ROB LUCAS

THE CRITICAL NET CRITIC

Four decades on from the origin of the Internet, and more than twenty years from the birth of the Web, discussions of these technologies retain a strong mystical odour. Prophecies about a coming 'information society', or of new technological ruptures comparable to the Industrial Revolution, have long served to conceal any realistic sense of what they most immediately are; the computer can still be portrayed as a thing of magic, a portal onto some other plane of Being; the Net even more so. Mainstream technology pundits have typically played a propaganda role for American hi-tech industries: 'we have a moral obligation to increase the amount of technology in the world', *Wired* magazine 'Chief Maverick' Kevin Kelly once declared, while Stewart Brand—founder of the *Whole Earth Catalogue* and a pioneer of the libertarian Californian tech culture with which the Net has been associated since the start—has come out as an advocate for biotech and nuclear energy.[1] At the same time such figures have been central in making a literary genre of the Web's mystification.

Carried away on theological flights of fancy, they have interpreted it as a great World Mind in gestation.[2] Treating technical progress in the microelectronics industry as an independent variable against which humanity in general may be measured, they have extrapolated from Moore's law—the observation that the number of transistors on integrated circuits doubles approximately every eighteen months—a future quantity-into-quality point of 'singularity' at which an ineffable synthetic superintelligence emerges, subsuming and transcending the human mind.[3] In a postmodern reincarnation of the divine watchmaker analogy, they have even suggested that the universe itself may not only resemble, but actually *be* a giant computer, predictably prompting speculations of a neo-Aristotelian cast: if the universe is a giant computer, what 'platform' does it run on, and which divine programmer could be its unmoved mover?[4] Even in its

more secular mode such literature has repeatedly forecast the technological transcendence of traditional economic norms.[5]

What is obfuscated in the mystification of these technologies is not ultimately a technical matter: it is the relations of ownership and power that lend themselves a body within this complex. Appearing primarily as technological matters, which enswathe the globe in an indifferent and universalizing technical logic, concretely these technologies are inseparable from the relations of the late 20th-century American capitalism which produced them. An analysis that pushed against this obfuscation might attempt what Adorno called a 'reductio ad hominem', exposing the social roots of this technological complex to grasp it as a key mediation in the reproduction of late capitalist society.

The delirium of utopian technology literature has typically summoned its opposite in a complement of naysayers and sceptics. Even in the early days of the Web, when the predominant tone was rapturous, *Wired* found its counterparts in bubble-bursters such as Clifford Stoll and Kirkpatrick Sale.[6] Today, amid increasing media noise about such things as Facebook addiction and Twitter trolling, the sceptical literature has taken on a new prominence, with books pouring from the trade presses and a steady stream of articles fretting about the deleterious effects of technology. If we are to attempt a disillusioned, materialist critique of current technology, an interrogation of such existing negative literature may be a useful step, helping us at least to deflate the grander claims of Silicon Valley's chief boosters. Within this huge literature, the work of Nicholas Carr stands out for the clarity and breadth of historical vision he has brought to bear. With its expansive interdisciplinary scope, weaving economic and technological history, neuroscience and McLuhanist

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[1] Kelly, 'How Computer Nerds Describe God', *Christianity Today*, 11 January 2002; Brand, *Whole Earth Discipline: An Ecopragmatist Manifesto*, New York 2009.

[2] See, for example, Jennifer Cobb Kreisberg, 'A Globe, Clothing Itself with a Brain', *Wired*, June 1995.

[3] See, for example, Ray Kurzweil, *The Singularity is Near*, New York 2005.

[4] Kevin Kelly, 'God Is the Machine', *Wired*, December 2002.

[5] See, *inter alia*, Kevin Kelly, *New Rules for the New Economy*, New York 1998; Chris Anderson, *The Long Tail: How Endless Choice is Creating Unlimited Demand*, London 2006; Chris Anderson, talk at *Wired 2011* conference—a project extended in *Makers: The New Industrial Revolution*, New York 2012.

[6] Clifford Stoll, *Silicon Snake Oil*, New York 1995; Kirkpatrick Sale, *Rebels Against the Future*, Reading, MA 1995.

media theory, Carr's project offers a particularly fertile basis for reflection. Carr is best known for his 2008 *Atlantic Monthly* article, 'Is Google Making us Stupid?' and its 2010 book-length extension in *The Shallows: How the Internet is Changing the Way We Think, Read and Remember*.[7] In these works Carr recapitulated longstanding worries of technology commentators about the fate of the book in an electronically mediated world; the concerns of figures like Lewis Mumford, Marshall McLuhan and Neil Postman are buttressed by accounts of recent developments in neuroscience and research on technology use, to support an argument that the Internet may be changing the very structure of our brains for the worse. But Carr made significant interventions prior to these works—*The Shallows* was the third book in a steady stream of publications on technology, running over more than a decade, all exhibiting a markedly negative perspective defined primarily against the grandiose claims of the tech industry and its advocates. The coherence of this broader output makes it worth surveying as a whole.

The tech critic as business guru

As distinct from most technology pundits, who often have at least one foot in the tech industry, Carr's affiliations have lain primarily with print media, high-end business journalism in particular. Following an MA in English and American Literature and Language from Harvard and a stint in management consultancy, he began his career as a professional technology sceptic while employed in a senior editorial capacity at the *Harvard Business Review*. Carr joined the journal in 1997, just as the dot.com bubble was beginning to inflate. By 1998 he was already writing on the potential ill effects of the new economy on the inner lives of individuals and companies. Alongside a generic business journalism portfolio, Carr covered the destabilizing potential of email for organizations, the corrosive effects of the contemporary labour process on individuals' characters, the effects of information piracy, the 'hypermediation' of economic transactions occurring on the Internet.[8] By 1999 he was already wondering whether 'our days toiling in virtual

[7] Nicholas Carr, *The Shallows: How the Internet is Changing the Way We Think, Read and Remember*, New York 2010.

[8] Nicholas Carr, 'The Politics of E-mail', *Harvard Business Review*, Mar–Apr 1998; 'Being Virtual: Character and the New Economy', *HBR*, May–Jun 1999; 'Briefings from the Editors', Jul–Aug 1999; 'Hypermediation: Commerce as Clickstream', *HBR*, Jan–Feb 2000.

companies' might make of us 'virtual men and women, efficient and adaptable but without substance'.

