

## The 1992 Voltaire Lecture (1): Dr Richard Dawkins *Viruses of the Mind* (2)

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The haven all memes depend on reaching is the human mind, but a human mind is itself an artifact created when memes restructure a human brain in order to make it a better habitat for memes. The avenues for entry and departure are modified to suit local conditions, and strengthened by various artificial devices that enhance fidelity and prolixity of replication: native Chinese minds differ dramatically from native French minds, and literate minds differ from illiterate minds. What memes provide in return to the organisms in which they reside is an incalculable store of advantages - with some Trojan horses thrown in for good measure ...

*Daniel Dennett*

### 1. Duplication-Fodder

A beautiful child close to me, six and the apple of her father's eye, believes that Thomas the Tank Engine really exists. She believes in Father Christmas, and when she grows up her ambition is to be a tooth fairy. She and her schoolfriends believe the solemn word of respected adults that tooth fairies and Father Christmas really exist. This little girl is of an age to believe whatever you tell her. If you tell her about witches changing princes into frogs she will believe you. If you tell her that bad children roast forever in hell she will have nightmares. I have just discovered that without her father's consent this sweet, trusting, gullible six-year-old is being sent, for weekly instruction, to a Roman Catholic nun. What chance has she?

A human child is shaped by evolution to soak up the culture of her people. Most obviously, she learns the essentials of their language in a matter of months. A large dictionary of words to speak, an encyclopaedia of information to speak about, complicated syntactic and semantic rules to order the speaking, all are transferred from older brains into hers well before she reaches half her adult size. When you are preprogrammed to absorb useful information at a high rate, it is hard to shut out pernicious or damaging information at the same time. With so many mindbytes to be downloaded, so many mental codons to be duplicated, it is no wonder that child brains are gullible, open to almost any suggestion, vulnerable to subversion, easy prey to Moonies, scientologists and nuns. Like immune-deficient patients, children are wide open to mental infections that adults might brush off without effort.

DNA, too, includes parasitic code. Cellular machinery is extremely good at copying DNA. Where DNA is concerned, it seems to have an eagerness to copy, like a child's eagerness to imitate the language of its parents. Concomitantly, DNA seems eager to be copied. The cell nucleus is a paradise for DNA, humming with sophisticated, fast and accurate duplicating machinery.

Cellular machinery is so friendly towards DNA-duplication that it is small wonder cells play host to DNA parasites - viruses, viroids, plasmids and a riff-raff of other genetic fellow-travellers. Parasitic DNA even gets itself spliced seamlessly into the chromosomes themselves. 'Jumping genes' and stretches of 'Selfish DNA' cut or copy themselves out of chromosomes and paste themselves in elsewhere. Deadly oncogenes are almost impossible to distinguish from the legitimate genes between which they are spliced. In evolutionary time, there is probably a continual traffic from 'straight' genes to 'outlaw', and back again (Dawkins 1982). DNA is just DNA. The only thing that distinguishes viral DNA from host DNA is its expected method of passing into future generations. 'Legitimate' host DNA is just DNA that aspires to pass into the next generation via the orthodox route of sperm or egg. 'Outlaw' or parasitic DNA is just DNA that looks to a quicker, less cooperative route to the future, via a sneezed droplet or a smear of blood, rather than via a sperm or egg.

For data on a floppy disc, a computer is a humming paradise just as cell nuclei hum with eagerness to duplicate DNA. Computers and their associated disc and tape readers are designed with high fidelity in mind. As with DNA molecules, magnetized bytes don't literally 'want' to be faithfully copied. Nevertheless, you can write a computer program that takes steps to duplicate itself. Not just duplicate itself within one computer but spread itself to other computers. Computers are so good at copying bytes, and so good at faithfully obeying the instructions contained in those bytes, that they are sitting ducks to self-replicating programs: wide open to subversion by software parasites. Any cynic familiar with the theory of selfish genes and memes would have known that modern personal computers, with their promiscuous traffic of floppy discs and e-mail links, were just asking for trouble. The only surprising thing about the current epidemic of computer viruses is that it has been so long in coming.

### 2. Computer Viruses: a Model for an Informational Epidemiology

Computer viruses are pieces of code that graft themselves into existing, legitimate programs and subvert the normal actions of those programs. They may travel on exchanged floppy discs, or over networks. They are technically distinguished from 'worms' which are whole programs in their own right, usually travelling over networks. Rather different are 'Trojan horses'; a third category of destructive programs, which are not in themselves self-replicating but rely on humans to replicate them because of their pornographic or otherwise appealing content. Both viruses and worms are programs that actually say, in computer language, 'Duplicate Me: Both may do other things that make their presence felt and perhaps satisfy the hole-in-corner vanity of their authors. These side effects may be 'humorous' (like the virus that makes the Macintosh's built-in loudspeaker enunciate the words 'Don't panic', with predictably opposite effect); malicious (like the numerous IBM viruses that

erase the hard disc after a sniggering screen-announcement of the impending disaster); political (the Spanish Telecom and Beijing viruses protest about telephone costs and massacred students respectively); or simply inadvertent (the programmer is incompetent to handle the low-level system calls required to write an effective virus or worm). The famous Internet Worm, which paralysed much of the computing power of the United States on November 2nd 1988, was not intended (very) maliciously but got out of control and, within 24 hours, had clogged around 6000 computer memories with exponentially multiplying copies of itself.

