The future of freedom on the Internet*

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Abstract

In which I discuss the nature of a diversion from the freedom of computation posed by certain social forces on the Internet, or, *How yesterday was a golden age, why today is depressing and what to say at tomorrow's cocktail party.*

1 Introduction

It is said that there is an ancient Chinese blessing or curse which wishes its recipients, "May you live in interesting times." It can be very well argued that we have been accorded precisely such a desire. We live in an age of powerful computing machines, each one more capable and efficient than the last, each one communicating with others, thereby allowing us to enjoy cultures at near the speed of light across the circumference of the Earth. There is little wonder why we are so excited about what we can do with such unfettered passages to fellow human beings. Yet we are rushing, as we are prone to do, into some of the possibilities without a deeper consideration of what they may entail. Imagine a society in which works of culture could be and, indeed, are hosted by middlemen whom we must reward in one way or another to merely peek at, let alone replicate, our very own discoveries. In what is more than a metaphor, what is happening on the Internet in this age of "outsourcing" is akin to delegating the very act of thinking, along with the sum of our knowledge, information or data, to other people without asking and being able to see why their minds, given our seed of thoughts, produced trees of other thoughts which we may choose to believe. The scientific method as counterintuitive protection against human self-deception fails in the face of mysteries artificially engineered to be inscrutable and impenetrable. We are well on our way to designing a vacuum of knowledge, ownership of culture, ideal human rights and, hence, freedom on the largest public network of computers, our collective consciousness, without necessarily realising it. In this essay, I discuss the nature of this social problem and what we may do to prevent this arguably undesirable course for society.

2 Yesterday

I dare say that this essay is long overdue. In between the time of the first, vague germination of these ideas and now, I have seen a few promising signs, such as the Franklin Street statement[12], but rarely a strong sense of purpose and achievement. I think that the time has long since arrived for us to speak and act on the matter. I fear that it is already too late in some ways, yet I remain optimistic in the technological sense.

Something truly monumental in human history happened in the 1980s: Richard Matthew Stallman (RMS) started the GNU free software project[10]. The GNU free software project is predicated upon four fundamental freedoms[24][Chapter 3]:

- Freedom 0: The freedom to run a program for any purpose;
- Freedom 1: The freedom to study how the program works and adapt it to your needs;
- Freedom 2: The freedom to distribute copies so that you can help your neighbours;
- Freedom 3: The freedom to improve the program and release your improvements to the public.

Over the years, RMS and other like-minded computer scientists have designed and built a completely free, as in the senses above, operating system for our computers. So as not to create confusion, an aphorism was discovered that describes the semantics of 'free' software: free as in free speech, not as in free beer[24][Chapter 3]. While it would be certainly overreaching and unfair to attribute the success of free software to one man, I think it is fairly indisputable to say that RMS was more responsible than anyone else to bring to fruition the state of free software as it is today. Today, we are fortunate to be able to run, if we so wish, a completely free operating system on our computers. Today, we are surrounded by a beautiful, ample garden of diverse and exotic species of free software. Tomorrow, however is very much uncertain to say the least, as I hope to soon convince you. I assume that you are familiar with the concepts of computer science, such as *algorithms*, *source code*, *compilers* and *operating systems*, complicated subjects but simple and elegant ideas to which I shall not devote the remainder of this essay.

Even in our relatively enlightened times, the very idea remains a most curious and odd one to us human beings. To RMS, the conditions for a free society is entailed by the simple premises of free software. How *true*, yet ... how *peculiar*. I maintain that it is a most counterintuitive thought for precisely the reason that human nature is not very a conducive medium to the idea. In many ways, making free software is quite a bit like being a vegetarian or even, to stretch the analogy to its breaking point, polytheism to those who are acquainted with monotheism.[1] Many of us eat eggs without so much as a second thought about

what they truly are at the very nature of their being.[2] At the heart of the debate is the following question: if we discover something that is naturally infinite, should we make it artificially finite?[3] The philosophy of free software says that we can choose to elevate ourselves over the uglier aspects of our all too human nature. I have seen the very people who should know better — computer scientists — publish otherwise scholarly articles without so much as a glimpse of any accompanying source code.[4] Some of them, involuntarily or worse, go so far as securing software patents[8], a most dangerous threat to the sustainability of free software and, more generally, the enterprise of science itself. I reiterate the point: the candle of free software requires expensive initiation and constant maintenance. That may be one reason why RMS devised that most mischievous GNU General Public License (GPL)[24][Section 4]. Freedom of your computation, whether I will it or not, in perpetuity. Altruistic copyleft enforced by selfish copyright. How orthogonal, how ingenious, how devious. At the very least, the GPL solves the problem of constant maintenance of freedom. The free software project would never be the same without someone as recalcitrant, principled and pragmatic as RMS. In the words of George Bernard Shaw, "The reasonable man adapts himself to the world; the unreasonable one persists in trying to adapt the world to himself. Therefore, all progress depends on the unreasonable man."[22][5] The GNU free software project is the direct consequence of a man who wished to use computers with good conscience and "without dishonor"; he resigned from the Artificial Intelligence laboratory so that MIT could not legally prevent him from sharing GNU software[24][Chapter 2]. The man is a latter day philosopher-scientist, a kind of a buddha[30].[6]