In 2003 Carr published his career-making article 'IT Doesn't Matter' in the *Harvard Business Review*. Directed at a business audience, 'IT Doesn't Matter' argued that information technology should not be considered a reliable source of competitive advantage, since it tended to become a mere commodity input and thus a simple operating cost for businesses. Carr had initiated the project after his editorial bullshit detector was triggered by hyperbolic claims, then common in business, about the virtues of IT investment. The title was a provocation for the industry, which obligingly howled in response: Bill Gates, Steve Ballmer (Microsoft CEO and President), Paul Flessner (Microsoft Senior Vice President), Craig Barrett (Intel CEO), Brad Boston (Cisco CIO), and many others felt sufficiently stung to reply to Carr's article in tones sometimes verging on outright denunciation. A year later he had left his editorial post at the *Harvard Business Review* to publish an expanded version of the same argument in book form as *Does IT Matter?* with the Harvard Business School Press.[9] Here Carr characterized IT as an 'infrastructural' rather than 'proprietary' technology, and attempted to offer a more sober perspective by focusing on long-term social and technological trends. He set his book on a sceptical foundation: if IT was so important to productivity, why had it spent four decades exerting negligible influence, before suddenly manifesting itself in the Clinton boom? Why did some industries and regions seem to benefit from it and others not? Why were the clear winners from technological development confined to a small set of companies while it appeared to have had a negative or limited effect on the rest? There seemed to be—as economists had been noting for decades—a certain 'trouble with computers' when it came to productivity figures.[10]

Small nut becomes universal solvent

On an abstract political-economic level, the extensive argumentation of *Does IT Matter?* was a sledgehammer for a rather small nut: it is a truism

[9] Nicholas Carr, *Does IT Matter? Information Technology and the Corrosion of Competitive Advantage*, Boston, MA 2004.

[10] For a decent account of the 80s and 90s debates on this problem, and for an implausible solution, see Thomas K. Landauer, *The Trouble With Computers: Usefulness, Usability and Productivity*, Cambridge, MA 1996.

that no individual company will succeed in securing for itself significant long-term advantage over competitors solely through the purchase of goods that are also available to those same competitors. But the burden of Carr's book was to provide an integrated economic and historical elaboration of the dynamics through which IT had been increasingly commoditized, making the transition from a prohibitively expensive endeavour for most companies—something only taken on at great risk by particular capitals in pioneering efforts, such as J. Lyons & Co's late 1940s LEO (Lyons Electronic Office)—to an increasingly standardized, widely available, mass-produced good with a rapidly deflating price tag coupled to its exponentially improving performance.[11] With this commoditization, Carr argued, IT had made the transition from a particular asset of the individual company to something 'shared' by companies, a commodity generally available to all. In the process it had become a standard aspect of infrastructure, a prerequisite for most businesses; it was thus clearly meaningless to appeal to IT spending as a primary basis for 'competitive advantage'.

Much of this story of commoditization could be told at the level of computer hardware, in isolation from other factors: here, there had been a rapid cheapening of goods related to the technical progress exemplified in Moore's law, and to the standardization in component manufacture represented by companies like Dell. Already by 2000 the cost of data processing had declined by more than 99.9 per cent since the 1960s, while storage was a tiny fraction of its 1950s price.[12] But for Carr, software also had particular characteristics which help to drive the commoditization of IT in general. Since typical production costs were very high and distribution costs very low, software had extraordinary economies of scale, often making the pooling of resources between firms preferable to the development of particularistic in-house technologies. This supplied an

[11] I will here unavoidably use two quite distinct, but confusingly similar, terms—'commoditization' and 'commodification'. The difference between them is related to the difference between the meaning of the word 'commodity' in mainstream economics and in Marxist political economy: for the former a commodity is something more specific—*The Economist* defines it as 'a comparatively homogeneous product that can typically be bought in bulk'. Commoditization indicates this standardization of the product, which allows it to be produced and sold in mass quantities. In Marxian terms however, a commodity is *any* good produced for sale on a market, and commodification is the transformation of something into a commodity in this sense.

[12] Carr, *Does IT Matter?*, p. 79.

economic rationale for the centralization of IT provision by third parties, who could make the most of these economies of scale by serving many clients. But it also provided an economic basis for the programmer's communitarian ethic, embodied in professional user groups such as IBM's long-running SHARE. The resulting standardizations of hardware and software meant that IT typically overshot the needs of its users, since technologies developed for the most demanding users tended to get generalized. This in turn put a deflationary pressure on prices, since it was rational for users to opt for cheaper, older or free technologies that were adequate to their needs, rather than wildly exceeding them. And since software was not subject to wear and tear, once it had saturated a market, new profits could only be gleaned by pushing users through an 'upgrade cycle', which they often resisted.

Carr viewed IT as infrastructural in the same sense as the railway, telegraph, telephone, electrical grid and highway systems. For Carr, the consolidation of this infrastructural status was a realization of IT's tendency to be cheapened, standardized and made generally available, issuing ultimately in its conversion into a grid-based utility—the apotheosis of commoditized IT. Increasingly, IT goods—software services, data storage and even computing power itself—would not be purchased as the fixed capital of individual companies, but would be based in vast centralized data centres and delivered as services over the Internet by a handful of very large providers. On this trajectory, IT was following a path previously taken by electricity provision—a historical analogy that Carr would spell out in his next book, *The Big Switch*.[13] With such services becoming ubiquitous and generally affordable, they offered little competitive advantage to individual capitals. Indeed, for Carr, precisely the opposite might be the case, for the drive towards standardization within IT also promoted uniformity at the level of business practices themselves, increasingly mediated by standard software, thus eroding competitive advantages beyond the level of IT, the 'universal solvent of business strategy'.