'Memes now spread around the world at the speed of light, and replicate at rates that make even fruit flies and yeast cells look glacial in comparison. They leap promiscuously from vehicle to vehicle, and from medium to medium, and are proving to be virtually unquarantinable' (Dennett in press). Viruses aren't limited to electronic media such as discs and data lines. On its way from one computer to another, a virus may pass through printing ink, light rays in a human lens, optic nerve impulses and finger muscle contractions. A computer fanciers' magazine that printed the text of a virus program for the interest of its readers has been widely condemned. Indeed, such is the appeal of the virus idea to a certain kind of puerile mentality (the masculine gender is used advisedly), that publication of any kind of 'How to' information on designing virus programs is rightly seen as an irresponsible act.

I am not going to publish any virus code. But there are certain tricks of effective virus design that are sufficiently well-known, even obvious, that it will do no harm to mention them, as I need to do in order to develop my theme. They all stem from the virus's need to evade detection while it is spreading.

A virus that clones itself too prolifically within one computer will soon be detected because the symptoms of clogging will become too obvious to ignore. For this reason many virus programs check, before infecting a system, to make sure that they are not already on that system. Incidentally, this opens the way for a defence against viruses that is analogous to immunization. In the days before a specific antivirus program was available, I myself responded to an early infection of my own hard disc by means of a crude 'vaccination'. Instead of deleting the virus that I had detected, I simply disabled its coded instructions, leaving the 'shell' of the virus with its characteristic external 'signature' intact. In theory subsequent members of the same virus species that arrived in my system should have recognized the signature of their own kind and refrained from trying to double-infect. I don't know whether this immunization really worked, but in those days it probably was worthwhile 'gutting' a virus and leaving a shell like this, rather than simply removing it lock, stock and barrel. Nowadays it is better to hand the problem over to one of the professionally-written anti-virus programs.

A virus that is too virulent will be rapidly detected and scotched. A virus that instantly and catastrophically sabotages every computer in which it finds itself will not find itself in many computers. It may have a most amusing effect on one computer - erase an entire doctoral thesis or something equally side-splitting - but it won't spread as an epidemic.

Some viruses, therefore, are designed to have an effect that is small enough to be difficult to detect, but which may nevertheless be extremely damaging. There is one type which, instead of erasing disc sectors wholesale, attacks only spreadsheets, making a few random changes in the (usually financial) quantities entered in the rows and columns. Other viruses evade detection by being triggered probabilistically, for example erasing only one in 16 of the hard discs infected. Yet other viruses employ the time-bomb principle. Most modern computers are 'aware' of the date, and viruses have been triggered to manifest themselves all around the world, on a particular date such as Friday 13th or April Fool's Day. From the parasitic point of view, it doesn't matter how catastrophic the eventual attack is, provided the virus has had plenty of opportunity to spread first (a disturbing analogy to the Medawar/Williams theory of ageing; we are the victims of lethal and sub-lethal genes that mature only after we have had plenty of time to reproduce (Williams 1957)). In defence, some large companies go so far as to set aside one 'miner's canary' among their fleet of computers, and advance its internal calendar a week so that any time-bomb viruses will reveal themselves prematurely before the big day.

Again predictably, the epidemic of computer viruses has triggered an arms race. Anti-viral software is doing a roaring trade. These antidote programs - 'Interferon'; 'Vaccine'; 'Gatekeeper' and others - employ a diverse armoury of tricks. Some are written with specific, known and named, viruses in mind. Others intercept any attempt to meddle with sensitive system areas of memory and warn the user.

The virus principle could in theory be used for non-malicious, even beneficial purposes. Thimbleby (1991) coins the phrase 'Liveware' for his already-implemented use of the infection principle for keeping multiple copies of databases up to date. Every time a disc containing the database is plugged into a computer, it looks to see whether there is already another copy present on the local hard disc. If there is, each copy is updated in the light of the other. So, with a bit of luck, it doesn't matter which member of a circle of colleagues enters, say, a new bibliographic citation on his personal disc. His newly entered information will readily infect the discs of his colleagues (because the colleagues promiscuously insert their discs into one another's computers) and will spread like an epidemic around the circle. Thimbleby's liveware is not entirely virus-like: it could not spread to just anybody's computer and do damage. It spreads data only to already-existing copies of its own database; and you will not be infected by liveware unless you positively opt for infection.

Incidentally, Thimbleby, who is much concerned with the virus menace, points out that you can gain some protection by using computer systems that other people don't use. The usual justification for purchasing today's numerically dominant personal computer is simply and solely that it is numerically dominant. Almost every knowledgeable person agrees that, in terms of quality and especially user-friendliness, the rival, minority system

is superior. Nevertheless, ubiquity is held to be a good in itself, sufficient to outweigh sheer quality. Buy the same (albeit inferior) computer as your colleagues, the argument goes, and you'll be able to benefit from shared software, and from a generally larger circulation of available software. The irony is that, with the advent of the virus plague, 'benefit' is not all that you are likely to get. Not only should we all be very hesitant before we accept a disc from a colleague. We should also be aware that, if we join a large community of users of a particular make of computer, we are also joining a larger community of viruses - even, it turns out, *disproportionately* larger.

