science." *Science* New Series 55.1426 (1922): 454-455, 454.
[15] Allen, 455. That many of these letters cluster around 1922 reflects how eager the community was for (something like) Science Service.

last is a complaint that would be echoed by Watson Davies, who recalls how a science report he had written for the *Washington Herald* was "corrected" in such a way that the results being reported were entirely inverted. Significantly, he recalls this being "about a year before the organization of Science Service."[16] Waldemar Kaempffert, then-editor of the magazine *Popular Science* (and thus someone who had tried – with less resources and authority, to do what Scripps and Slosson were doing with Science Service), summarises the bleak prospects for communication between science and the media under such conditions: "Since these are the editorial standards of the day, is it any wonder that scientists hold aloof from the reporter? Is it any wonder that they *do not wish to be made ridiculous?*"[17] He explains: "So long as the standards of American journalism are what they are, it will be difficult to enlist the whole-hearted cooperation of scientific men in popularizing the results of their researches."[18] As an evermore dismayed scientific community gradually lost faith in the capacity of the press to accurately report their findings, they became less willing to speak to journalists at all, and the quality of science journalism began a steady decline. Consequential effects upon the reception of popular articles on science were inevitable.

Kaempffert blamed the declining standards on the tendency of editors to appeal to their audience's reliable self-interest: "Our newspapers and magazines are right in demanding what they call 'human interest,'" he writes. "But our newspapers and magazines ride human interest too hard. […] So long as our newspapers publish

[16] Davis, 242. That this story became exemplary of the failings of the pre-Science Service press is evident from its repetition by Coghlan in *Science Monthly*, 62.2 (June 1946), p. 538.
[17] Waldemar Kaempffert, Letter to *Science*, New Series, 55.1432 (9 June 1922): 620-621, 621.
[18] Kaempffert, 620.

simply gossip […] we have little to hope from them."[19] But if the editors had hoped to secure a larger audience through dumbing-down the scientific content of their publications, the actual effect – in the long term – was quite the opposite. Allen again: "many intelligent readers say they either do not read or do not believe the stuff peddled as science by most newspapers. Under such conditions why should the reading public take any interest in popular science writing?"[20] The "intelligent reader" was being driven away, the more difficult content was being replaced with "gossip." Popular science was being ruined by popular taste.

Amid a growing aversion to popular writing, Science Service was formed to attempt to improve the reputation of science writing among both the public (and especially the all-important "intelligent public") and – as importantly – those scientists whose work was increasingly being misreported or distorted by the press. Kaempffert doubted if the public were really so gaudy in their tastes as apologists for low-quality journalism assumed: "The newspaper and magazine editor constantly uses the stock argument that he 'gives the public what it wants.' But does he really know what the public wants?"[21] (On this issue, the editors then – as now – presumably erred with H. L. Mencken's often-quoted assessment that "No one […] ever lost money by underestimating the intelligence of the great masses of the plain people." [22]) Citing the high sales of titles such as *The Saturday Evening Post* as evidence that good quality popularisation can coexist with healthy profits, Kaempffert reminds fellow editors that "the *facts*, simply, humanly, and interestingly presented are 'what the public

[19] Kaempffert , 620.
[20] Allen, 454-455
[21] Kaempffert, 621.
[22] Mencken, H. L. "Notes on Journalism," *Chicago Daily Tribune* (19 September 1926): g1

wants.'" [23] Others were less optimistic. Ominously, some seemed to feel that declining standards were the result of giving the public *too much* choice. E. T. Brewster, in 1922: "our public library has to buy books, just off the press, on palmistry, handwriting, character reading and fifty seven other varieties of nonsense; while, significantly, it owns no old volumes on such topics." To illustrate how pervasive this trend to irrationalism has become, he adds: "The current number of the *Atlantic Monthly* carries the advertisement of a professional astrologer!"[24]

The Educative Limits of Popularisation

The proposed cure for this gradual slump back into magical thinking was better science popularisation and more of it. The future would be fine just so long as science could be explained to everyone. But as the science became increasingly complex, explaining it became increasingly difficult. At least some of the epistemic prestige attached to scientific knowledge stems from the sheer difficulty of its acquisition. How, against the rapid expansion of the sciences, were they supposed to keep the people informed? Amid an increasing number of complaints that scientists themselves were deliberately making their work incomprehensible, Slosson had said that "Science Service will aim to act as a sort of liaison officer between scientific circles and the outside world" in order to "to enlighten the layman," reminding us that "The specialist is likewise a layman in every science except his own and he, too, needs to have new things explained to him in non-technical language." [25] But there are limitations to the information non-technical

[23] Kaempffert, 621.
[24] Brewster, 622.
[25] Slosson, "A New Agency…," 322.

language can carry, and opinions differ on the explanatory limits of popularisation. Kurt Vonnegut reports overhearing Irving Langmuir, Nobel Chemist, telling someone that "Any person who can't explain his work to a fourteen-year-old is a charlatan"[26] – though Slosson himself was a little less optimistic: "We may not go so far as Tolstoy who said that you can explain Kant to a peasant if you understand Kant well enough."[27]