3 Today

It is plain to see that the feudal system has not disappeared. It has, *au contraire*, adapted to the times. We may be freer than some of our ancestors ever were but we are not yet as free as we may wish to be. Over the ages, we have told ourselves many stories, be they myths or not, of freedom over oppression, of power over tyranny, of good over evil. Some of them may even attribute excessive credit to a few characters but it could not be denied that these narratives, legends or not, pass the torch of hope and courage to its listeners. I sometimes wonder whether men could live in sanity without even the falsest of hopes. Would our esteemed and honourable ancestors have sacrificed themselves if they could not foresee a better future for the children of their children?

On March 12 2008, I happened to attend a Courant lecture by Jon Kleinberg (JK), entitled "The Geography of Social and Information Networks."[7] JK's talk was divided into two parts: the former was about information flow in large networks and the latter, which concerns us, was about an attack on anonymised "social networks."

If the hosts of your social network asked you whether it would be quite all right for them to share their social graph with interested third parties, what would you say?[8] At the very least, this might mean that they would like to

share your address book. If they added the condition that the social network would be shared only by replacing all identifiable names with random numbers, what would you say now? At first blush, it doth sound reasonable. They have quite graciously undertaken the burden of hosting our social activities for not a penny and we have agreed to anonymously share our collective behaviour in exchange. We have thus personal assistants, once the luxury of few, for the mere cost of having our lives prudently harvested for the purposes of commerce or curiosity. Sometimes, such mines of data, the stuff of dreams of social scientists, are ordained even when we are paying for the services of our hosts. Such is the norm of some large operations of commerce in our time that this particular case is not terribly surprising. This is the *de facto* arrangement of anonymised social networks.

As proper computer scientists must do, Lars Backstrom, Cynthia Dwork and JK, amongst others, have shattered the well-intentioned but unfortunately misguided illusion of such anonymity[15]. An abstract description of their work is that even given a graph G of an anonymised social network, it is possible to identify and compromise the privacy of targeted individuals by at least two different kind of techniques, being respectively active and passive attacks. First, I will describe the simpler version of the active attack. We begin by observing that an anonymised social network consists of a graph in which its nodes correspond to people while its possibly undirected edges correspond to relationships between people. In order to provide some degree of anonymity, the names of people have been substituted with random, say, numbers. The active attack begins with the construction of a subgraph H which consists of k 'beacon' nodes. The attacker then creates relationships between[9] these k beacon nodes and embeds H in the social network by carefully building relationships between these k beacon nodes and b targeted individuals (whose privacy is to be compromised) in such a manner that H could later be found within G even when the names of people have been substituted with noise. The creativity of their work lies in the fact that none of these activities is technically illegal in isolation or in combination, that H can be astonishingly small[10], that the attack can be hard to detect, that with high probability H can be recovered from G and that the recovery can be done relatively quickly.[11] I will not describe their 'cut-based' active attack, but their passive attack works by k people who are already members of the social network agreeing to form a coalition so that their subgraph H could be later recovered with techniques similar to those utilised by the active attack. In a similar vein, other computer scientists have discovered techniques for deconstructing the anonymity of some prominent social networks[18][19].

The very same day or the next that I heard this lecture, I decided to renounce my membership of a social network and have never returned. A most pleasant side effect is that I became happier. Ever since then, I have had the dubious pleasure of excusing myself from social networks by attributing a Courant lecture.

How should we interpret this problem? Some may say that we simply have to exercise more precautions in properly anonymising social networks before releasing them. I think that you may see for yourself how this is missing the

forest for the trees. The larger issue in sight is that by relying on centralised technology, we are as a side effect building massive, proprietary databases of our societies. When all roads lead to Rome, it is only inevitable that Rome comes to know much, perhaps more than may be desired, about its travellers. It has not occured to us until quite recently of the magnitude of this side effect and how it may be, accidentally or worse, misused[1]. It is high time that we come to think about the repercussions of much worship and little skepticism of technology.