Returning to possible uses of viruses for positive purposes, there are proposals to exploit the 'poacher turned gamekeeper' principle, and 'set a thief to catch a thief'. A simple way would be to take any of the existing anti-viral programs and load it, as a 'warhead; into a harmless self-replicating virus. From a 'public health' point of view a spreading epidemic of antiviral software could be especially beneficial because the computers most vulnerable to malicious viruses - those whose owners are promiscuous in the exchange of pirated programs - will also be most vulnerable to infection by the healing anti-virus. A more penetrating anti-virus might - as in the immune system - 'learn or 'evolve' an improved capacity to attack whatever viruses it encountered.

I can imagine other uses of the computer virus principle which, if not exactly altruistic, are at least constructive enough to escape the charge of pure vandalism. A computer company might wish to do market research on the habits of its customers, with a view to improving the design of future products. Do users like to choose files by pictorial icon, or do they opt to display them by textual name only? How deeply do people nest folders (directories) within one another? Do people settle down for a long session with only one program, say a word processor, or are they constantly switching back and forth, say between writing and drawing programs? Do people succeed in moving the mouse pointer straight to the target, or do they meander around in time-wasting hunting movements that could be rectified by a change in design?

The company could send out a questionnaire asking all these questions, but the customers that replied would be a biased sample and, in any case, their own assessment of their computer-using behaviour might be inaccurate. A better solution would be a market research computer program. Customers would be asked to load this program into their system where it would unobtrusively sit, quietly monitoring and tallying key-presses and mouse movements. At the end of a year, the customer would be asked to send in the disc file containing all the tallies of the market research program. But again, most people would not bother to cooperate and some might see it as an invasion of privacy and of their disc space.

The perfect solution, from the company's point of view, would be a virus. Like any other virus it would be self-replicating and secretive. But it would not be destructive or facetious like an ordinary virus. Along with its self-replicating booster it would contain a market research warhead. The virus would be released surreptitiously into the community of computer users. Just like an ordinary virus it would spread around, as people passed floppy discs and e-mail around the community. As the virus spread from computer to computer, it would build up statistics on user behaviour, monitored secretly from deep within a succession of systems. Every now and again, a copy of the virus would happen to find its way, by normal epidemic traffic, back into one of the company's own computers. There it would be debriefed and its data collated with data from other copies of the virus that had come 'home'.

Looking into the future, it is not fanciful to imagine a time when viruses, both bad and good, have become so ubiquitous that we could speak of an ecological community of viruses and legitimate programs coexisting in the silicosphere. At present, software is advertised as, say, 'Compatible with System 7: In the future, products may be advertised as 'Compatible with all viruses registered in the 1998 World Virus Census; immune to all listed virulent viruses; takes full advantage of the facilities offered by the following benign viruses if present ...' Word-processing software, say, may hand over particular functions, such as word-counting and string-searches, to friendly viruses burrowing autonomously through the text.

Looking even further into the future, whole integrated software systems might grow, not by design, but by something like the growth of an ecological community such as a tropical rainforest. Gangs of mutually compatible viruses might grow up, in the same way as genomes can be regarded as gangs of mutually compatible genes (Dawkins 1982). Indeed, I have even suggested that our genomes should be regarded as gigantic colonies of viruses (Dawkins 1976). Genes cooperate with one another in genomes because natural selection has favoured those genes that prosper in the presence of the other genes that happen to be common in the gene pool. Different gene pools may evolve towards different combinations of mutually compatible genes. I envisage a time when, in the same kind of way, computer viruses may evolve towards compatibility with other viruses, to form communities or gangs.

But then again, perhaps not! At any rate, I find the speculation more alarming than exciting.

At present, computer viruses don't strictly evolve. They are invented by human programmers and if they evolve they do so in the same weak sense as cars or aeroplanes evolve. Designers derive this year's car as a slight modification of last year's car, and they may, more or less consciously, continue a trend of the last few years - further flattening of the radiator grill or whatever it may be. Computer virus designers dream up ever more devious tricks for outwitting the programmers of anti-virus software. But computer viruses don't - so far - mutate and evolve by true natural selection. They may do so in the future. Whether they evolve by natural selection, or whether their evolution is steered by human designers, may not make much difference to their eventual performance. By either kind of evolution, we expect them to become better at concealment, and we expect them to become subtly compatible with other viruses that are at the same time prospering in the computer community.

DNA viruses and computer viruses spread for the same reason: an environment exists in which there is machinery well set up to duplicate and spread them around and to obey the instructions that the viruses embody. These two environments are, respectively, the environment of cellular physiology and the environment provided by a large community of computers and data-handling machinery. Are there any other environments like these, any other humming paradises of replication?

### 3. The Infected Mind

I have already alluded to the programmed-in gullibility of a child, so useful for learning language and traditional wisdom, and so easily subverted by nuns, moonies and their ilk. More generally, we all exchange information with one another. We don't exactly plug floppy discs into slots in one another's skulls, but we exchange sentences, both through our ears and through our eyes. We notice each other's styles of moving and of dressing and are influenced. We take in advertising jingles, and are presumably persuaded by them, otherwise hard-headed businessmen would not spend so much money polluting the air with them.