When Huxley called abbreviation a "necessary evil" it was necessary because knowledge must not be contained in only one place, and evil because the abbreviation would result more often than not in misunderstanding. The way Huxley saw it, by the time the material had been processed into a form suitable for public digestion, there was almost nothing of value left. Richard Feynman had once expressed a similar sentiment: asked by a journalist whether he could explain in simple terms what his Nobel Prize was for, he (is at least said to have) replied: "Listen buddy, if I could tell you in a minute what I did, it wouldn't be worth the Nobel Prize."[28] Elsewhere, Feynman wrote of the un-translatability of physics: "Physicists cannot make a conversion to any other language. If you want to learn about nature, to understand nature, it is necessary to understand the language that she speaks in."[29] The "language" Feynman has in mind is mathematics, and he is unequivocal on this point: "it is impossible to explain honestly

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[26] Vonnegut, *Palm Sunday: An Autobiographical Collage,* New York: Delta, 1981: 157. Elsewhere, Vonnegut fictionalised the same episode, adding a punchline: "'If there's something you don't understand,' urged Dr Breed, 'ask Dr Horvarth to explain it. He's very good at explaining.' He turned to me. 'Dr Hoenikker used to say that any scientist who couldn't explain to an eight-year-old what he was doing was a charlatan.' 'Then I'm dumber than an eight-year-old,' Miss Pefko mourned. 'I don't even know what a charlatan is.'" (*Cat's Cradle*, New York: Delta, 1963: 27)

[27] Slosson, "A New Agency…," 322.

[28] Quoted in Gleick, James. *Genius: Richard Feynman and Modern Physics.* London: Abacus, 1995, 378.

[29] Feynman, Richard P. *The Character of Physical Law* (1959) Cambridge, MA: MIT Press, 1990: 58.

the beauties of the laws of nature in a way that people can feel, without their having some deep understanding of mathematics."[30] The contention here is that there is only so much science that can be explained without recourse to mathematics, and there seems to be no place for such mathematics in popularisations. Stephen Hawking reports being warned that every equation he included in *Brief History* would halve the readership[31] (a factoid gleefully rebuked by Ian Stewart and Jack Cohen, who point out that if this were the case, Roger Penrose's *The Emperor's New Mind* would have sold only one-eighth of a copy[32]).

Advocates of scientific literacy often point to popularisations as a means of remedying scientific ignorance. Raymond Tallis suggests that as "there is no shortage of reliable popularisations" scientific ignorance is inexcusable, "all that is required is some effort."[33] But it's clear that popularisations alone won't educate their readership in the appropriate sense. Confronting the quite different problem of scientific pretension (which entails a *sort* of scientific ignorance), Alan Sokal and Jean Bricmont uncover a class of thinker whose ingestion of popular books has led to an inflated sense of comprehension. Whilst Sokal and

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[30] Feynman, *The Character of Physical Law* 39-40.

[31] "Someone told me that each equation I included in the book would halve the sales. I therefore resolved not to have any equations at all. In the end, however, I *did* put in one equation, Einstein's famous equation, $E=mc^2$. I hope that this will not scare off half of my potential readers." Hawking, Stephen. *A Brief History Of Time: From the Big Bang to Black Holes*. Toronto: Bantam, 1995, vi-vii

[32] "They say that every formula halves the sales of a popular science book. This is rubbish – if it were true, then *The Emperor's New Mind* by Roger Penrose would have sold one-eighth of a copy, whereas its actual sales were in the hundreds of thousands. However, just in case there is some truth to the myth, we have adopted this way of describing the formula to double our potential sales. You all know which formula we mean. You can find it written out in symbols on page 118 of Stephen Hawking's *A Brief History of Time* – so if the myth is right, he would have sold twice as many copies, which is a mind-boggling thought." (Pratchett, Terry, Ian Stewart, and Jack Cohen. *The Science of Discworld*. London, Ebury, 2002: 23)

[33] Tallis, *Newton's Sleep: Two Cultures and Two Kingdoms*. London: MacMillan, 1995: 7

Bricmont advocate the reading of popularisations, they are quick to stress the educative limitations:

> Obviously, it is legitimate to think philosophically about the content of the natural sciences. […] But, in order to address these subjects meaningfully, one has to understand the relevant scientific theories at a rather deep and inevitably technical level; a vague understanding, at the level of popularizations, won't suffice.[34]

Of course, reading *A Brief History of Time* doesn't make you a cosmologist, anymore than reading *The Reader's Digest Medical Guide* makes you a doctor. But if it won't facilitate meaningful interaction, what is popular science writing doing, and will the end result of popularisation be of any use at all? [35]

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[34] Sokal, Alan and Jean Bricmont, *Intellectual Impostures: Postmodern Philosophers' Abuse of Science*. Trans. Sokal and Bricmont. London: Profile, 1998: 176

[35] Amid a booming market for science writing, today's popularisers are (understandably) reluctant to concede the educational redundancy of popular science writing. Richard Dawkins, surely one of that boom's progenitors (and certainly one of its benefactors), wonders if there may be a way out: "it is possible to enjoy the Mozart concerto without being able to play the clarinet …. Couldn't we learn to think of science in the same way?" (*Unweaving the Rainbow: Science, Delusion and the Appetite for Wonder*. Harmondsworth: Penguin, 1998: 36). Dawkins is asking (somewhat hopefully) if we can separate learning to "play" science from learning how to listen to it. We can assume that Feynman would have been pessimistic. He thought that science without mathematics wasn't just a case of learning to listen rather than learning to play, it was like teaching music to the deaf (*The Character of Physical Law* 58). Speaking from the same field, C. P. Snow once described the scientifically ignorant as "tone-deaf" – "Except this tone-deafness doesn't come by nature, but by training, or rather the absence of training" (*The Two Cultures and A Second Look: An Expanded Version of The Two Cultures and the Scientific Revolution*. Cambridge: Cambridge UP, 1964:14).