Heavy economy

On this level, Carr seemed to see IT as exhibiting, and potentially contributing to, a general economics of decline. In this, his perspective

[13] Nicholas Carr, *The Big Switch: Rewiring the World, from Edison to Google*, New York 2008.

appears a pessimistic inversion of the 'new economy' optimism which accompanied the dot.com bubble that burst in 2000, just a few years before the publication of *Does IT Matter?* Where enthusiasts of the late nineties had anticipated an IT-precipitated lift-off into the 'weightless economy', Carr saw an IT-induced drag, hastening descent. There were many indications that IT itself might be at the end of its 'buildout' phase: the excess of fibre-optic and processor capacity over the needs of users, the general affordability of IT goods and the growing conversion of IT vendors into suppliers of cloud computing; in these Carr saw a historical analogy with previous technology investment cycles. The economic indicators were not promising: there were few signs of a positive contribution from IT to productivity in other industries but a significant contribution to technological unemployment, accompanied in the IT industry itself by deflationary tendencies and rapidly diminishing returns. These did not look like the signs of an industry destined to remain—as many Silicon Valley types still seem to believe—forever young.

In the eight years since *Does IT Matter?* IT would, as Carr anticipated, increasingly migrate into 'the cloud', as the world's information and computing power has become monopolized by a handful of giant companies. Deflationary tendencies in some areas have perhaps even exceeded Carr's expectations, cancelling or blocking the very commodity status of many IT goods in the process. Access to major Internet services is often given away for free, in a bid for rapid expansion—to be 'monetized' at a future date, once a monopoly has been established—or in exchange for user data which can form the basis of marketing and advertising revenue. In this sense the analogy between IT and the electrical grid which Carr sketched in *The Big Switch* may reach its limits: the revenue streams of the electricity provider are still derived from the sale of electricity, whereas it is only in a minority of cases that large tech companies derive revenue directly from a utility provided—Amazon's 'Elastic Cloud Compute' (EC2) and 'Simple Storage Service' (S3), for example. Massive economies of scale and vast markets, combined with network effects, have given IT companies an extremely strong tendency to monopoly-status, making the strategic counter-provision of services for free an economically rational practice for competitors. This has become a standard tool in the armoury of the giants, alongside patent litigation, buyouts and the binding of users into technological 'ecosystems' and 'walled gardens'. In this environment, only a few Internet-based companies make significant profits—on its IPO this year, even Facebook struggled to give

any convincing picture of its long-term prospects for profitability. And where profits are gleaned from the sale of marketing services they exist only as a cost to other capitals, which is to say as a *deduction* from profits at the level of the social whole.

To Carr, the maturation of 'infrastructural technologies' appeared an intensely destructive process: old businesses and even whole industries were destroyed, jobs were lost and economies suffered. A long time before the dot.com crash, and countering a prophet of an earlier new economy, Luxemburg noted that many of the crises of the 19th century followed phases of heavy infrastructural investment.[14] Carr would probably concur: a suggestion that the culmination of the infrastructural buildout of the mid 19th-century might have played a role in sparking the Long Depression of 1873–96 draws *Does IT Matter?* to a close:

> In the 1870s, the world was also emerging from a technology-inspired spending-spree. The rapid expansion of rail, shipping and telegraph lines opened the door to global free trade and inspired massive capital investment. The resulting combination of rapidly increasing production, surging productivity, fierce competition and widespread industrial overcapacity set the stage for nearly three solid decades of deflation, despite the continued expansion of the world economy . . . Profits fell along with prices, and businesses suffered . . . Workers lost their jobs, farmers and labourers rebelled, and countries began to rebuild barriers to trade.[15]

Infrastructural or proprietary?

This is a compelling account, preferable by far to gush of a *Wired*-magazine sort and a great deal more realistic. Carr's polemic against the notion that IT investment *per se* could be good for 'competitive advantage' produces some odd effects, however, as it overflows from business-guru tips on the vagaries of IT investment into the elaboration of a more general historical-economic argument. And Carr's suggestion that IT was at the end of its 'buildout' would seem, *prima facie*, to be contradicted by the present situation in which Apple has become the world's highest valued company ever—and the current second most profitable—against

[14] Rosa Luxemburg, 'Reform or Revolution?' (1899), in *The Essential Rosa Luxemburg*, Chicago 2008, pp. 52–3. Luxemburg was countering Bernstein's claim that infrastructural investment, credit and capitalist cartels would enable capital to overcome its own crisis tendencies.

[15] Carr, *Does IT Matter?*, pp. 146–7.

a backdrop of ongoing global crisis, while other companies such as Google and Amazon still seem to remain in a phase of heroic growth.[16] More substantially, there are a number of conceptual slippages in Carr's story of IT's commoditization and deflation, and its evolution towards grid-based utility status. To what extent are these tendencies specific to IT and its status as 'infrastructural technology'? Indeed, to what extent is IT necessarily an infrastructural matter?

The opposition between the 'proprietary' and the 'infrastructural' is central to Carr's argument, but it is also the basis of some confusion. For Carr, the 'proprietary' signifies particularistic technologies not possessed by competitor firms—and thus potentially important for competitive advantage—while the 'infrastructural' signifies the opposite: technologies that are generally available. Since IT goods have tended to be cheapened and to become widely available they do not have a stable proprietary status in Carr's sense. But the confusing thing about this terminology is that many IT goods which are 'proprietary' in the normal sense—they are possessed as property—are 'shared' or 'infrastructural' in Carr's sense: standard-issue desktop computers and their operating systems, for example. And, on the other hand, many IT goods that are 'infrastructural' in the normal sense—they are inseparable from communications networks—are strongly 'proprietary' in Carr's sense: Google's data centres are fixed capital investments employing technologies shrouded in secrecy, and hardly replicable by would-be competitors. Even in Carr's specific usage of these terms, a technology that is 'proprietary' for one company—it has sole ownership of it—can presumably be the basis of an 'infrastructural' good for others, as in the case of utilities. Furthermore, IT investment may result in something that is 'proprietary' in Carr's sense, *even when* it involves the purchase of generic

[16] Apple's record-breaking market valuation in 2012 comes in a period of fairly moderate price–earnings ratios based on the continuing high profitability that it has displayed since the introduction of the iPhone. At $33bn Apple is only beaten on annual profits by Exxon Mobil's $41.1bn, and it dwarfs Google's $9.7bn and Amazon's $0.6bn. Although it has consistently had little success over the last decade or so in capturing new markets, Microsoft's continuing dominance in operating systems and its buyouts of existing products also keep it at the high end of the profitability scale, at $23.5bn. See 'The World's Biggest Companies', Forbes.com, April 2012; Steven Russolillo, 'Apple's Market Value: To Infinity and Beyond!', *Wall Street Journal*, 20 August 2012. Philip Elmer-DeWitt, 'Andy Zaky makes the case for buying Apple now', *Fortune*, 10 October 2012; Jay Yarrow, 'Chart of the Day: The Astounding Growth of iPhone Profits', *Business Insider*, 2 August 2012.

commodities: Facebook's purchases of masses of standard hardware, for example, enabling it to run the server farms which support its social-media monopoly. So, it seems that this opposition is a false one.