Think about the two qualities that a virus, or any sort of parasitic replicator, demands of a friendly medium, the two qualities that make cellular machinery so friendly towards parasitic DNA, and that make computers so friendly towards computer viruses. These qualities are, firstly, a readiness to replicate information accurately, perhaps with some mistakes that are subsequently reproduced accurately; and, secondly, a readiness to obey instructions encoded in the information so replicated.

Cellular machinery and electronic computers excel in both these virus-friendly qualities. How do human brains match up? As faithful duplicators they are certainly less perfect than either cells or electronic computers. Nevertheless, they are still pretty good, perhaps about as faithful as an RNA virus, though not as good as DNA with all its elaborate proofreading measures against textual degradation. Evidence of the fidelity of brains, especially child brains, as data duplicators is provided by language itself. Shaw's Professor Higgins was able by ear alone to place Londoners in the street where they grew up. Fiction is not evidence for anything, but everyone knows that Higgins's fictional skill is only an exaggeration of something we can all do. Any American can tell Deep South from Mid West, New England from Hillbilly. Any New Yorker can tell Bronx from Brooklyn. Equivalent claims could be substantiated for any country. What this phenomenon means is that human brains are capable of pretty accurate copying (otherwise the accents of, say, Newcastle would not be stable enough to be recognized) but with some mistakes (otherwise pronunciation would not evolve, and all speakers of a language would inherit identically the same accents from their remote ancestors). Language evolves, because it has both the great stability and the slight changeability that are prerequisites for any evolving system.

The second requirement of a virus-friendly environment - that it should obey a program of coded instructions - is again only quantitatively less true for brains than for cells or computers. We sometimes obey orders from one another, but also we sometimes don't. Nevertheless, it is a telling fact that, the world over, the vast majority of children follow the religion of their parents rather than any of the other available religions. Instructions to genuflect, to bow towards Mecca, to nod one's head rhythmically towards the wall, to shake like a maniac, to 'speak in tongues' - the list of such arbitrary and pointless motor patterns offered by religion alone is extensive - are obeyed, if not slavishly, at least with some reasonably high statistical probability.

Less portentously, and again especially prominent in children, the craze is a striking example of behaviour that owes more to epidemiology than to rational choice. Yoyos, hula hoops and pogo sticks, with their associated behavioural fixed actions, sweep through schools, and more sporadically leap from school to school, in patterns that differ from a measles epidemic in no serious particular. Ten years ago, you could have travelled thousands of miles through the United States and never seen a baseball cap turned back to front. Today the reverse baseball cap is ubiquitous. I do not know what the pattern of geographic spread of the reverse baseball cap precisely was, but epidemiology is certainly among the professions primarily qualified to study it. We don't have to get into arguments about 'determinism'; we don't have to claim that children are compelled to imitate their fellows' hat fashions. It is enough that their hat-wearing behaviour, as a matter of fact, is statistically affected by the hat-wearing behaviour of their fellows.

Trivial though they are, crazes provide us with yet more circumstantial evidence that human minds, especially perhaps juvenile ones, have the qualities that we have singled out as desirable for an informational parasite. At the very least the mind is a plausible candidate for infection by something like a computer virus, even if it is not quite such a parasite's dream-environment as a cell nucleus or an electronic computer.

It is intriguing to wonder what it might feel like, from the inside, if one's mind were the victim of a 'virus': This might be a deliberately designed parasite, like a present-day computer virus. Or it might be an inadvertently mutated and unconsciously evolved parasite. Either way, especially if the evolved parasite was the memetic descendant of a long line of successful ancestors, we are entitled to expect the typical 'mind virus' to be pretty good at its job of getting itself successfully replicated.

Progressive evolution of more effective mind-parasites will have two aspects. New 'mutants' (either random or designed by humans) that are better at spreading will become more numerous. And there will be a ganging up of ideas that flourish in one another's presence, ideas that mutually support one another just as genes do and as I have speculated computer viruses may one day do. We expect that replicators will go around together from brain to brain in mutually compatible gangs. These gangs will come to constitute a package, which may be sufficiently stable to deserve a collective name such as Roman Catholicism or Voodoo. It doesn't too much matter

whether we analogize the whole package to a single virus, or each one of the component parts to a single virus. The analogy is not that precise anyway, just as the distinction between a computer virus and a computer worm is nothing to get worked up about. What matters is that minds are friendly environments to parasitic, self-replicating ideas or information, and that minds are typically massively infected.

Like computer viruses, successful mind viruses will tend to be hard for their victims to detect. If you are the victim of one, the chances are that you won't know it, and may even vigorously deny it. Accepting that a virus might be difficult to detect in your own mind, what tell-tale signs might you look out for? I shall answer by imagining how a medical textbook might describe the typical symptoms of a sufferer (arbitrarily assumed to be male):

1. The patient typically finds himself impelled by some deep, inner conviction that something is true, or right, or virtuous: a conviction that doesn't seem to owe anything to evidence or reason, but which, nevertheless, he feels as totally compelling and convincing. We doctors refer to such a belief as 'faith'.