3.1 The slippery slope from freedom to serfdom

Whether we realise it or not, we are losing control over our data and we are losing control over our computation. In many ways we were fortunate that a few decades ago, the accident of history was such that advances in microcomputing technology overtook mainframe computing technology to favour the liberating progress of personal computers. With the present development and popularity of increasingly small and lightweight computers, computational power is more or less inversely proportional to mobility. While it is understandable that we must sometimes sacrifice one virtue for another, it should not be forgotten that either arrangement incurs a loss and hence we should weigh our losses accordingly.[12] Every computer ever manufactured has only ever been an approximation of the universal computer, which has infinite time and space, and we should asymptotically approach this ideal because more computing prowess leads to more exploration of knowledge. While the proprietary software of yesteryears lived on our computers, even if we could not study how they worked or share copies or modifications, nowadays, both program and data, the ingredients of any computing machine, are beginning in earnest to live on what are called "clouds." Clouds are amorphously beautiful, but they are also opaque and occasionally hail thunderstorms. We must be careful that the incredibly powerful magic and abstraction of industry and technology do not lead us astray from the scientific desire for understanding the nature of things. If we cannot look into a cloud and observe what happens inside, how are we to verify our understanding of where lightning comes from? The scientific method breaks down with black boxes: is the Automaton Chess-Player or a *homunculus* the one playing adroit games of chess[20]? Now, certainly no one person is able to learn everything nor would he even want to. The abstraction of skills and knowledge is a very powerful method for coping with the tremendous, sprawling complexity that is reality. As Alfred North Whitehead put it so succintly, "We think in generalities, but we live in detail."[13] When shoes need mending, we pay a visit to the cobbler, when good wine needs to be complemented, we see the fisherman, and when more light needs to be cast, an algorithm recursively consults itself. It is of course remarkable that in this day and age, we do not even have to cook our own meals, repair our own automobiles, calculate our own income taxes, disseminate our own works of art and now, compute on our own tremendously powerful computing machines, so that we may choose to focus on our interests, but at what price? The opacity of some of our modern traditions of life, especially those of

commerce, is producing a wearing effect on intellectual life. We are encouraged or even forced to know less about more, so much so that some of us find it easier to believe that extraterrestrial civilisations, not our esteemed forefathers, engineered the great wonders of the ancient world, or, to consider a more recent example, that rocket scientists played a crude game of deception than actually land men on the Moon with theory cruelly validated by experiment after experiment.[14] The scientific method almost demands for free software in computer science, so that we may teach our children not only how our increasingly unfathomable complex machinery work, but also how to cooperate with one another to construct things larger than our individual selves. Unfortunately, I fear that our state of mind is getting worse. "Fear not, fret naught," they say, "let us outsource our worries away." Entire nation-states are on the precipice of embracing "value-added service-oriented economies," in which "intellectual property" is the king who refuses to abdicate and whose authority is challenged at great cost.[15] Proponents of the principle of free markets, regrettably, turn away when unfair copyright licenses and patents stifle intellectual growth and hence progress by treating Platonic, infinitely reproducible and mutable ideas as if they were precious, scarce earth. In a way, the whole situation is a bit like grown men behaving as children do and appealing to the might of guardian governments, throwing their hands into the air and shouting, "It is not fair — how could he steal *my* idea and perfectly compete with me in a free market!" Some economists claim that without incentives (a shorter term for the common idiom 'carrot-and-stick') such as temporary monopoly, we human beings are not likely to discover much of value. Is this tenet, on which much depends, true?

I am not one of the brave Luddites, but I am also concerned that in more ways than one, as with any double-edged sword, the Internet is not only a harbringer of revolution, but also of regression[4][13][14][25]. In particular, without delving into psychological ramifications, the "web applications" regression is promising to undo decades of laborious computer science, specifically that most utilitarian of theories, operating systems. We were once advised that it is good to host our own copies of operating systems on our computing territories, to give residence to these local governers who algorithmically manage other guest software with our data on our behalf and ensure that they behave as well as possible with each other and our computer. One could, if one so wished, study not only the outwards appearance but the internal mechanisms of a free operating system in order to understand the processes of governance of his computing machine. If one did not like a certain management policy or thought that he could improve upon it, then he could do so and share his modifications if he thought that they were worth the while. Today, we are urged to host "web operating systems," if they could be called that, on computing machines so small and powerless that they could hardly manage a required operating system to manage a World Wide Web browser which in turn manages web applications, program and data which ultimately live on remote black boxes of Leviathan proportions.[16] This may indeed be a more convenient arrangement for many people who wish for simpler computing, but if we now wish to use the functionality and data of web applications, we must usually obtain the blessed privilege

of talking to "web services" on these black boxes, through a Cerberus otherwise known as an Application Programming Interface (API), which answers particular questions but says nothing else otherwise. At the same time, these colossal automata are answering problems at which artificial intelligence is still abysmally poor by inviting masses of people to solve them in a one-way process known as "crowdsourcing." Should the crowd not ask, "Do social networks allow us to freely import and export our own data between other networks or to study their private algorithms being used for the public good? When a web service recommends a cultural artifact that it claims we would enjoy, how could we objectively make certain that it is not a self-fulfilling prophecy?" Few web services permit us to study their algorithms, which prevents us from running our own copies, let alone variations.