Wittgenstein was more derisive still, characterising the "popular-science lecture" as: "a lecture intended to make you believe that you understand a thing which actually you don't understand, and to gratify what I believe to be one of the lowest desires of modern people, namely the superficial curiosity about the latest discoveries of science." ("A Lecture on Ethics," *The Philosophical Review*, 74.1 [January 1965]: pp. 3-12, 4) It's safe to say that Feynman wouldn't have gone so far, but Wittgenstein's remark about "superficiality" is important (though it's really *not* important that it was Wittgenstein who said this, and not someone else) Note that the charge being made is not – as with Sokal and Bricmont and Feynman – that

Sokal and Bricmont, again, are of special interest here. It is difficult to gauge how useful they believe popularisations are. Whilst they admit that "it is usually possible to explain [difficult scientific concepts] in simple terms, at some rudimentary level,"[36] they are quick to illustrate the limitations of such knowledge. Concerning conflicting findings by different researchers working on solar neutrino emission levels (a study outside Sokal or Bricmont's field), they claim:

> we could get a rough idea by examining the scientific literature on the subject; or failing that, we could get an even rougher idea by examining the sociological aspects of the problem, for example, the scientific respectability of the researchers involved in the controversy. … But the degree of certainty provided by this kind of investigation is very weak.[37]

This last issue of "scientific respectability" highlights another problem for the keen amateur. As Christopher Norris points out:

> one need only glance at a typical number of up-market popularizing journals like *New Scientist* or *Scientific American* to see how narrow is the line that separates "advanced" theoretical physics from the crankier versions of New Age thinking or sheer science-fiction fantasy. …[O]ne just can't be sure … which are (supposed to be) the purveyors of mere fashionable nonsense and which are reputable scientific sources.[38]

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what can be *learnt* from popularisation is necessarily superficial, but that the curiosity itself is superficial: not education but mere intellectual voyeurism.

[36] Sokal and Bricmont, 176. They add: "For example, although neither of us has any training in biology, we are able to follow, at some basic level, developments in that field by reading good popular or semi-popular books" (176-77). Regarding the difficulty of comprehension outside of specialisation, see Erwin Chargaff, "Building the Tower of Babble" in *Nature* 248 (1974): 776-79. Chargaff feared that acute scientific specialisation would eventually bring communication between scientists to a halt, and a situation would arise where nobody could ever "know more than an ever smaller portion of what they must know in order to function properly" (777).

[37] Sokal and Bricmont, 87

[38] Norris, Christopher. *Deconstruction and the "Unfinished Project of Modernity,"* London: Athlone, 2000, 197

Popularisations remain a site where unorthodox and radical theories enjoy a wide readership – to the chagrin of many professional teachers who find their students (a lay audience awaiting conversion) arrive "primed" (or, in Dawkins's language: infected) with theories that have enjoyed popular success but little or no institutional endorsement. So, for example, although Elaine Morgan's "Aquatic Ape" theory of human evolution was, as Adrienne Zihlman puts it, "taken about as seriously by anthropologists to explain human origins as Velikovsky's *Worlds in Collision* was taken by astronomers to explain the origin of the earth," [39] anthropologist John Langdon is nonetheless able to report that "the aquatic ape hypothesis continues to be encountered by puzzled students who wonder why mainstream paleoanthropologists overlook it."[40] Zihlman records a familiar discrepancy: "Both [Velikovsky and Morgan's theories] appealed to a popular audience but seemed absurd to those within the field." [41] Similar stories emerge across the academy. Though flattered by the public interest in his discipline manifested by the "deluge of books … for the lay person," archaeologist Brian Fagan is dismayed that the "the fantasy fringe continues to bombard the archaeological landscape with its pet theories, many of them devoted to extraterrestrial beings, exotic explanations of human prehistory and the usual diffusionist and astronomical hypotheses."[42] Langdon suspects the issue common to all cases is the tendency to seek narrative order over factual accuracy: "Professionals and lay persons alike are reluctant to look for complex

[39] Zihlman, Adrienne, review of *The Monkey Puzzle: Reshaping the Evolutionary Tree* by John Gribbin and Jeremy Cherfas. *American Anthropologist* New Series 85.2 (1983): 458-459, 459.
[40] Langdon, John H. "Umbrella hypotheses and parsimony in human evolution: a critique of the Aquatic Ape Hypothesis" *Journal of Human Evolution* (1997) 33:479–494, 480. He adds: "If only because of this last audience [i.e., puzzled students], it should not be ignored."
[41] Zihlman, 459.
[42] Fagan, Brian. "Genesis I.1; Or, Teaching Archaeology to the Great Archaeology Loving Public," *American Antiquity* 42.1 (1977): 119-125, 119-120.

stories with weak plots." But "[r]esponsible scientific answers are much more difficult to deliver. … Lay audiences do not readily sit still for a recitation of technical details."[43] Whilst he thinks there is also a sociological component to the fondness for radical theories ("heterodox ideas feed on a suspicion of and rebellion against establishment science and other authority … there is a special appeal for peripheralized segments of the population in rejecting the authority that science and academia represent" [44]), even the enthusiastic reader who thinks highly of science and scientists faces problems. The reason why it is hard to tell the sense from the nonsense is in part due to the ever-widening gulf between science and commonsense beliefs about the world, and in part rooted in the type of understanding available to thinkers whose lack of scientific training limits their reading matter to popularisations (rather than technical journals). Unlike, say, medical ethics or even evolutionary psychology, there are no intuitions here against which to measure the feasibility of ideas like "superstrings" and "wormholes."