A further confusion occurs within Carr's conceptualization of infrastructural or 'shared' technologies. On the one hand these are associated with general processes of commoditization—the reduction of hardware to cheap, standardized components by companies like Dell, or the centralization of software production due to extreme economies of scale. But on the other hand, IT is identified as infrastructural and thus 'shared' in the same sense as the rail or telephone network. These are clearly two quite different things, and while it is possible there is some relation between them, this would need to be clearly elaborated; in Carr's account they are simply conflated. What's more, there are problems with both. Firstly, the commoditizations of hardware and software may be viewed merely as extreme examples of the general dynamics of capitalist technical development, which of course tends over time to cheapen—and often to standardize—the production of many goods. The generalization of technical advances is an elementary part of such processes: useful technical innovations tend to end up 'shared' between capitals in the weak sense that competition and commodification propel their diffusion. In this sense, there are few technical innovations that remain enduring sources of 'competitive advantage', so it means little to argue this about IT in particular. Secondly, the 'infrastructural technologies' with which Carr groups IT are all communications or transport networks that are inherently not possessed by any individual user in such a way as to be capable of offering a unique advantage. Access to such things, if not ownership, is 'shared' by individual capitals more or less by definition: if both ownership and usage of such a technology are held uniquely by a single capital, it clearly fails to play any infrastructural role, so it is again a truism to argue that the 'infrastructural' character of IT militates against any possibilities for 'competitive advantage'.

Despite these conceptual problems, the overall picture is a plausible one, supported with pertinent historical examples. It may thus be worthwhile to step back from Carr's interpretative framework and attempt briefly to account for the same phenomena using some alternative distinctions. Because the picture which we are working with is predominantly economic in character, this will be a generally political-economic discussion, but a concrete *technical* understanding of IT is also relevant,

as long as it is kept in mind that technologies are social artefacts and not metaphysical entities.

What kind of technology is IT?

Computers, software etc. are not always and not inherently communications technologies, and their history is distinct from that of the telecoms infrastructure. IT goods only become infrastructural insofar as they play a role within communications technologies, and they have historically done this primarily through their integration with a pre-existing telecommunications infrastructure. We thus need to make a distinction here between means of communication and what we might call the 'means of computation'. It is only the former which may be viewed as inherently infrastructural, 'shared' in the strong sense, and immediately prone to the types of 'network effects' exemplified in technologies such as the telephone.[17] Because of their socially general character, the development of new means of communication is typically a difficult matter for individual capitals; they tend to be hugely expensive to develop, and to involve complex issues of coordination. For these reasons they are often brought into being by state fiat—just as the Internet was. Goods produced for the purpose of information processing are not inherently prone to the same problems. They can, from the outset, be produced by individual capitals without concern for the general problems of infrastructure. But, like many significant technical innovations, their production tends to start out complex, expensive and difficult, before being finessed and cheapened over time. In the process they make a transition from what are effectively prototypes and short runs to mass-produced goods, at least insofar as a market exists or can be created for them. It is in essence this dynamic that Carr reads as a process of commoditization. At this level IT goods are little different from microwaves or refrigerators.

Beyond this, however, it is possible to identify a strong affinity for standardization which is peculiar to the computer, for all true computers—in Alan Turing's sense—are logically identical: all are 'universal Turing machines' capable in principle of running any program written for any other computer, from the first mainframe to the most advanced modern data centre. The possibility of copying software and functionality from

[17] A single telephone is useless; the same telephone connected to another is somewhat useful; connected to a network of several it is dramatically more so: the usefulness of the technology increases with the size of the network.

one computer to another is thus basic to computing.[18] Furthermore, *all* encoded data is—like language—necessarily iterable and thus, in principle, capable of being copied. There are, of course, many situations in which it is not only possible, but also very useful to be able to copy software and data from one computer to another; a parallel argument can be made at the level of hardware components. Concrete incompatibilities between individual machines thus appear an impediment to transfers that 'should' by definition be possible. For users, there are penalties in purchasing non-standard IT goods that inhibit such transfers, and concomitantly for producers a strong incentive to enable them—especially once standards have already begun to cohere. The creation of standards to interlink such machines and to facilitate the transfer of data and functionality thus inevitably presents itself as a problem to be solved, and it is this that ultimately leads, amongst other things, to the Internet and Web, two technologies which are most fundamentally realizations of technical standards—TCP/IP (Transmission Control Protocol/Internet Protocol) for the former, and HTTP (Hypertext Transfer Protocol) for the latter. More than any particular technology, phenomena like the Internet and Web are products of communications protocols: sets of precise rules for transferring data from one computer to another.

If the computer, then, is not inherently a means of communication, the universality of its basic logical construction means that it is highly probable people will want to find standard ways to move data, software and hardware components between individual computers. And, once these are well established, it is only a small step to start using the transfer of data between computers for communication between people, especially once the mass production of hardware—which itself is promoted by, and in turn promotes, technical standardization—results in computers becoming widely distributed across society. The computer then, as a social artefact, has at least some strong elective affinities with means of communication, and we see these realized in the fusion of means of communication and computation which is the Internet.

Standard stoppages

Once a large network such as the Internet arises, the penalties of departing from its standards become so great as to rule it out in most cases,

[18] Alan Turing, 'Computing Machinery and Intelligence', *Mind*, vol. LIX, no. 236, October 1950, pp. 441–2.

thus reinforcing the underlying proclivity for standardization. Yet standardization deprives individual IT manufacturers of significant ways of qualitatively differentiating their products from those of competitors. If a given IT commodity is fundamentally generic, and it can thus be readily exchanged for one produced by a competing capital, competition will tend to be focused more strongly around factors such as speed and capacity—which have so far proven technically quite open-ended—and price.[19] It may then be that the importance of standardization here means that competitive dynamics, which are obviously general to capitalism as a whole, are particularly acute when computing is involved, and even more so once the computer has begun to be used for communication.