By the winds of ignorance and innocence, we are navigating perilously close to the uncharted rocks of cultism. While there is no organised conspiracy to sail such a course, disparate forces are converging on the same class of solutions, solutions that are not conducive to our recent and hard-earned public freedoms. Perhaps centralisation and freedom will always be orthogonal to each other. We often hear from businessmen who bemoan the scarcity of "scalable" technology that serve millions or billions of people all at once and others of their brethren who coincidentally begin proffering such solutions, but scalability is a more serious problem for monopolies or oligopolies than it is for freedom. Let us think about how some companies achieve scalability. Instead of sharing "trade secrets" with their neighbours, they go to the extensive trouble of maintaining globe-spanning networks of commerce of mind-boggling scale.[17] One could reasonably doubt that Adam Smith quite had this in mind when he spoke of the 'invisible hand.'[23, Section IV.2.9]

Why are we losing our freedoms in the realm of networked computing? One of the defining traits of our species, culture, compels us to do as our neighbours do. When we see them calling out to us via intermediaries from across the planetary distances of space and time, we naturally reach out to them, yet we later find ourselves divided into exclusive tribes because the ill-conceived rules of modern-day commerce do not encourage competitors to talk to each other, requiring us to effectively form allegiances or 'social cascades' of popularity. In more ways than one, the worst part of the problem is *ourselves*, since we do little or nothing to enact passive resistance against the purposeless partitioning of humanity. As we become ever more (selectively) connected with our fellow men, are we at the same time growing our wisdom and intelligence? As the world grows faster and smaller, can we afford not to deliberate and think? A number of men of literature, from Edward Gibbons to Ralph Waldo Emerson, have opined on the importance of solitude to the creativity of humanity.[18] Perhaps there are other ways of trade, commerce and life that encourage cooperation rather than competition, other modes of thought that remain unexplored because of our ancient weakness of seeing dichotomies where there are none, our eternal penchant for blessing one while cursing all others; in any case, the power law distributions that are induced by our current economies are not very healthy for the human condition, even though it has been argued that randomness is

the great equaliser[19] of societies[26].

In addition, I am of the opinion that the lion's share of the blame for the current dilemma on the Internet must surely and ultimately lie on computer scientists, for we have failed to make computing simpler and, most importantly, as free as possible. Why must it be so arduous a task to run our own secure electronic mail servers that we have come to rely on "webmail" experts to handle something as relatively simple as sending a message from point A to point Z? The computer science literature is riddled with technically excellent distributed electronic mail or file systems that have not captured the public imagination for one reason or another. Why is this the case? The cynic may hazard the guess that such freedom-friendly technology do not easily lend themselves towards building fiefdoms, but it is much more likely that the reason for our present condition is the principle of the path of the least resistance. Centralisation is probably the simplest, if not the most robust, way for human beings to even begin thinking about and solving a large class of problems. In order to illustrate the problem, the reader is invited to produce a correct *and* efficient protocol for transient elections; that is, suppose that you are a member of a Greek part-time parliament whose constituents, being enthusiastic traders, cannot help themselves but to always move in and out of the assembly, sometimes while passing crucial legislation. Many intricacies about this problem have been brushed away; the enterprising reader will in time, no doubt, rediscover them.[20]

I once went to listen[21] to a man speak about how a middlemen industry of copyrighted art works is stifling his web service, which serves and recommends similar art works for our free appreciation, by insisting on more *royalty* fees. I sympathised with his predicament and explained at some length that the users of his web service are paying him too, in a sense, by judging on his recommendations which, in turn, are being used to improve his service. Since we are helping one another, could he give his users the option, possibly commercial, to import their preferences from his web service and export it to another, if they so wish? Questions immediately arose on whether he could do so without sharing his trade secrets. The problem with our problem, of freedom on the Internet, is that it is abstract and not as visceral as, say, a terrorist attack[26]. It is difficult to discuss complex issues such as "digital rights management" (DRM)[22] and the freedom of culture without diving into the nuances and subtleties that are the deep caverns of important philosophical matters[17]. One may retort, "Why should I care about how it all works and who does it for me? All I wish to do is to share the captured moments of my celebration of life." Lest that I be misunderstood, the problem is really not so much of privacy as much as it is of power and freedom. Indeed, the former is quite properly the consequence of the latter. If you accept the premise of free speech and consequently free software, then you must naturally extend it to computer networks, especially the largest one of them all, the Internet.