Speaking at Science Service's decennial conference in 1932, Arthur A. Noyes (then Director of the Gates Chemical Labs at Caltech) had complained that this inability to discriminate between science and nonsense was a problem intrinsic to popularised science:

> The great defect in the scientific information that is disseminated through newspapers is that there is nothing to show whether it is accurate or not. In three cases out of four it is not reliable and is therefore misleading. […] For, as I have said, one of the greatest defects of popular scientific

[43] Langdon, 493. He adds: "These difficulties assail mainstream science. Professionals and lay persons alike are reluctant to look for complex stories with weak plots." (493)
[44] Langdon, 493

> publication is that one does not know whether it means anything whatever.[45]

Telling science from nonsense has a special importance for the role of popularisation as a democratic aid. The problem is obvious: in order to perform useful work for democracy, science popularisation will need to supply the public with sufficient information for them to make "safe" decisions about policies regarding science and technology. Unfortunately, co-mingled with science popularisation is fantasy and nonsense pretending to be science, and the audience for popularisations are categorically unable to distinguish between the two. Science popularisation is unable to supply its readership with enough information to assess the reliability of what they are reading.

The Boundaries of Participation

If science popularisation won't be providing sufficient cognitive grounds to assess theories, then how are its readership supposed to know if they are making a responsible decision? Sokal and Bricmont's suggestion that we assess the "respectability" of the writer is deeply unsatisfactory, and although they quickly acknowledge that this type of measure provides only the weakest sort of security, they don't have an alternative. Popularisation doesn't provide enough information to make our choices meaningful, but we must use popularisations to make our choices because, short of undergoing scientific training, that's the only option we have. Accepting this very low threshold for proof is necessary for ensuring that at least *some* interaction can occur between the experts and their public. (This is the necessity Huxley spoke of.) But a consequence of doing so is that the filtration devices

[45] Noyes, Arthur A. "Science Service Conference" *Science* 76.1964 (August 19, 1932), pp. 151-158; 155.

that keep proper science epistemically respectable are disabled by the conversion into an accessible form. (This is the evil that Huxley spoke of.) Sokal and Bricmont don't say it explicitly, but the subtext is inevitable: if you're not an expert, you had better not have an opinion.

Left to judge the merit of a popularisation on the basis of the "reputation" of its author, to whom shall we turn to assess the respectability of a scientist? Presumably, to the other respectable scientists.[46] But that's no real sort of choice: instead of being told that this or that is the case, we accede to the authority of science by proxy. Choice is illusory because the way we decide on who is respectable is through seeking the opinion of other respectable writers.

Worse (which was Sokal's main complaint), science popularisation may in fact create the impression that real knowledge has been secured through skim-reading two-hundred pages of breezy prose. This is the flip side of encouraging participation: if it is to be genuine participation (and not simply the paternalistic fallacy of "outreach") then the scientists must be prepared to find that their public doesn't necessarily agree. Participation ought to involve more than simply learning enough to feel rational about agreeing with the scientific orthodoxy. If the idea of public participation is taken seriously, then that certainly means the right to veto practice (for example: stem cell research, animal/human chimeras), and may mean the right to decide on matters of scientific belief. In other words, if the public believes in the Biblical account of creation, then that's the account the scientists ought to call orthodox.

[46] This circularity offers fertile conditions for the formation of a cadre of mutually supportive writers, each assuring the public that their colleague is truly a decent scientist with truth on his or her side. It ought to come as no surprise, then, that just such a cadre already exists in the EP proponents championed in the internet age by gatekeeper figures such as Denis Dutton and, especially, John Brockman. Reading *edge.org* or *aldaily.com* is illustrative of this.

But such a conception is potentially absurd: would we then be free to contest such basic claims as "All things are made of atoms," or even "The Earth orbits the Sun"? In the closing chapter of *Against Method*, Paul Feyerabend suggests that we would, and that a "democratic science" would be better for all parties: "It is the *vote* of *everyone concerned* that decides fundamental issues such as […] the truth of basic beliefs such as the theory of evolution, or the quantum theory, and not the authority of big-shots hiding behind a non-existing methodology."[47] As Feyerabend sees it, science is forced upon us:

> Modern society is "Copernican" not because Copernicanism has been put on a ballot, subjected to a democratic debate and then voted in with a simple majority; it is "Copernican" because the *scientists* are Copernicans and because one accepts their cosmology as uncritically as one once accepted the cosmology of bishops and cardinals.[48]

Like of much of what Feyerabend says in that book, it's not clear how seriously this should be taken. Is society Copernican to the extent that society believes (to a majority cut) that the Earth orbits the sun and not the other way around? Or is the society Copernican in some realist sense that insists the Earth really does orbit the sun? Unless Feyerabend wants us to subscribe to something like idealism, there's no way to get the orbit going the other way around.[49] So it's not clear how society "decides" if it is going to be Copernican or not. It simply