There is also inherent in the computer, however, a tendency to undermine competitive dynamics at the level of software. Since what is produced for one is, at least in principle, capable of running on all others—and this possibility is enhanced with increasing standardization—and since software code is highly labour-intensive to produce initially but inherently iterable once written, there is a strong possibility that a single capital can serve the entire market for a particular software commodity. If the technical universality of the computer may promote competitive dynamics at some levels, then, it promotes monopolies in software. It may be tempting to refer to the 'natural monopoly' character of means of communication here, but it is notable that these monopolistic possibilities in software exist independently of any technological convergence of computation with the means of communication. The formation of monopolies at the level of software is, however, not the end of the story. As noted above, the very ease with which monopolies are potentially formed in software makes extraordinary counter-measures rational for competitors. It may even be rational to give away software entirely for free, or to fund the development of a Free or Open Source Software equivalent, if it helps prevent a competitor from developing a monopoly position from which it may thereby threaten to impinge upon other lines of production in which profits are still possible, or to grab a market that might be 'monetized' in some other way later. The tension between monopoly and competitive dynamics in software thus tends not only to lead to declining prices, as in the case of hardware, but to destroy software's commodity status altogether, as the market gradually fills with free alternatives to a dominant product.

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[19] Already in 1950, Alan Turing recognized that speed would be the main qualitative difference between computers. See 'Computing Machinery', p. 441.

These general considerations correspond more or less to what has actually happened in the history of IT in terms of standardization, rapid technical progress and deflationary tendencies at the level of hardware, and strong monopoly tendencies at the level of software coupled with tendencies for software to be decommodified, even before the full convergence of IT and means of communication. Such dynamics have led to the centralized data centres of the present, which run on vast quantities of cheap, standard hardware and Free or Open Source software, and which supply potentially universal markets with proprietary—but often free (in terms of price)—software services. Of course, this cursory sketch isolates peculiarities of IT from the larger macroeconomic context. In any real economic history of these developments, other factors such as the role of cheap Asian labour would have to be considered.

Finally, if both hardware price deflation and the destruction of the commodity status of software tend to limit the prospects for profitability of IT firms even while monopoly positions develop, we might expect the dominant players to exploit their positions to derive revenue from non-IT sources or seek to move into fresh lines of production. And this is precisely what we do see: Google giving away most of its software services for free, but deriving its revenue from marketing; Amazon remaining centred on its role as a retailer of non-IT goods, such as books, but branching out into the production of new kinds of gadgets; Apple taking a significant part of its revenue from content sales via the iTunes store, while repeatedly moving into new lines of production. The imperative to exploit tech-monopoly positions for non-tech revenues might also help explain the increasing alignments between these tech giants and commercial content providers. If it is tempting to appeal to the evidence of the continuing buoyancy of leading IT players, against the grim economic outlook described by Carr, it may be that their success is precisely predicated on their extracting revenues from areas that are not presently afflicted with the general limits of the IT industry. These currently successful companies, defying a global context of crisis, may be the exceptions that prove the rule.

End of work

Carr's next book was published four years later, as the tocsins began to sound for the 2008 financial crisis. *The Big Switch* expanded the argument of *Does IT Matter?*, drawing out the historical analogies between

the development of electricity into a utility, and that of IT. Here, Carr sketched various dark prospects to be anticipated as results of the culmination of IT's 'buildout'. Notably, he gave a version of what might be called the 'end of work' theory of technological development, predicting rising technological unemployment stemming from advances in IT. Carr argued that the unemployment caused by computerization differed from earlier such developments: electrification contributed to the creation of an expanded white-collar workforce, for example, even as its application in the factory was destroying manufacturing jobs. But computers did not generate significant amounts of new employment; while they might augment demand for clerical information-processing, these tasks themselves can often be done by computers. Thus computerization 'extends the replacement of workers by machines from the blue-collar to the white-collar world'. Drawing on Jagdish Bhagwati, Carr suggested this might help explain the growing income inequalities under neoliberalism and the stagnation of incomes at the lower end of the scale: with continuous displacement of workers, pressure on wages 'becomes relentless'. At the same time, the tiny elite that controlled the data centres on which the grid-based Net runs was becoming astonishingly wealthy.[20]

Carr was particularly concerned with the fate of the intellectual worker, as the professional labour force of industries associated with information—newspapers, publishing, broadcasting—was thinned out through their subsumption under the Internet's 'universal medium'. Between 2001 and 2007, jobs in the American publishing and broadcasting industries had declined by 13 per cent, according to the US Department of Labor, with no corresponding rise in Web-related employment—here there was an even steeper decline of 29 percent over the same period.[21] (Updating Carr's statistics, US jobs in publishing industries except the Internet have now declined almost 30 per cent since 2001, broadcasting except Internet by 20 per cent, and jobs in data processing, hosting and related services by 25 per cent.[22]) Meanwhile, Carr noted, the tendency of search-oriented information retrieval to 'unbundle' content, disembedding articles from magazines and newspapers, and in the process imposing an economic calculus onto the composition of individual pieces that

[20] Carr, *The Big Switch*, pp. 136, 145–7.

[21] Carr, *The Big Switch*, p. 134.

[22] US Department of Labor, Bureau of Labor Statistics. Jobs in 'Other information services' have rebounded since the mid-2000s, and are now 13 per cent higher than in 2001, but the aggregation of Web-related publishing and search employment with such things as library services renders comparison problematic.

were now forced to compete with each other for search-engine ranking, was contributing to a decline of quality journalism.