I met JK at another lecture the next day and asked him, "What if we break up the pieces... what if G was not in the hands of one but of many?"

3.2 A short digression on the virtues of efficiency

Strictly speaking, the generalisation that "scalability is a more serious problem for monopolies or oligopolies than it is for freedom" may not always hold true. Recently, I had the pleasure of conversing with a few computer scientists who happened to be experts on wireless communications. When I pressed them on the question of why a distributed, free wireless network does not exist, they maintained that while it may be technically possible, its performance would be atrocious. Well, if that may be case, perhaps we must trade time for freedom. Perhaps we have fooled ourselves into blindly worshipping the importance of efficiency, whose beneficiaries vary across the layers of society. Nassim Nicholas Taleb (NNT) warns us that our networked systems, such as the financial industry and electrical grid, are optimised, as opposed to biological systems, to the point of being terribly vulnerable to black swans[27].[23] There is a wonderful observation by Ian Clarke, discoverer of Freenet, for which I shall take the liberty to quote at length[5].

> It is curious that most of the creations of man follow a design philosophy which is alien to that employed in most biological organisms, including man himself. Whereas evolution has discovered that successful systems tend to be decentralised with only the minimum centralised control possible, the systems created by man tend to have a highly centralised architecture. Computers have central processing units, computer networks have hubs, and the operation of a car depends upon that of a small fuel pump. While it could be argued that a person is centrally controlled by the brain, if we look at each of the sub-systems within a person, we discover a degree of redundancy. Large portions of the brain can be removed with little significant degradation in performance. Compare this with one of man's most complex creations, the computer. Remove or damage even a microscopic component of a computer, and in the vast majority of cases the computer will stop working completely. There are examples where some form of redundancy has been incorporated into a design, however in comparison to nature's example these are clumsy and inelegant. Many people point to the Internet as an example of a distributed, decentralised, and robust architecture. This is not the case. Internet Protocol (IP) addresses are passed down from a centrally controlled system. The Domain Name System (DNS) upon which the modern Internet depends is ultimately controlled by one organisation. In most countries there is a small number of backbones upon which that country depends to provide access to the Internet. There are frequent failures in this system (at the time of writing there has already been at least one significant failure in the D.N.S in 1999 alone), and as the Internet becomes more important these failures will become more significant. Perhaps it is possible to design a system which is decentralised, and distributed, while retaining the elegance of natural solutions.

It would be prudent to observe that while Freenet may not ensure efficiency, it does deliver privacy to the best of its abilities.

If time is of the essence, then we should be doing far more to increase our mortal lifespans instead of only going the other way around the problem, which is to decrease the lifetimes of inaminate things.

3.3 Another short digression, but on examined altruism

The twisted vines of our history and the experience of our own lives have taught us time and again that we can be astonishingly cruel to each other. Why, then, do some insist on this seemingly blind attachment to unconditional good? Certainly some human beings do not deserve a shred of our respect and the goodness of our hearts.[24] Just as the benevolence of a baker may not serve us dinner[23][Section I.2.2], can we, like Adam Smith, find a selfish justification for free software? Surprisingly and fortunately, evolution has found that selfishness, hidden in the guise of altruism observed as, for instance, nepotism or the 'tit-for-tat' strategy[21, Chapter 16] in some living beings, can form an evolutionarily stable strategy, which is to say that certain kinds of altruism are actually the best selfish courses of action over time under some conditions. Imagine that! It is as if the universe was conspired to heap such acts of irony upon us. Such bastions of evolutionary biology as William D. Hamilton, John Maynard Smith, George R. Price, Robert L. Trivers and Richard Dawkins have explained how this may curiously be the case, most notably as that powerful *weltanschauung* known as the 'selfish gene'[6]. As you may have expected, reciprocal altruism is indeed encoded in the GNU GPL: it is impossible for anyone to distribute proprietary software that are built upon free software without, ironically enough, violating extant copyright laws.[25] If I wish to spread variants of your free software for my own interest, I am obligated to share them with everyone else, including yourself, for his own interests. This is a perfectly respectable and, more importantly, enforced mode of cooperation, so to speak, by twisting one another's arms. Of course, it is difficult with such intimate cooperation to produce a monopoly on the vital resources of life; some people find this to be an unthinkable proposition, yet that is how it is if we wish to live honourably. Alas, we have come to be so blasé to the common fallacy that monopolies of riches are always deserved, for how else could we live peacefully with the fact? I have heard its horrific corollary, uttered by quite reasonable people, that the poor generally deserve to be so, never mind that incompetence or malice can be more than amply rewarded by good fortune or skill in this indifferent universe. Free software, via the rational strategy that is reciprocal altruism, provides us with an intelligent kind of salvation from the ever-tempting regression to pure selfishness, while intellectual property is akin to nuclear weapons, in the sense that the optimal strategy may lead to the mutual assured destruction[7] of our cultures. It is curious that while philosophers are often accused of living in an abstract, Platonic realm, the western civilisations are, sadly, becoming ever more respectably entrenched in imaginary property and wealth, with the rest of the world following suit.