2. Patients typically make a positive virtue of faith's being strong and unshakeable, in spite of not being based upon evidence. Indeed, they may feel that the less the evidence there is, the more virtuous the belief (see below). This paradoxical idea that lack of evidence is a positive virtue where faith is concerned has something of the quality of a program that is self-sustaining, because it is self-referential (see the chapter 'On viral sentences and self-replicating structures' in Hofstadter 1985). Once the proposition is believed, it automatically undermines opposition to itself. The 'lack of evidence is a virtue' idea would be an admirable sidekick, ganging up with faith itself in a clique of mutually supportive viral programs.

3. A related symptom, which a faith-sufferer may also present, is the conviction that 'mystery; *per se*, is a good thing. It is not a virtue to solve mysteries. Rather we should enjoy them, even revel in their insolubility.

Any impulse to solve mysteries could be seriously inimical to the spread of a mind virus. It would not, therefore, be surprising if the idea that 'mysteries are better not solved' was a favoured member of a mutually supporting gang of viruses. Take the 'Mystery of the Transubstantiation: It is easy and non-mysterious to believe that in some symbolic or metaphorical sense the eucharistic wine turns into the blood of Christ. The Roman Catholic doctrine of transubstantiation, however, claims far more. The 'whole substance' of the wine is converted into the blood of Christ; the appearance of wine that remains is 'merely accidental', 'inhering in no substance' (Kenny 1986 page 72). Transubstantiation is colloquially taught as meaning that the wine 'literally' turns into the blood of Christ. Whether in its obfuscatory Aristotelian or its franker colloquial form, the claim of transubstantiation can be made only if we do serious violence to the normal meanings of words like 'substance' and 'literally'. Redefining words is not a sin but, if we use words like 'whole substance' and 'literally' for this case; what word are we going to use when we really and truly want to say that something did actually happen? As Anthony Kenny observed of his own puzzlement as a young seminarian, 'For all I could tell, my typewriter might be Benjamin Disraeli transubstantiated...'

Roman Catholics, whose belief in infallible authority compels them to accept that wine becomes physically transformed into blood despite all appearances, refer to the 'Mystery' of the Transubstantiation. Calling it a Mystery makes everything OK, you see. At least, it works for a mind well prepared by background infection. Exactly the same trick is performed in the 'Mystery' of the Trinity. Mysteries are not meant to be solved, they are meant to strike awe. The 'mystery is a virtue' idea comes to the aid of the Catholic, who would otherwise find intolerable the obligation to believe the obvious nonsense of the transubstantiation and the 'three-in-one: Again, the belief that 'mystery is a virtue' has a self-referential ring. As Hofstadter might put it, the very mysteriousness of the belief moves the believer to perpetuate the mystery.

An extreme symptom of 'mystery is a virtue' infection is Tertullian's '*Certum est quia impossibile est*' (It is certain because it is impossible). That way madness lies. One is tempted to quote Lewis Carroll's White Queen who, in response to Alice's 'One can't believe impossible things' retorted 'I daresay you haven't had much practice ... When I was your age, I always did it for half-an-hour a day. Why, sometimes I've believed as many as six impossible things before breakfast'. Or Douglas Adams's Electric Monk, a labour-saving device programmed to do your believing for you, which was capable of 'believing things they'd have difficulty believing in Salt Lake City' and which, at the moment of being introduced to the reader, believed, contrary to all the evidence, that everything in the world was a uniform shade of pink. But White Queens and Electric Monks become less funny when you realise that these virtuoso believers are indistinguishable from revered theologians in real life. 'It is by all means to be believed, because it is absurd' (Tertullian again). Sir Thomas Browne quotes Tertullian with approval, and goes further: 'Methinks there be not impossibilities enough in religion for an active faith'. And 'I desire to exercise my faith in the difficultest point; for to credit ordinary and visible objects is not faith, but persuasion.'

I have the feeling that something more interesting is going on here than just plain insanity or surrealist nonsense, something akin to the admiration we feel when we watch a 10-ball juggler on a tightrope. It is as though the faithful gain prestige through managing to believe even more ridiculous things than their rivals succeed in believing. Are these people testing - exercising - their believing muscles, training themselves to believe impossible things so that they can take in their stride the merely improbable things that they are ordinarily called upon to believe?

While I was writing this, The Guardian (29th July 1991) fortuitously carried a beautiful example. It came in an interview with a rabbi undertaking the bizarre task of vetting the kosher-purity of food products right back to the

ultimate origins of their minutest ingredients. He was currently agonizing over whether to go all the way to China to scrutinize the menthol that goes into cough sweets. 'Have you ever tried checking Chinese menthol ... it was extremely difficult, especially since the first letter we sent received the reply in best Chinese English, 'The product contains no kosher' ... China has only recently started opening up to kosher investigators. The menthol should be OK, but you can never be absolutely sure unless you visit.' These kosher investigators run a telephone hotline on which up-to-the-minute red-alerts of suspicion are recorded against chocolate bars and cod-liver oil. The rabbi sighs that the green-inspired trend away from artificial colours and flavours makes life miserable in the kosher field because you have to follow all these things back. When the interviewer asks him why he bothers with this obviously pointless exercise, he makes it very clear that the point is precisely that there is no point:

That most of the Kashrut laws are divine ordinances without reason given is 100 per cent the point. It is very easy not to murder people. Very easy. It is a little bit harder not to steal because one is tempted occasionally. So that is no great proof that I believe in God or am fulfilling His will. But, if He tells me not to have a cup of coffee with milk in it with my mincemeat and peas at lunchtime, that is a test. The only reason I am doing that is because I have been told to so do. It is doing something difficult.