If there is something linking Carr's economic arguments to the inward turn of his 2010 best-seller *The Shallows* it is, I think, a concern for the fate of this figure, threatened not only by economic tendencies but also by the cognitive ramifications of the decline of print—scissoring vectors which may jointly render its position precarious. Indeed, the theme of a threatened print industry would recur in *The Shallows*, alongside the more neurological arguments.[23] It is at the close of *The Big Switch* that Carr bridges these levels, capping off the negative outcomes to be anticipated from the culmination of IT's buildout in the global computing grid with a sketch of the basic thesis of *The Shallows*. Taking up a position inverting that of *Wired* magazine's Kevin Kelly—who merrily embraces the prospect of our becoming so dependent on 'the Machine' that it may feel like we've 'had a lobotomy' when divorced from it—Carr worries about the thinning out of our intelligence that may result from sustained Internet use. Unlike the printed page, with its many cognitive virtues, the Net 'stresses immediacy, simultaneity, contingency, subjectivity, disposability, and, above all, speed'. Through its use we stand to reduce our thinking to a thin, procedural operation formally mirroring machine computation, devoid of the depths of a traditional literary intelligence.[24]

Penalties and distress

The literature of technological anxiety has a long pedigree. In 1889, a contributor to *Nature* magazine reflected on the 'penalties and distresses' that 'inexorably follow each new invention'—calamities 'actually produced by the novel appliances which have been regarded as benefits and wonderful improvements':

> At present our most dangerous pet is electricity—in the telegraph, the street lamp and the telephone. We have introduced electric power into our simplest domestic industries, and we have woven this most subtile of agents, once active only in the sublimest manifestations of Omnipotence, like a web about our dwellings, and filled our atmosphere with the filaments of death.[25]

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[23] Carr, *The Shallows*, pp. 92–3.
[24] Kelly, 'We Are the Web', *Wired*, August 2005; Carr, *The Big Switch*, pp. 225–9.
[25] Charles Hallock, 'Nature's Revenge on Genius', *Nature*, November 1889.

The critical technology literature focused around what I think we can view as a single, long-emergent telecoms–computation complex has, however, articulated a specific set of anxieties around human thought. Lewis Mumford, writing from the depths of the Great Depression, raised concerns about the coming technology which, *mutatis mutandis*, could slot straight into current popular debates:

> When the radio telephone is supplemented by television, communication will differ from direct intercourse only to the extent that immediate physical contact will be impossible . . . What will be the outcome? Obviously a widened range of intercourse: more numerous contacts: more numerous demands on attention and time. But unfortunately, the possibility of this type of immediate intercourse on a worldwide basis does not necessarily mean a less trivial or less parochial personality. For over and against the convenience of instantaneous communication is the fact that the great economical abstractions of writing, reading and drawing, the media of reflective thought and deliberate action, will be weakened . . . That the breadth and too-frequent repetition of personal intercourse may be socially inefficient is already plain through the abuse of the telephone . . . With the telephone the flow of interest and attention, instead of being self-directed, is at the mercy of any strange person who seeks to divert it to his own purposes.[26]

While he is typically remembered as the first *Wired*-style techno-evangelist, Marshall McLuhan too, in *The Gutenberg Galaxy*, worried about the detrimental effect that the coming electronic communications infrastructure would have on the book and its many emanations, such as the interiorized reader.[27] Following McLuhan, figures in a broadly 'McLuhanist' tradition, such as Neil Postman, have recapitulated this theme.[28] While the immediate object of concern has changed over time—from Mumford's radio telephone–television convergence, to McLuhan's 'electric technologies', to Postman's television and 'computer technology', and now to Carr's concern about the Internet and utility-grid IT—these could all be viewed as snapshots on a continuous line of technological development.

The originality of *The Shallows* lies primarily in its employment of the theory of neuroplasticity, and certain studies on the usability of hypertext vis-à-vis printed text, to lend a more scientific basis to such

[26] Lewis Mumford, *Technics and Civilization* (1934), Chicago 2010, p. 240.
[27] Marshall McLuhan, *The Gutenberg* Galaxy (1962), Toronto 2011.
[28] Neil Postman, *Amusing Ourselves to Death*, New York 1985; and *Technopoly: The Surrender of Culture to Technology*, New York 1992.

longer-standing claims of critical technology literature, which have typically been of a wilder, more speculative character. But the basic tale is an old one, associated in particular with McLuhan and his followers. According to this story writing, print, electronic media—sometimes even language itself—are all 'technologies' that give significant shape to our cognitive (and, perhaps, other) capacities; with each innovation, these capacities are thus altered; and therefore, just as writing destroyed the human capacities and social structures of oral culture, electronic media now threaten to destroy those of print culture. In such accounts, the shift from orality to literacy is often captured—as it is in *The Shallows*—through reference to the *Phaedrus*.[29] With great irony, Plato's text has Socrates telling the story of Theuth, the inventor of writing, and the great King Thamus's dismissal of his claims: 'this invention will produce forgetfulness in the learners' souls, because they will not use their memories'—'they will appear to be omniscient and will generally know nothing; they will be tiresome company, having the show of wisdom without the reality.'

The next turn of this narrative is typically represented by the invention of the Gutenberg press, but Carr sketches a number of significant developments in the intervening history of writing which helped in the spread of literacy: the codex, the creation of orderly textual grammars, and the break-up of the older *scriptura continua*—which tended to demand a vocalizing decipherment—into spaced and thus more readily parsable words, thereby facilitating silent reading. This brought a greater privacy and internality to the experience of reading, aiding the sustained attention that permitted a greater complexity of argument. But reading remained a relatively restricted activity until the Gutenberg press changed the economics of publishing, miniaturizing the book and enabling its incorporation into daily life. With the mass-produced text, silent reading became an increasingly widely practised activity, promoting a generalized 'ethic of the book'. Now, with the decentring of the book in the age of the Internet, a new 'intellectual ethic' is coming into force, as text is increasingly subsumed by the computer and proliferated by electronic means. With these developments, concludes Carr, the depths of the cultivated literary mind stand to be lost as we paddle in the intellectual shallows of constant distraction and information overload.

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[29] See for example Postman, *Technopoly*, pp. 3–20.

Stupid is as stupid does

The central neuroscientific observation which *The Shallows* brought to bear on this was that human brains are deeply plastic in nature, constantly in a process of anatomical and physiological transformation as they reshape themselves in response to experience; it is through the shifting connections between neurons and the generation of new ones that we learn and remember. While much of 20th-century neuroscience was dominated by a mechanical metaphor which implied that brain structure was necessarily fixed, it has undergone a transformation towards a much more fluid model, following Michael Merzenich's 1980s publication of results demonstrating the existence of extensive neuroplasticity in monkeys. Beginning with the discovery that brain structure could change in adaptation to physical traumas, an awareness grew that the brain is actually in a process of constant change throughout our lives. Activities, the general flux of experience, even thought itself, shape and reshape, strengthen or weaken existing neural connections. As Carr notes, in a winking perversion of Feuerbach, or perhaps Descartes, 'we become, neurologically, what we think'.