Even then, we poignantly understand that free software necessarily appears, as long as our kind of myopic, evolution-driven civilisation lasts, foolish, sub-optimal and inefficient, similar to the ideas of Mohandas Karamchand Gandhi. With regard to the tantalising conclusion of Bertolt Brecht's play, *The Good Person of Szechwan*, how does one live justly in an unjust world? Can we render justice evolutionarily stable or must we escape the vulgar trappings of natural selection? When I try to explain some of the ideas in this essay to other people, I am sometimes essentially asked, albeit through veiled euphemisms, "Yet how would I prosper without necessarily manipulating, deceiving or exploiting fellow human beings who are returning the favour?" I leave its answer to you, my dear reader.

4 Tomorrow

When I was an undergraduate student, I happened to see the need for distributed computation on the World Wide Web and wrote about it.[26] Unfortunately, I had not yet cultivated the technical skills to build anything of sufficient importance then, besides the thought that certain extant technologies would eventually fill the niche, and little did I even foresee conflicts with the freedom of computation. The remainder of this essay was the hardest to write because I still do not have precise answers. I hope to change this in the near future, but lest you be disappointed, for now I will only briely comment on what we should do. I do not come to you bearing heart-wrenching tales of fear and doom and then concluding by offering for sale magical, colourful, little pills of panacea. However, unlike black swans, which in principle can never be tamed and which it would be foolish to ask for oracles, the conundrum in hand should have technological resolutions. I simply do not, at the moment, know what they must be. In any case, I have grown suspicious of singular answers to our pressing problems; similar challenges in different circumstances probably merit different responses.

There is that wise old saying, *de gustibus non est disputandum.* Freedom dictates that you and I have a say in the matter. If you find the *status quo* to be appropriate, then so be it. I do think that the present technology on the World Wide Web is probably the most suitable choice for, say, the purpose of trade. By the same right, we should have other choices of technology for other purposes. Although one way may be objectively better than another in a given context, I have lately learned that the importance of the freedom of culture cannot be underestimated. One could think of it as scientific politics; without experimentation, we will not know. Freeman Dyson once observed[7] on the importance and economics of pioneer colonies, especially in outer space, an idea which I like to think of as 'parallel civilisations.' It is easy to see that all ideas are not born equivalent, but if a society wishes to adopt an idea, then it could do so with no cost or detriment to other societies by branching from its parent society and experimenting with the idea in an isolated trajectory, unlike our present situation in which all eggs are in one fragile basket. We might have better prospects for more stable forms of peace if we acknowledge that

some ideas are simply mutually exclusive and do not offer hope for reconciliation. Certainly as human beings we must learn to hold dear the importance of diversity, but sometimes this is most unfortunately not very becoming to the human nature that is not of our choosing. Perhaps someday we may engineer a successful *coup d'état* of our subconscious minds, but until that day, rather than trying to actualise the improbable, we may as well come to recognise our weaknesses and work around them. If to each society its own world, then the universe might be a better place. Emigration and immigration, not to mention communication, would doubtlessly be thornier problems in outer space and the laws of chance will eventually realise some societies that are arguably less desirable than others. Conflicts over shared resources may also become less probable but not impossible. This will indeed be a problem for sentient beings, but the same laws of chance will see some societies survive longer and prosper better than others. While John Rawl's theory of justice seems specifically tailored for human beings,[27] one can see how an independent observer could be in the 'original position'[11] with respect to parallel civilisations.

4.1 The technic of freedom

4.1.1 The liberation of data

Recently, Sir Timothy Berners-Lee (TBL), discoverer of the World Wide Web, delivered a most curious and enthusiastic lecture[2]. He introduced the notion of *linked data*, which are bits of information that have names and relationships between each other, and showed us that it is useful because linked data beget more data. Each of us were encouraged to do our part, no matter how little it may be, to make linked data so that together we may produce a whole that is more valuable than a linear sum of its parts. Unfortunately, we as curators of data do not necessarily find it interesting to release them as linked data, preferring instead to keep them in isolation. We were urged to say aloud, "RAW DATA NOW!" He concluded by saying, "I want you to make it and I want you to demand it." Perhaps the discoverer has now seen that his own discovery has not become as conducive to our freedoms and as nurturing of our cultures as it should have. There is a number of limitations with the technology of the World Wide Web that does not render it amenable to freely processing data. Of course, TBL and the rest of the World Wide Web Consortium have long ago recognised these problems and are in the process of more than simply remedying it by inventing the Semantic Web technology, which is extremely promising but sadly neglected for reasons having likely to do with popularity. We spend so much time and effort "tagging," or manually labelling, data on the World Wide Web simply because we did or do not know how to make algorithmic sense of data on a large scale, or how to teach our computing machines to be as intelligent as we are, if not smarter.[28] In order to advance our freedom and the art of computer science, one of our most important aims must be to release our public data into the commons with the proper copyright licenses.