Helena Cronin has suggested to me that there may be an analogy here to Zahavi's handicap theory of sexual selection and the evolution of signals (Zahavi 1975). Long unfashionable, even ridiculed (Dawkins 1976), Zahavi's theory has recently been cleverly rehabilitated (Grafen 1990a; Grafen 1990b) and is now taken seriously by evolutionary biologists (Dawkins 1989). Zahavi suggests that peacocks, for instance, evolve their absurdly burdensome fans with their ridiculously conspicuous (to predators) colours, precisely because they are burdensome and dangerous, and therefore impressive to females. The peacock is, in effect, saying: 'Look how fit and strong I must be, since I can afford to carry around this preposterous tail.'

To avoid misunderstanding of the subjective language in which Zahavi likes to make his points, I should add that the biologist's convention of personifying the unconscious actions of natural selection is taken for granted here. Grafen has translated the argument into an orthodox Darwinian mathematical model, and it works. No claim is here being made about the intentionality or awareness of peacocks and peahens. They can be as sphexish or as intentional as you please (Dennett 1983, 1984). Moreover, Zahavi's theory is general enough not to depend upon a Darwinian underpinning. A flower advertising its nectar to a 'sceptical' bee could benefit from the Zahavi principle. But so could a human salesman seeking to impress a client.

The premise of Zahavi's idea is that natural selection will favour scepticism among females (or among recipients of advertising messages generally). The only way for a male (or any advertiser) to authenticate his boast of strength (quality, or whatever it is) is to prove that it is true by shouldering a truly costly handicap - a handicap *that only a genuinely strong* (high quality, etc) male could bear. It may be called the principle of costly authentication. And now to the point. Is it possible that some religious doctrines are favoured not in *spite of* being ridiculous but precisely *because* they are ridiculous? Any wimp in religion could believe that bread *symbolically* represents the body of Christ, but it takes a real, red-blooded Catholic to believe something as daft as the transubstantiation. If you can believe that you can believe anything, and (witness the story of Doubting Thomas) these people are trained to see that as a virtue.

Let us return to our list of symptoms that someone afflicted with the mental virus of faith, and its accompanying gang of secondary infections, may expect to experience:

4. The sufferer may find himself behaving intolerantly towards vectors of rival faiths, in extreme cases even killing them or advocating their deaths. He may be similarly violent in his disposition towards apostates (people who once held the faith but have renounced it); or towards heretics (people who espouse a different - often, perhaps significantly, only very slightly different - version of the faith). He may also feel hostile towards other modes of thought that are potentially inimical to his faith, such as the method of scientific reason which may function rather like a piece of antiviral software.

The threat to kill the distinguished novelist Salman Rushdie is only the latest in a long line of sad examples. On the very day that I wrote this, the Japanese translator of *The Satanic Verses* was found murdered, a week after a near-fatal attack on the Italian translator of the same book. By the way, the apparently opposite symptom of 'sympathy' for Muslim 'hurt', voiced by the Archbishop of Canterbury and other Christian leaders (verging, in the case of the Vatican, on outright criminal complicity) is, of course, a manifestation of the symptom we diagnosed earlier: the delusion that faith, however obnoxious its results, has to be respected simply because it *is* faith.

Murder is an extreme, of course. But there is an even more extreme symptom, and that is suicide in the militant service of a faith. Like a soldier ant programmed to sacrifice her life for germ-line copies of the genes that did the programming, a young Arab or Japanese is taught that to die in a holy war is the quickest way to heaven. Whether the leaders who exploit him really believe this does not diminish the brutal power that the 'suicide mission virus' wields on behalf of the faith. Of course suicide, like murder, is a mixed blessing: would-be converts may be repelled, or may treat with contempt a faith that is perceived as insecure enough to need such tactics.

More obviously, if too many individuals sacrifice themselves the supply of believers could run low. This was true of a notorious example of faith-inspired suicide, though in this case it was not 'kamikazi' death in battle. The Peoples Temple sect went extinct when its leader, the Reverend Jim Jones, led the bulk of his followers from the United States to the Promised Land of 'Jonestown' in the Guyanan jungle where he persuaded more than 900 of them,

children first, to drink cyanide. The macabre affair was fully investigated by a team from the San Francisco Chronicle (Kilduff and Javers 1978):

Jones, 'the Father; had called his flock together and told them it was time to depart for heaven. We're going to meet; he promised, 'in another place.'

The words kept coming over the camp's loudspeakers.

'There is great dignity in dying. It is a great demonstration for everyone to die.'

Incidentally, it does not escape the trained mind of the alert sociobiologist that Jones, within his sect in earlier days, 'proclaimed himself the only person permitted to have sex' (presumably his partners were also permitted). A secretary would arrange for Jones's liaisons. She would call up and say, 'Father hates to do this, but he has this tremendous urge and could you please ... ?' His victims were not only female. One 17-year-old male follower, from the days when Jones's community was still in San Francisco, told how he was taken for dirty weekends to a hotel where Jones received a 'minister's discount for Rev. Jim Jones and son'. The same boy said:

I was really in awe of him. He was more than a father. I would have killed my parents for him.