The experimental work of Eric Kandel, which earned a 2000 Nobel Prize, indicated that memory was related to new neuronal growth, and that the habituation of sea slugs to a repeated experience was embodied in a physical weakening of specific synaptic connections, demonstrating neurological bases for learning. From this followed an undermining of strongly genetic-determinist positions: while genes undoubtedly specified many of the basic connections between neurons, experience could regulate the strength and long-term effectiveness of these links, and 'switch on' or off specific genes.[30] In this view, natural-selective logics function at the basic level necessary to enable the brain to follow its own neurological processes of adaptation throughout the life of the individual—to 'escape the restrictions of its own genome', as neurologist Alvaro Pascual-Leone put it. Carr's popularization of such neuroscientific counter-evidence to genetic reductionism perhaps explains the scoffing *New York Times* op-ed from Steven Pinker, lobbed in Carr's general direction with little attempt at reasoned argument.[31]

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[30] Carr, *The Shallows*, p. 187.

[31] Steven Pinker, 'Mind Over Mass Media', *New York Times*, 10 June 2010.

For Carr, however, this apparently liberating view of the brain did not amount to a complete neurological open-endedness. On the contrary: as repeated experiences or activities strengthened specific neural connections these could take on a coercive character, compelling us to exercise them further and thus locking in rigid behavioural patterns which could have negative consequences—drug addiction, to pick an obvious example. At the extreme, sufferers from depression and OCD might perpetuate the neurological bases of their own conditions. Neurological change could also involve the weakening of beneficial connections, as neurons were repurposed by changed patterns of behaviour: London taxi drivers tend to have a smaller anterior hippocampus in order for their posterior hippocampus to accommodate a vast spatial knowledge of the city.

Tool use, too, has strong neurological effects, with tools actually mapped by our neurons as if they were extensions of the body; thus violinists develop a demonstrably different brain structure to others. This was the capstone to Carr's neuroscientific argument: if the science was right, the extensive daily Internet use to which our minds were increasingly submitted had to be inscribing significant new neurological patterns. With its quick request/response cycles, multisensory stimulation and informational overload, the Net was perfectly suited to retrain our brains into addictive new behaviours. Worse, it induced a state of distraction as the welter of data vied for our attention. In this state of overload, humans had to struggle to synthesize new experience, to convert it into the kind of meaningful long-term memory that was the basis of further understanding. What seemed to be getting lost were the neurological benefits of book reading: the capacities for sustained focus and linear, structured thinking. Numerous studies, many of which were systematically surveyed in 2005 by Diana DeStefano and Jo-Anne LeFevre, had served to indicate hypertext's cognitive inferiority to the traditional printed page.[32] Rather than offering stimulating opportunities for the non-linear exploration of topics, as was once thought, the constant navigational possibilities encountered on a hypertext page added a significant cognitive overhead, as the reader was asked constantly to choose between the text before her and some other temptation. In one of his more tenuous rhetorical manoeuvres—reminiscent of McLuhan's claim that electronic media were inducing a new state of tribalism—Carr suggested that we were

[32] Diana DeStefano and Jo-Anne LeFevre, 'Cognitive Load in Hypertext Reading: A Review', *Computers in Human Behavior*, vol. 23, issue 3, May 2007, pp. 1616–41.

being returned to a primordial state of distraction, regressing to a primitive state from which the Gutenberg press had previously freed us.

The question concerning technology

In addition to McLuhan, Mumford's *Technics and Civilization* was an influence here. For Mumford as for McLuhan, technological developments marked out transformations of humanity itself, enhancing our faculties but altering them in the process. In this argument, what Carr termed 'intellectual technologies' in particular—map, clock, typewriter—both augmented our mental abilities and transformed them. Each carried an 'intellectual ethic', a hidden norm of mental functioning, that might be obscure to users—and even inventors—yet which shaped them nonetheless. As these technologies entered general use, passing down the generations, their intellectual ethics became ingrained in the structures of human experience, acquired as standard by each individual. The history of technology could thus be read as a history of transformations in the human mind. It was the clock, in Mumford's thinking, which, by enabling an abstract conception of time, set in play the mathematization of reality and the beginnings of scientific modernity. Similarly, the map enabled an abstraction from the experience of space. For Carr, given what we now know about neuroplasticity, each of these technological transformations must have had implications at a neurological level—though this claim could not be falsified by digging up the brains of our ancestors.

But what might explain the timing of the uptake of technologies? Why, for example, did the water-wheel—already considered a potential source of power in the Roman Empire—only seriously catch on in Europe in the later feudal period?[33] The invention of a technology, that is to say, is not enough to explain its generalization, nor that of any resulting 'intellectual ethic'. In more technicist, and especially McLuhan-influenced, readings the development of 'technologies' such as writing and the Gutenberg press often serves as the explanatory ground for a vast array of phenomena, from the creation of the modern nation-state to the development of an interiorized, reflective subjectivity. But what explains the perfection of the Gutenberg press itself around 1450, and why did its use catch on so rapidly? Many in Europe other than Johann Gutenberg

[33] Perry Anderson, *Passages from Antiquity to Feudalism*, London 1974, pp. 79–80.

were simultaneously straining at that time to develop a technical solution to the problem of the mechanical reproduction of text. From the end of the 12th century the commercially organized mass-production of manuscripts had advanced apace, fuelled by the development of a reading public around the new universities, and turning out works of literature and romance as well as treatises in law, politics and science, and editions of classical authors such as Aristotle. The Gutenberg press was, of course, invented to solve a specific problem: that of the economical reproduction of text. And this could only be a problem insofar as books were already in demand among a substantial social layer that wanted to read them and was able to pay for them—a demand which was evidently not met by the production of manuscripts.[34]

The Gutenberg press, as Carr is well aware, did not precede or produce the literate subject, but merely facilitated its generalization by making the production of books more economical. Along the way it undoubtedly—through some of its own formal characteristics—exerted an influence on the text it carried, through the standardization of typographical practices and styles, or the page lengths technically viable for printing and binding, for example. It would follow that the reading experience was thereby shaped in significant ways. But there is a tendency in the critique of technology to over-emphasize such factors at the expense of farther-reaching socio-historical explanations. If the history of technology may be read as a history of transformations in the human mind, we need also to remember that there will be many other determinants simultaneously shaping that mind: city life, war, procreation, to name but three. More generally, one would need to look at the extent to which the exchange relation mediates social reproduction; the structure and role of the family; the existence of larger-scale social and cultural formations such as classes, genders, castes or religions; the degree of linguistic uniformity; the formalization of acceptable behaviours as laws or ethical norms; patterns of work and education. Such things must, of course, have had some bearing on the historical generation of the literate individual associated in this tradition with the Gutenberg press. A similar array of factors would need to be taken into account in considering any analogous transformations that may be underway in the age of the Net.