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[47] Feyerabend, *Against Method: Outline of an Anarchistic Theory of Knowledge* London: New Left Books, 1975: 309.
[48] Feyerabend, 301-02
[49] Well, there is: you could remove (or, as with Pluto, declassify) all the other planets from the solar system, at which point, the relative motion of the Earth and the sun would be comparable: either could be said to be revolving around the other. As it stands, the other planets form a reference point against which to make the claim that the sun is at the centre. It is at the centre of a series of rotational orbits. It could not be at the centre of only one rotational orbit. In this respect, Copernicanism is a majority case: if there was only one planet, it wouldn't revolve around the sun, but one two are doing it, then you have a point of reference.

decides whether it will *sanction* Copernicanism. Policy can be decided in this fashion, but policy has no bearing upon the (epistemological) grounds for belief and so no bearing upon beliefs themselves.[50]

A democratic science would be a strange thing indeed. It seems coherent to talk about voting for one policy or another, but less coherent to talk about voting for one theory or another. If popularisation ever did have the educative, democratically useful function that Huxley and the originators of Science Service claimed for it, then it would (presumably) not be in the sense that the *content* of science should be democratically selected. Above all, "voting" for theory choice is resisted because it overturns any notion of the epistemic superiority of experts upon which the business of science popularisation is predicated. Popularisation necessarily carries information down from those who are expert to those who are not expert.[51] One consequence of this structure is that it doesn't leave much room for scepticism. Unless you have scientific training, almost all the science you learn about will be

[50] Meanwhile, there is an apparent inconsistency as regards the scepticism toward scientific practice but faith in the democratic apparatus – as Sokal and Bricmont point out,: "How, after all, does one find out exactly what 'some people believe', if not by using methods analogous to the sciences (observation, polls, etc.)?" (Sokal and Bricmont, *Intellectual Impostures*, 78) Voters will want the same sort of evidence that the scientists had. And presented with this evidence, and assuming their general rationality (as a prior condition of the legitimacy of democracy and eligibility for voting in the first place), they will presumably come to the exact same conclusion.

[51] You might object at this point that this is not the case for one of the most successful popularisations of the recent past: Bill Bryson's *A Brief History of Nearly Everything*. However, although it is true that Bryson himself admits to being no more a scientist than the audience he has in mind, he builds the history by consulting a series of experts and – acting as an interviewer – asks them the questions we would ask if – like him – we had very little scientific knowledge. So the content of the information is not decided by Bryson. Additionally, it is cross checked by a team of scientists – so one might expect the information in Bryson's book to be even more reliable than in those cases where an individual were writing alone and free to vent prejudices. Wikipedia presents obvious parallels here.

popularised, simplified science.[52] Without expertise, the reader of popularisations cannot decide which parts of the popularisation to believe. Or rather, they cannot have good grounds for believing Brian Greene when he is writing about relativity, but not when he is writing on quantum mechanics. The audience for popularisations are necessary credulous.

Owing to the credulity of its audience, the popularisation becomes a venue where radical, unorthodox ideas are (so far as their intended audience is concerned) indistinguishable from the mainstream, respectable, orthodox ideas. And whilst this might not matter for some cases – whether we believe humans passed through an aquatic or semi-aquatic phase in their evolution, whether we think that speciation occurred in spurts or at a steady pace – our inability to determine which are the legitimate theories and which are what Norris called the "crankier, new-age versions" does have important ramifications for the value of popularisation as a means of helping citizens of increasingly technologised democracies make choices about how to proceed. In issues which certainly do affect voters, such as climate change, the "orthodox" line is increasingly difficult to draw. The self-titled "Sceptical Environmentalist" Bjorn Lomborg's case against the stronger claims of the ecology movement is rendered far more forcefully and to a much broader and – for the main part – less educated audience by Michael Crichton in his 2004 novel *State of Fear*. *State of Fear* is fictional only insofar as the characters and plot are invented: the speeches these characters make are annotated by numerous footnotes and two appendices of scholarly apparatus are included. Crichton was later called to testify before a Senate committee

[52] Note that there's no implication here that scientific training is in any way the preserve of a privileged few: we all had the opportunities, we either lacked the inclination or the proclivities to act upon those opportunities.

on the “real” threat posed by global warming. Amid all this, the “consensus” opinion of the relevant section of the scientific community is difficult to assess. The same can be put for stem-cell research, the use of nuclear power, and numerous questions arising in bioethics.

Competition from radical theories and plain hokum had long been a problem for science popularisers: E. T. Brewster, the 1922 *Science* correspondent who was aghast that the *Atlantic Monthly* carried even an advertisement for an astrologer, had recognised that the “honest” populariser had a difficult task ahead of him: “The writer with an unhampered imagination can turn out stuff that the public prefers; and he can do twice as much of it in a day.”[53] The mild reply to Brewster’s distaste is simply to say that if the public prefers it, what harm can it be doing? The stronger reply is more interesting, and points up a contradiction at the heart of the effort to employ popularisation as a tool to improve democracy: if popularisation is conveying enough scientific knowledge to enable voters to make informed decisions about policy, then surely it is conveying enough information to validate their choice of theories. And surely a public trusted to select the correct policies can be trusted to make the right choice of scientific theories?