Other men of literature[3, 17, 31] have masterfully reviewed and discussed the

state of our copyright, patent and other so-called intellectual property systems. Come the day we universally recognise that copyright — *the right to copy* — is an artificial barrier enacted by men to deliberately control other men, comes the day humanity becomes that much closer to enlightenment. Nature could not be more apathetic about what can be physically copied, be it the ingredients of life or its artifacts, and thus it is up to us whether or not we, beings of the dawn of consciousness, choose to escape from our destinies. Yet, of course we cannot do so without somehow engineering a clever scheme to molt our primeval foolishness; enlightenment is worth nothing if it cannot remain as stable and intelligent as selfishness.

4.1.2 The liberation of computation

As I have argued, the technology of the World Wide Web is ill-suited for certain purposes.[29] However, some say that careful adaptation or repurposing of one kind of technology to fashion a different one has historical precedence with valid applications and that the same may be done with the World Wide Web.[30] While this may be the case, we should not commit the time-honoured fallacy of attributing history to justify our present actions. My point is that we simply do not have to depend on the World Wide Web for all of our computing needs. It may be countered that we are too heavily invested in the World Wide Web to abandon it at this stage of its development.[31] Abandoning it would be terribly silly, to say the least: I wish only to advocate that it is not ideal for social teleology. Far too often, we make the mistake of assuming that the contending alternative, now that the orthodoxy has been challenged, waiting in the wings, must be pure and right.

While in the interim we could liberate networked software by using the appropriate copyright licenses,[32] the best thing that we can do to assure freedom in the future, I think, is to build distributed systems of computation[28]. Why should we do so? I submit to the consideration of the reader that we have sufficient free software to sustain free computation except in the realm of networked computing. When we wish to learn more about a subject matter and hence issue some queries to search engines of the World Wide Web, we are benevolently answered with a tractable list of highly-ranking linked documents, but do we know why they were ranked in such a way and not another? When we transmit to centralised servers our memories of life in the form of binary digits, will anyone else own our data? How long will our data exist on external repositories and what then should the repositories be no more? Would it be in anyone's interest to study our lives by processing our data? How could we ensure that we will communicate with each other securely and privately, if need be, through centralised servers? What of our rights to dissent to or defect from a social network? Curiously, many outwardly centralised systems rely internally on distributed systems for their operations. Why should we not simply bypass the middlemen by constructing these distributed systems for ourselves? It is not terribly difficult to see how and why distributed, decentralised computing systems will help us to address the concerns raised here. To consider but an

example, some distributed file systems store encrypted, redundant copies of files over many computers in order to provide not only security and reliability but also privacy by properly routing all communications[5]. It is just as easy to imagine some of the disadvantages of decentralisation as compared to centralisation: relative inefficiency in terms of performance, the difficulty of sustaining monopolies, the psychological as well as sociological incompatibilities and so on. Nevertheless, these limitations, if they cannot be technologically mitigated, will be necessary compromises for a better kind of freedom. It goes without much saying that at the very least, public distributed systems of computation and data should be as secure, private, reliable and efficient as possible while simultaneously fostering liberty of computation and data, searchable indices of the public domain and a sense of community.

4.2 Conclusion

We have examined the good that is free software and its subversion in order to hark back to proprietary computation. Some private interests enjoy free software because they can exploit it, but so does free software exploit them in turn. Lately, a few of these parties have learned how to skew the symmetry of the reciprocal altruism by selling software as restricted network services. Yea, we *homo sapiens sapiens* tend to be clever in such wicked ways too. One part of me says that men, who are apt to treating fellow men with such misbegotten ills, do not deserve very much freedom; another part of me says that we are but children who need to somehow search for an eight-fold path heading towards enlightenment. A man needs to protect himself from other men in much the same way a bacterium needs to protect itself from its brethren, but as bacteria exchange genetic material, the machinery of life, from time to time in an intriguing process known as conjugation, so do men learn to sometimes cooperate with one another for the basic, indirect and final cause of propagation of genes. Such are the vagaries and exigencies necessitated of life by evolution. I find myself much less enthusiastic and more tired than I was when I begun writing this essay and thus, I leave you with this ambiguous ending, in which the author is unsure of the merits of his findings that, do not really matter when in the process of calling for better public freedom, in the true spirit of self-interest, that of his own is procured along the way and when no number of verses could displace one effective deed. Is this the most important problem in the world? Why, hardly so. There are far more important problems to concern ourselves with. Nevertheless, I suppose that those of us who care about personal freedom should keep these matters in mind as we come to depend evermore on the Internet. In our luxury, we should design and build free, distributed, networked software to be released to the public domain so that our descendants will know how to do the same. Meanwhile, as we battle with the deeper tragedies that have plagued humanity for aeons, we should do whatever we can to defend our freedom from nemeses — ourselves — in various guises. Alas, all the blindingly efficient computing machines in the world will come to naught when we have little or no control over what is being computed for our thoughts.