What is remarkable about the Reverend Jim Jones is not his own self-serving behaviour but the almost superhuman gullibility of his followers. Given such prodigious credulity, can anyone doubt that human minds are ripe for malignant infection?

Admittedly, the Reverend Jones conned only a few thousand people. But his case is an extreme, the tip of an iceberg. The same eagerness to be conned by religious leaders is widespread. Most of us would have been prepared to bet that nobody could get away with going on television and saying, in all but somany words, 'Send me your money, so that I can use it to persuade other suckers to send me their money too.' Yet today, in every major conurbation in the United States, you can find at least one television evangelist channel entirely devoted to this transparent confidence trick. And they get away with it in sackfuls. Faced with suckerdom on this awesome scale, it is hard not to feel a grudging sympathy with the shiny-suited conmen. Until you realise that not all the suckers are rich, and that it is often widows' mites on which the evangelists are growing fat. I have even heard one of them explicitly invoking the principle that I now identify with Zahavi's principle of costly authentication. God really appreciates a donation, he said with passionate sincerity, only when that donation is so large that it hurts. Elderly paupers were wheeled on to testify how much happier they felt since they had made over their little all to the Reverend whoever it was.

5. The patient may notice that the particular convictions that he holds, while having nothing to do with evidence, do seem to owe a great deal to epidemiology. Why, he may wonder, do I hold this set of convictions rather than that set? Is it because I surveyed all the world's faiths and chose the one whose claims seemed most convincing? Almost certainly not. If you have a faith, it is statistically, overwhelmingly likely that it is the same faith as your parents and grandparents had. No doubt soaring cathedrals, stirring music, moving stories and parables, help a bit. But by far the most important variable determining your religion is the accident of birth. The convictions that you so passionately believe would have been a completely different, and largely contradictory, set of convictions, if only you had happened to be born in a different place. Epidemiology, not evidence.

6. If the patient is one of the rare exceptions who follows a different religion from his parents, the explanation may still be epidemiological. To be sure, it is *possible* that he dispassionately surveyed the world's faiths and chose the most convincing one. But it is statistically more probable that he has been exposed to a particularly potent infective agent - a John Wesley, a Jim Jones or a St Paul. Here we are talking about horizontal transmission, as in measles. Before, the epidemiology was that of vertical transmission, as in Huntington's Chorea.

7. The internal sensations of the patient may be startlingly reminiscent of those more ordinarily associated with sexual love. This is an extremely potent force in the brain, and it is not surprising that some viruses have evolved to exploit it. St Teresa of Avila's famously orgasmic vision is too notorious to need quoting again. More seriously, and on a less crudely sensual plane, the philosopher Anthony Kenny provides moving testimony to the pure delight that awaits those that manage to believe in the mystery of the transubstantiation. After describing his ordination as a Roman Catholic priest, empowered by laying on of hands to celebrate Mass, he goes on that he vividly recalls

... the exaltation of the first months during which I had the power to say Mass. Normally a slow and sluggish riser, I would leap early out of bed, fully awake and full of excitement at the thought of the momentous act I was privileged to perform. I rarely said the public Community Mass: most days I celebrated alone at a side altar with a junior member of the College to serve as acolyte and congregation. But that made no difference to the solemnity of the sacrifice or the validity of the consecration.

It was touching the body of Christ, the closeness of the priest to Jesus, which most enthralled me. I would gaze on the Host after the words of consecration, soft-eyed like a lover looking into the eyes of his beloved ... Those early days as a priest remain in my memory as days of fulfilment and tremulous happiness; something precious, and yet too fragile to last, like a romantic love-affair brought up short by the reality of an ill-assorted marriage (Kenny 1986, pp. 101-102).

Dr Kenny is affectingly believable that it felt to him, as a young priest, as though he was in love with the consecrated host. What a brilliantly successful virus! On the same page, incidentally, Kenny also shows us that the virus is transmitted contagiously - if not literally then at least in some sense - from the palm of the infecting bishop's hand through the top of the new priest's head: 'If Catholic doctrine is true, every priest validly ordained derives his orders in an unbroken line of laying on of hands, through the bishop who ordains him, back to one of the twelve Apostles ... there must be centuries-long, recorded chains of layings on of hands. It surprises me that priests never seem to trouble to trace their spiritual ancestry in this way, finding out who ordained their bishop, and who ordained him, and so on to Julius II or Celestine V or Hildebrand, or Gregory the Great, perhaps' (Kenny 1986 p 101 ). It surprises me, too.

#### 4. Is Science a Virus?

No. Not unless all computer programs are viruses. Good, useful programs spread because people evaluate them, recommend them and pass them on. Computer viruses spread solely because they embody the coded instructions: 'Spread me'. Scientific ideas, like all memes, are subject to a kind of natural selection, and this might look superficially virus-like. But the selective forces that scrutinize scientific ideas are not arbitrary or capricious. They are exacting, well-honed rules, and they do not favour pointless self-serving behaviour. They favour all the virtues laid out in textbooks of standard methodology: testability, evidential support, precision, quantifiability, consistency, intersubjectivity, repeatability, universality, progressiveness, independence of cultural milieu, and so on. Faith spreads despite a total lack of every single one of these virtues.