Certainly, it is not immediately clear why popularisation couldn’t also work as a means of choosing between competing theories. The criticism is that exposure to science popularisation alone doesn’t allow for valid theory choice because it doesn’t supply sufficient information to make a meaningful decision one way or the other. Yet if this is the case then it seems to also invalidate the (apparently) useful role played by science popularisation as a means of selecting between policies. In other words, if popularisation is not capable of doing theory choice work, then it’s not at all clear how it will be capable of doing the policy

[53] Brewster, 622.

choice work. In many cases, policy choice is *de facto* theory choice,[54] so either science popularisation is useful for both roles, or it's useful for neither. It doesn't seem to make sense to allege that it is useful for one and not the other. Caught between being educationally redundant or dangerously empowering, science popularisation must be seen to be adequate to the task of selecting between policies, but inadequate to the task of selecting between theories. And it seems that achieving that balance requires fudging the content: if there is a danger of the readership choosing the wrong theory, limit the choice.

Certainly, inasmuch as they threaten the appearance of consensus, the presence of any "alternative" theories is usually regarded as intolerable. In recent years, the calls for teaching creationism alongside evolution in schools has forced some scientists into explicit statements about exactly this sort of incompatibility: under no circumstances must science be taught "alongside" rival belief systems, for this creates the impression (favourable to the relativist) that scientific knowledge is one type among many, with no privileged access to how-things-really-are. Calling it "a time-wasting distraction," Richard Dawkins and Jerry Coyle are typical in their insistence that teaching intelligent design (ID) beside the Darwinian account is not merely a case of giving each side a fair hearing, but a dilution of the usefulness of orthodox account: "The seductive 'let's teach the controversy' language still conveys the false, and highly pernicious, idea that there really are two sides."[55] The process of pitting one against the other insists that for the purposes of evaluation, both are treated with equal respect. So either the science comes to be seen a

[54] Assuming that a policy was chosen rationally, policy choice embeds a theory choice.
[55] "One side can be wrong" Richard Dawkins and Jerry Coyle (2005) *The Guardian* (Thursday September 1): 4, and online: http://www.guardian.co.uk/life/feature/story/0,13026,1559743,00.html

pseudo-religious worldview (which is how the SSK people want to have it) or else the ID comes to seem like a respectable and serious account of the cosmos (which is what the religious leaders want). The science is made to seem of a part with the other (political) debates going on. As soon as the debate begins, biology seems to be on a level with ID.

Dawkins/Coyle and Sokal/Bricmont seem to want dispensation to veto dissent, to insulate their theories from critical challenges. But at the foot of this is not a strategic or territorial attempt to accord a special place for scientific knowledge. Rather – more in the spirit seen in the reaction by Fagan, Zihlman, and Langdon to the appeal of radical theories – it is an affirmation of what they hold to be the reality and the necessity of expertise. In trying to outlaw choice, what Sokal/Bricmont and Dawkins/Coyle want to preserve is the epistemic status of expert knowledge – an issue which generates obvious difficulties for the democratic aims of science popularisation.

Democracy and Expertise, Propaganda and Paternalism

So in addition to the *cognitive* problems of comprehension, there is also the *social* problem of reconciling the political ideals of democracy with the epistemic ideals of expertise. It's a position outlined (and resisted) by Stephen Turner in a 2001 essay, "What is the Problem with Experts?" As Turner explains, expertise, though apparently essential to science, is inimical to liberal democracy inasmuch as non-experts cannot challenge expert knowledge. He points out that those activities and practices whose performance and comprehension requires (or whose successful performance is characteristic or definitive of) expertise – such as genetic engineering or nuclear physics – are "out of the reach of democratic control […] simply because 'the public', as a public, cannot understand the issues."

Even if the public are offered choices about whether and how such activities are undertaken, insofar as meaningful engagement requires expert knowledge, whatever choices are made remain "necessarily actions beyond the genuine competence"[56] of those asked to make decisions about them. Secondly, in the wake of social constructivism, the "cognitive authority" of experts is regarded now as a non-neutral (that is, politically charged) condition. There's a real problem here, as Turner points out: "if the liberal state is supposed to be neutral with respect to opinions […] what about expert opinions?"[57] Seen now to be partial, politically rooted, socially and culturally contingent, the "expert opinion" is foremost an opinion, and as an opinion, vulnerable to displacement by other types of opinion.

When these two positions are combined, the consequences are striking, as Turner explains:

> We are left with a picture of modern democratic regimes as shams, with a public whose culture [is] controlled or "steered" by experts whose doings are beyond public comprehension (and therefore beyond intelligent public discussion), but whose 'expert' knowledge is nothing but ideology, ideology made more powerful by the fact that its character is concealed. This concealment is the central legacy of liberalism. The public, indeed, is its pitiful and ineffective victim.[58]

So expertise is never "neutral" and democratic participation is illusory. Ultimately, expertise is inimical to democracy because experts are always a minority, and expert decisions will always be privileged over and supervene upon the decisions of the masses. Democracy looks undesirable if it has the potential to trump expert knowledge,

[56] Turner, Stephen (2001) "What is the Problem with Experts?" *Social Studies of Science* 31.1 (Feb 2001): 123-49; at 123-124.
[57] Turner, 124.
[58] Turner, 127.

while expert knowledge looks undesirable if it operates outside the realm of democracy. It seems that though both are desirable, they will not co-exist. The choice, as Turner underlines, is stark: "we are faced with the dilemma of capitulation to 'rule by experts' or democratic rule which is 'populist' – that is to say, that valorises the wisdom of the people even when the 'people' are ignorant and operate on the basis of fear and rumour."[59]

We're back to Scripps's fears about mob rule. If it was this same conflict which prompted his exasperated complaint about the need for intelligent democracies, then it also seems clear that Scripps himself didn't suffer too much hand-wringing over the problems thus presented: the choice between mob rule and expert rule was no choice at all. But the resolution – to privilege expertise over democracy – does point up an important problem with the original intentions for Science Service.