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Notes

[1]. . . and, I suppose, *vice versa*.

[2]Quite recently, I have had the pleasure of the ensuing horrific revelation at one of my breakfasts.

[3]While it is practically infinite, I worry that this is what will become of solar energy. If extraterrestrials delivered to us such technology, what would our monopolists do?

[4]At the very least, the replicability of otherwise scientific experiments now become questionable.

[5]What is often left unquoted is what concludes his observation: "The man who listens to Reason is lost: Reason enslaves all whose minds are not strong enough to master her."

[6]This is not to say that RMS is renowned for being the friendliest of fellows.

[7]By the way, Eugene P. Wigner delivered his Courant lecture on "The unreasonable effectiveness of mathematics in the natural sciences" at New York University on May 11 1959[29].

[8]Whose data is it anyway? Who "owns" novel mutations of billion-year-old genes?

[9]Technically, the attacker has to build a random graph with a Hamiltonian path.

[10]k is $\Omega(\sqrt{\log n})$ and $O(\log n)$, where n is the number of nodes in G, while b is $O(\log^2 n)$.

[11]The search runtime depends on the size of the search tree, which is shown to be $O(n^{1+\epsilon})$ with high probability for every $\epsilon > 0$.

[12]In older days, small computers which depend on larger, more powerful computers for useful work were given the non-too-flattering term, "dumb terminals."

[13]An astounding testatement to this statement, from his book, *Essays in Science and Philosophy*, is the *Principia Mathematica*, co-authored with his student Bertrand Russell.

[14]When I questioned a 9/11 "truther" at Washington Square Park, he felt his freedom of speech was attacked instead of answering my skepticism on what qualifies him to speak on the architecture and engineering of skyscrapers. Truth, alas, is not democratic.

[15]The sheer selfishness and questionable vogue of intellectual property cannot be cursorily summarised and must remain the scope of another essay.

[16]This bootstrapping may be done away with when possible to do so.

[17]In contrast, see the OpenCola or Open Source Beer project, or, for that matter, simply imagine the absurdity of making intellectual property of food or drink recipes.

[18]Although, as with any generalisation, it is too simplistic to fit to our messy world.

[19]A misnomer, to be sure, for it tends to equalise men over time, not space.

[20]This is indeed a vexing challenge. A most clever formulation of the problem and its solution is presented by Leslie Lamport[16], the same genius partly responsible for the free typesetting software that shaped this essay. In fact, politics has much to learn from computer science; unfortunately, this must remain the subject of another essay.

[21]It is curious that the ones who say that the Internet is "democratizing" speech are the very same ones who either talk or are talked about at public forums. Something about human psychology appears to induce power law distributions.

[22]RMS renames it more appropriately to 'digital restrictions management.'

[23]The problem with NNT's values of life is that it is next to impossible to find bliss within them.

[24]A motif that is explored in Fyodor Dostoyevsky's *The Idiot* and, more recently, in Joel and Ethan Coen's cinematic adaption of Cormac McCarthy's *No Country for Old Men*.

[25]Unfortunately, it is possible to bypass this by providing software as web services.

[26]My now lost proposal was called "distributed web processing." Perhaps some of my friends remember it; one of them even expressly advised me to act on the idea.

[27]After all, liberty is not the highest concern for ant colonies, which do survive without it.

[28]Similarly, we write "unit tests" which are merely proofs that some random simulations of our software are correct, while we do not teach or learn how to use more sophisticated mathematical techniques to prove or disprove certain global properties conjectured of our software.

[29]A notable violation is the 'exaptation' of the 'stateless' Hypertext Transfer Protocol to somehow maintain 'stateful' connections.

[30]An example is programming libraries which work around the limitations of amnesiac computer terminals in order to maintain a stateful text-based user interface.

[31]On the other hand, if the dictum of separation of data and design had been observed, then the predicament would have been a lesser one.

[32]See, for example, the GNU Affero General Public License[9].

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