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[34] Lucien Febvre and Henri-Jean Martin, *The Coming of the Book: The Impact of Printing, 1450–1800*, London 1976, pp. 15–76.

Though his technological perspective has sometimes overreached itself—*The Big Switch* practically suggested that grid-based electricity could explain the whole shape of 20th-century American capitalism—Carr has not been naive to such matters.[35] Aware that arguments of this kind conventionally call forth accusations of technological determinism, he attempted in *The Shallows* to head these off with a distinction of levels. At the level of immediate experience—and even sometimes at a social level—humans could clearly choose which tools to use, and how to deploy them; but from a broader historical perspective, technological development must be viewed as having its own logic, for the human race did not volunteer *en masse* to adopt a technology like the clock, the map, the gun or the Internet, or choose in pristine, abstract freedom how to use it. This did not mean that technologies develop autonomously—the roles of social, economic and other factors also needed to be considered—but it was clear that a new technology, once it began to take hold, exerted a certain kind of compulsion. Whilst this is no doubt true, what is obscured in these qualifications is any sense of the proportional weight of these various factors. Can it be shown that the influence of technology on the structures of cognition is so great as to justify technological periodizations of the modalities of human thought *per se*? Might not other factors reverse or cancel whatever influence technology might be thought to have, or complicate it to the extent that we would be better served looking for another waymark? Does it make sense, for example, to see the invention of text in itself as marking the end of the era of orality, when epic poets persisted in many parts of the world for several thousand years after and alongside its invention?

Standpoint of the interface designer

The primary causal factor Carr identifies in the decline of the 'cathedral-like' literate mind is the computer as an object of practical interaction. It is through our direct engagement with this tool that it can most plausibly be said to provoke the formation of new neural patterns, just as violin-playing cultivates a specific neurological mapping. And, with the Web an increasingly dominant source of information, it is on this immediate level that the displacement of the book is grasped: instead of picking up the book we open the laptop; instead of the book's quiet focus we immerse ourselves in the Web's blizzard of data. It is through this

[35] Carr, *The Big Switch*, chapter 5.

interaction that we transform ourselves, in some ways for the worse. The two sole elements of this conceptual figure are the individual human user, and the technology with which they interact: it expresses what we might call the 'standpoint of the user-interface designer'. The neuroscientific developments on which Carr bases his arguments are also the basis for current research on 'Brain–Machine Interfaces'—directly brain-controlled prosthetics—while research on computer use that he employs is of the same type that Web designers use when refining Web applications.[36] The user viewed from these perspectives is necessarily a rather abstract individual, largely undetermined by social, economic, geographical, cultural or other conditions. Confined to such well-defined areas of enquiry, this abstraction is a rational one. But Carr wants to draw from the experience of this abstract individual a broader socio-historical vision of cultural decline, and it is not clear that this approach provides a sufficient basis for such a vision. While we might accept that Carr's neurological arguments about Web use are compelling, on their own they do not fully justify the broader picture given in *The Shallows*.

A limitation of the 'standpoint of the interface designer' is that it is liable to leave us pondering upon limited, merely technical fixes. Might the beleaguered subject of *The Shallows* find comfort in new anti-distraction, anti-fragmentation, anti-high-speed forms of content provision? Will our salvation be the e-reader perhaps, with its general lack of flashing banner ads and hyperlinks that may sabotage concentration? Carr seems to have foreseen that such thinking might blunt the negative force of his argument and spends some time arguing, somewhat unconvincingly, that e-readers are just as distracting as fully-fledged computers.[37] While they clearly have their limitations, their clunky interfaces and limited Web access hardly entice us to stray waywardly into the Web's data thickets in the same way that a proper Web browser does. But nor could we plausibly argue that such tools will solve the problems facing the traditional literate mind: because the problems of this mind are not merely technical, but social and economic. They are also political.

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[36] For brain–machine interfaces see e.g. Lebedev and Nicolelis, 'Brain–machine Interfaces: Past, Present and Future', *Trends in Neuroscience*, vol. 29, issue 9, pp. 539–43; for Web usability research see especially Jakob Nielsen's work at useit.com.

[37] Carr, *The Shallows*, pp. 101–4. Elsewhere Carr has written more plausibly of the problems of e-books, not in terms of distraction, but in terms of their lack of the permanence possessed by the printed page. See Carr, 'Books That Are Never Done Being Written', WSJ, 31 December 2011.

Carr's model for what we might call the 'book-user'—the contemplative literate subject—is grounded particularly in visions from American Transcendentalism and Romantic poetry. It is Nathaniel Hawthorne sitting meditatively in Concord, Massachusetts, prior to having his concentration broken by the intruding sounds of modernity, or the Keats of *Ode to Psyche*.[38] This figure supplies the norm against which to measure our technological decline. But it surely faces many other challenges at present than the formal character of technology: the generalization of insecurity and economic precarity; the erosion of the separation between work and life; the decline of the home's integrity as a space external to the bustle of capitalist existence. In this world it is for most of us, sadly, a rare thing to be able to carve out the psychological space that this figure requires, to sit at length with the tranquillity required for 'deep' reading. The computer and the Web may well be significant factors in bringing this situation about—not only through our direct interactions with them, but also through their social, economic and cultural implications, many of which are ably traced by Carr across his three books. But there are clearly other factors too, beyond technology. The Web, we might say, is the pre-eminent technological construct of an increasingly sickly neoliberal capitalism. As such, it is a major factor in shaping the vectors of behaviour and experience that characterize this world. But it is also a product of these, and of the society in which they take place. It is hardly surprising that the technology of a hyper-flexibilized, insecure, turbulent world offers little security to the purposefully structured, meditative mind.

[38] Carr, *The Shallows*, epigraph and pp. 166–71, 219–20.