You may find elements of epidemiology in the spread of scientific ideas, but it will be largely descriptive epidemiology. The rapid spread of a good idea through the scientific community may even look like a description of a measles epidemic. But when you examine the underlying reasons you find that they are good ones, satisfying the demanding standards of scientific method. In the history of the spread of faith you will find little else but epidemiology, and causal epidemiology at that. The reason why person A believes one thing and B believes another is simply and solely that A was born on one continent and B on another. Testability, evidential support and the rest aren't even remotely considered. For scientific belief, epidemiology merely comes along afterwards and describes the history of its acceptance. For religious belief, epidemiology is the root cause.

#### 5. Epilogue: Happily, viruses don't win every time.

Many children emerge unscathed from the worst that nuns and mullahs can throw at them. Anthony Kenny's own story has a happy ending. He eventually renounced his orders because he could no longer tolerate the obvious contradictions within Catholic belief, and he is now a highly respected scholar. But one cannot help remarking that it must be a powerful infection indeed that took a man of his wisdom and intelligence - now President of the British Academy, no less - three decades to fight off. Am I unduly alarmist to fear for the soul of my six-year-old innocent?

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#### Notes

(1) The Voltaire Lecture is arranged by the British Humanist Association on behalf of the Voltaire Trust. The Voltaire Trust Fund was set up by the late Dr Theodore Besterman to promote and publish Lectures about Humanism or related aspects of philosophical or scientific thought. Previous lecturers have included Sir Hermann Bondi, Professor Bernard Crick, Professor Antony Flew, Michael Foot, and Ludovic Kennedy.

(2) This publication of *Viruses of the Mind* was a pre-print of a chapter in *Dennett and his critics; demystifying mind* (edited by Dr Bo Dahbom) published by Basil Blackwell, May 1993.

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#### (3) Introduction to the 1992 Voltaire lecture by Dr Harry Stopes-Roe

Humanism is built on Darwin. Darwin had a great insight: that the limitless subtlety and purposiveness of life - and in particular human life - could have derived from random variation and natural selection. If this is true, there is no need to assume any god who ordained the processes whereby life evolved. There is no need even to assume some in-built drive in life, which would be more than chance and reproduction. Or, putting the point positively: it is reasonable for us to accept that the evolution of life, and in particular human life, was *naturalistic*.



Before Darwin, human life seemed to be the supreme fact which required a Divine explanation. It has taken nearly a century and a half to work out some of the most significant developments in the evolutionary sequence - and of course very much more remains to be done. But it now is reasonable to say that no God nor any super-purpose is required, not even to explain the human sense of moral responsibility, and the uniquely developed human capacity to understand. This is vital to Humanism, for those human capacities give us our base for a human morality. The theory of evolution deals with matters of fact, it does not justify values; but morality comes from our human nature, which is the product of evolution. Thus Humanism is tenable only in so far as the Darwinian theories are plausible, for we require them not only to justify our rejection of God, but also to show us these human propensities from which we derive our morality. 'Nature red in tooth and claw' is not exactly right.

Richard Dawkins has demonstrated himself to be one of this century's most powerful exponents of the Darwinian insight, both in the development of its technical details, and in popular exposition. He has a clarity of mind, a sharpness in the recognition of analogies, and a vividness of ideas and language, that is the envy of very many; and the fear of quite a few. He clearly rattled the Archbishop of York, John Habgood, in their debate on science and religion last spring!

His first book *The Selfish Gene* immediately replaced the previous generation of Darwinian expositions, and his *Blind Watchmaker*, and his TV appearances, have consolidated his position. Unfortunately his graphic way of expressing ideas has been misinterpreted. There may have been some excuse for this in *The Selfish Gene*; but sometimes readers were downright perverse. In that book he assumed too much that his reader would be willing to follow his imagery. But even so, if anyone says that he has such crude ideas as "we are governed by our genes"; or "genes have aspirations"; and therefore he is "reductionist"; then that person merely shows he (or she) has not read the book carefully. John Habgood is an example. He ended his reply in the debate I have just mentioned by describing *The Selfish Gene*: "It is a more blatant piece of anthropomorphism than any found within Christian theology:" So much the worse for John Habgood!

But there is more scope for the basic idea of "natural selection" than biological evolution. Tonight Dr Dawkins applies this concept to another argument. Religious people often argue: "God must be true; how else could religion and the idea of God have such power?" Those who reject God must answer this question. Religion certainly has had, and still has, horrific power. Why should something be so powerful, which is not only difficult to believe, but damaging in its consequences - think of the Roman Catholic attack on contraception in the developing world? Dr Dawkins shows how God and religion act as "Viruses of the Mind": he shows how those features, which are so counter-intuitive, should have been expected.

This lecture is supported by The Voltaire Trust, which was endowed in the memory of Voltaire, and to advance Humanism. The lecture we are about to hear will excellently serve both functions. Just imagine Voltaire sitting amongst us: he would so much have enjoyed this analysis of religion and its spacious authority!