In drafting the remit for Science Service, Scripps had tried to make clear this distinction between a democratic science and science for democracy: "[our] sole object should be to present facts in readable and interesting form – facts on which the reader could and probably would base his opinion on a subject of politics." [60] This division between informative facts and politically biased narrative was central to Scripps's conception of how Science Service would operate. Despite the politicised language he (apparently) used in private, in drafting the remit for Science Service, Scripps was adamant that bulletins ought not to indulge propagandistic urges: "The first aim of this institution should be just the reverse of what is called propaganda." [61] Watson Davies expands on this, stressing the importance of the "differentiation between popularization and propaganda" and adding that

[59] Turner, 124.
[60] Scripps quoted in Davis, 244.
[61] Scripps quoted in Davis, 244.

"Proselytising should have no more place in dissemination than in research itself."[62] Although Slosson – the institution's very first director – would shortly afterwards claim of Science Service that "It will not indulge in propaganda *unless it be propaganda to urge the value of research and the usefulness of science.*"[63]

To this day, Scripps's media empire retains the motto: "Give Light and People Will Find Their Own Way." Illumination wasn't the same as guidance. Facts alone were not propaganda. The intention seems noble enough, but what allowance for "interpretation" will really be given – and was such choice even desirable? The tension between Scripps's ideal of an agency which offers, Joe-Friday style, "just the facts" and Slosson's concession that it will avoid propaganda except when it's science propaganda, goes to the core of the problem for reconciling the ideals of science education and democratic choice. The view of popularisation as nothing more than a dispensary of scientific facts cannot hold. "Dissemination" was nothing without direction. Worse (as Dawkins and Coyne fear), simply exposing the public to both sides of the debate might ultimately be counterproductive to popularisation's higher aims as a means of helping the public make choices. Slosson realised that the framework into which those facts are supposed to be fit is every bit as important as the facts themselves. Writing on the dire state of newspaper journalism, Slosson agrees that "[a] few more facts are really needed to season the mass of fiction there,"[64] but that this alone is not enough: "isolated facts, however

[62] Davis, 244.
[63] Slosson, "A New Agency…," 322 (emphasis added).
[64] Slosson, Edwin E. "Popular Science," Letter to *Science* New series 55.1427 (5 May 1922): 480-482, 480-481.

numerous and authentic, do not constitute science."[65] He draws attention to a necessary limit on what popularisations can accomplish:

> We may also hope to get over some idea of the relations between facts and how the scientist finds his facts and what he gets out of them. But we can not expect that the newspaper reader will acquire the habit of persistent experimentation, constant criticism, rigorous reasoning, projection of hypotheses, balancing of theories and suspension of judgement characteristic of the scientific mind. If the layman could get all this he would be not a layman but a scientist.[66]

Slosson's last comment here captures the essence of the problem: expertise can't be an entirely shared venture. The act of popularisation itself presupposes experts who know more about something than the mass of men. In other words, "scientist" and "laymen" are mutually defining terms, the existence of a category of "layman" to whom a subject-matter is being explained presupposes a category of experts from whom the explanation stems. As Turner puts it: "it is the character of expertise that only other experts may be persuaded by argument of the truth of the claims of the expert; the rest

[65] Slosson, "Popular Science," 480. The disinterested manner in which scientific research is (ideally, at least) conducted was inappropriate for – indeed, inimical to – the requirements of making the results of that research interesting and accessible. Later in his tenure as Science Service director, Slosson writes on the divergence between the agenda of science writing and the agenda of popularisation: "The aim is now to eliminate the personal element from science and reduce it to an abstract and timeless formula. This may be necessary as a scientific method but it naturally results in the decline of interest. The old textbooks are more readable than the modern. […] I am not advising that our textbooks should return to the leisurely literary style of long ago but we can not expect depersonalized science to be popular. Whatever is without 'human interest' is not interesting to humanity." (Slosson, "Popular Science," 481) By way of illustration: most people writing about Watson and Crick's announcement of the discovery of the structure of DNA in Nature in 1953 quote that paper's final sentence – "… has not escaped our notice" – and admire the restraint with which they have expressed the enormity of their finding. But whoever does quote this nearly always provides a gloss, explaining why that restraint (obvious to the suitably knowledgeable) was impressive.

[66] Slosson, "Popular Science," 480-481.

of us must accept them as true on different grounds than other experts do."[67] In the translation to popular format, the "usefulness" of science is lost. And so:

> The facts of nuclear physics, for example, are "facts", in any real sense (facts that one can use effectively, for example), only to those who are technically trained in such a way as to recognize the facts as facts, and do something with them. The non-expert is not trained in such a way as to make much sense of them.[68]

Expertise is beyond the reach of democracy simply because expert knowledge is knowledge that non-experts cannot assess. This is no mere inconvenience, but definitive of "expertise" – expertise is just that sort of knowledge that is not commonly possessed. It is by definition elitist, for "expert" is a *relational* category, not an absolute degree of competence calibrated on some external scale.

Science Service – and popularisation generally – can offer information, but it's not offered as a menu of available truths from which a reader might reject the less palatable. Science popularisation did not offer beliefs to choose between, but, as Scripps had it in the first place, (indisputable) facts upon which beliefs might be more sensibly predicated. Presenting "just the facts" was fine if you assumed that science itself amounted to nothing more than "just the facts." But the facts were, as Slosson realised, only a small part of what it meant to be a scientist. No amount of facts would provide what was really wanted: the careful habits of practice, methodological procedures, and sceptical attitude that characterised the scientific thinker. Popularisation could surely not hope to make scientists out of its readers, but it might yet prevent them from adhering to the faulty

[67] Turner, 129.
[68] Turner, 129.

versions of science that seem to have been so common in the press at the time. Slosson's claim that Science Service propaganda was allowed if it was in the service of science signalled not a widening of public choice, but a narrowing, a tactical constriction. Science popularisation did not exist to supply the people with the necessary information to make *a* choice, but to supply them with sufficient information to make *the correct* choice.

Conclusion

Democracy is dangerous only if the electorate are insufficiently educated about the decisions they are required to make. The initial hope was that popularisation would remedy this potentially dangerous ignorance (for science-based issues). But unfortunately, popularisation simply isn't able to deliver the necessary information nor qualify the electorate in ways which meaningfully validate their choices. And whether those are policy choices or theory choices, the intellectual demands of each are equal – because they are versions of the same task – and beyond the capacity of the popularisation. The demand that popularisation be comprehensible means that it is not also comprehensive. The accommodations made in order to make the material accessible simultaneously made it inadequately educative. Popularisation simply lacks the intellectual bandwidth necessary to convey sufficient information to *validate* the (policy and theory) choices that the electorate in a liberal democracy are required to make. Consequently, popularisation – if it was to do anything useful at all – would not be offering the electorate real choices. If popularised scientific information was going to maintain the freedom of society and insulate the population from rule by the technologically empowered in

the way Aldous Huxley had hoped it might then it would need to do so in a most devious and paternalistic fashion.

Popularisation didn't simply aim to "disseminate" scientific facts – as was the stated goal of the Service – but rather, it aimed to promote a positive image of science and scientists. The promotion of scientific understanding was tied up with the promotion of the scientific enterprise. Popularisation's pedagogic function was inseparable from its propagandistic role. Crucially, Science Service was a service for the *scientists* as much as a service for the public. The aim of promoting science was always also an aim to suppress and eliminate superstition and non-scientific thinking. This negative agenda – popularisation's secondary function as a means for the suppression of dissenting or contradictory views – was every bit as important as the positive agenda of disseminating scientific knowledge.

Popularisations, then, didn't exist to offer choice but to *constrain* choice and offer in its place the illusion of choice. The popularisation would not be a site where the authority of experts could be challenged, but where the authority of experts would be compounded. Being "steered" by experts was at least safer than being steered by the untrained masses.[69] "If the mob must rule, educate the mob" is neat slogan – but an impossible goal. The upshot of thinking about the uses of expertise is the conclusion that no amount of popularisation will really suffice for achieving the democratically useful (perhaps even vital) role demanded of it inasmuch as no amount of popularisation will substitute for the years of training to qualify as an expert: the participation threshold is simply too high. The inimicality of scientific expertise and liberal democracy meant that the popularisation – no

[69] As Ibsen had put it in *An Enemy of the People* – a play which dramatises the conflict of expertise set against the majority: if the intelligent were as a matter of necessity in a minority, then majority rule meant that the stupid would rule over the clever, and that could never be right.

matter how effective – would not do what was required of it, and could not be offered as information on which to base free and open choice.

If popularisation ever did have the educative, democratically useful (even vital) function that Huxley and the originators of the Science Service claimed it could have, then among the available variants on orthodox scientific opinion – the aquatic ape, punk eek, the diffusionist and interventionalist theories, even the creationist story – that useful, democratic function is disabled. The process of abbreviation and translation that produces accessible science writing also strips away the mechanisms by which the scientists themselves are able to assess the reliability of a theory or the proper weight that ought to be accorded to a given fact.

Shadowing nearly all of these comments on popularisation – with the noted exception of Feyerabend – is the sense that public choice is intolerable: Huxley's fear for the "dangerous half-truths" which were the "current coin of thought," Scripps's desire to foster an "intelligent" and "safe" democracy, Brewster's concerns about the rise of astrology, and seen today in the reaction to magical thinking from popularisers like Dawkins and advocates like Daniel Dennett. Choice is intolerable because it is antithetical to (and incompatible with) a realist epistemology. Bernard Davis once called the error of thinking the other way around "the moralistic fallacy"[70] – meaning, with a debt to G. E. Moore, an attempt to derive an is from an ought. So far as a realist epistemology is concerned, fifty-million fans can be wrong. The democratic function of science popularisation has never been about helping people make choices about science, but about helping them make choices about politics. To this end, it doesn't seek to provide a variety of different scientific theories from which the public might choose between, but rather, a stable, monadic account of science from

[70] Davis, Bernard B. "The Moralistic Fallacy." *Nature* 272 (1978): 390.

which sensible policy might be decided. Even the appearance of choice is intolerable, insofar as it erodes the usefulness of the science popularisation that does exist. Being able to choose on matters of science is poor for the science and poor for the people. Popularised accounts of science can be offered as a means of helping people make decisions about policy, but not decisions about science, and what scientific knowledge is made available in a popular form will be useful to public debate to the extent that it is not itself debateable. For as E. T. Brewster had complained back in 1922: “Here then lies the real trouble: The reading public does not know good science from bad; but if it did, it would almost certainly choose the bad.”[71]

[71] Brewster, 622.

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