End of technological innocence

Casio PB-110. That was the first computer that I laid my hands on – my father got it for me when I was 14 or so. Programming a computer was wonderfully satisfying. It was also around that time that I read about 5th generation computers and artificial intelligence -- I did not necessarily grasp what that meant beyond the vague idea that machines could think. Combined with the simple thrill of problem-solving and programming, and excited with the prospect of 'thinking machines', I was hooked by computers.

I have come a long way since then -- I went on to get a B.Tech, M.S. and PhD in Computer Science. Yet, along the way, technological fascination has given way to a sense of unease surrounding technology. Even as I continue to be engaged with and by computers, the technological innocence has long disappeared – 'thinking machines' no longer interest me. This essay is an attempt to grapple with what changed.

I was in a state of technological innocence till perhaps about 1998 – a couple of years into my Ph.D. program at the University of Wisconsin, Madison. I don't remember thinking about the public interest, ethics surrounding technology, impacts of technologies on society, or other such weighty matters. In retrospect, that innocence was not limited to technology – the ignorance ran far deeper than that. I was not really attuned to the world and its workings – the social, political, economic, cultural, ecological, governance, and various other systems and forces that shape our world. I was a frog in the technological well. This is not to imply that I am no longer a frog in other wells – it is just that I don't feel I am a digital frog anymore.

It was around 1998 that I got familiar with the debates around the Narmada Valley Development Project. Without going into the details of these debates what is pertinent in the context of this essay is that large dams are monumental technological and engineering accomplishments. But like all technological artefacts, they interact with the various non-technological social[1] forces and produce consequences that are not always for the good. These and other debates surrounding technology (genetic engineering, nuclear power, nuclear weapons, 'labour-saving' technologies) along with some academic courses in history of science, and various other factors (my circle of friends, for one, or the nature of the UW-Madison campus, for another) expanded my thinking about technology.

Today, the popular discourse around most technologies is based on value associations of advancement, progress, development, inevitability, and various shades of technological determinism (technological change is inevitable, technology changes society, technology-driven change is always good). These associations get especially stark with computers and associated digital technologies.

To use an admittedly vague abstraction, every technology has its own internal potential to influence and

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[1] Here and in the rest of this essay, I use the term 'social' as a proxy for the various non-technological forces: societal, political, economic, cultural, economic, ecological, religious, and others.

be influenced by each of the social forces operating in our world. Thus, how a particular technology will be designed, used, and what impacts it has in our world is a complex interplay of these internal potentials and the external forces. To take a simple example, in an urban US neighbourhood where machine dryers are the norm and which is more concerned about visual aesthetics and less about energy usage, use of a clothesline can lead to conflicts or can herald a 'green movement'[2], whereas the use of a clothesline in an Indian setting where they are the norm has no significant social implication. A clothesline is a drying technology and so is a machine dryer, but, when compared to the clothesline, the potential of a machine dryer to adversely affect our environment is significantly higher because it consumes electricity in its operation and far more material resources in its production.   Thus, a technology's internal design (machine dryer vs. clothesline) interacts with external forces (neighbourhood visual aesthetics, zoning laws, traditional practices, effects of greenhouse gases) to produce effects that only make sense when technology is seen as embedded within a social fabric.

Without electricity, another ubiquitous technology, modern industrial civilization might simply grind to a halt. In the past, most of us did not have to look beyond the switches we flipped: the dams that generated the electricity and their impacts on people or the environment; the coal-burning plants and the pollution they caused; the nuclear-power plants and the impacts of mining uranium on those who lived nearby, and so on. But, in our climate-changing world today, we come face to face with this other side of electricity consumption and generation – its impacts on our climate, because that more starkly than probably anything else highlights the embedded / interwoven / interdependent nature of our technologies.

Computers, as technologies, are subject to all of the same considerations. Being real material products, they need to be manufactured, they consume resources, and they produce waste. Even the Internet, often experienced as virtual and immaterial, is realized through a panoply of physical products: computers, cables, switches, routers, satellites, electricity generators, data centers, batteries, etc. All of these consume material resources and produce waste. Where do these resources come from? How are they produced? Where does the energy come from?[3] What happens to the waste? How is the waste handled? Electronic waste (compounded by the fast-paced obsolescence of computers) is a serious problem today. Yet, does it have to be this way? Couldn't computers and computing systems be designed with a view to minimizing obsolescence, electronic waste, enable upgradation and be repaired? There is nothing inevitable about this path – it is just that like all other material products,

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2 This is not a contrived example. Search for *'The Right to Dry'* on the web. Example: *The Right to Dry: A Green Movement Is Roiling America; Clothesline Has Neighbors Bent Out of Shape in Bend; An Illegal Solar Device* http://online.wsj.com/public/article/SB119007893529930697.html Last accessed: Dec 31, 2007

3 Data centers that power a lot of the internet's web services are an increasing source of power consumption today. Around the world, they consume tens of gigawatts of electricity. According to a news report I read, in 2005, data centers accounted for 1.2% of electricity consumption in the US. This 1.2% does not account for all the computers used in homes and offices, and this is before YouTube, Myspace, Facebook, etc. really kicked off. As more and more people get on the internet, as more and more data migrates to the internet, as more and more devices are internet-enabled and exchange data on the internet, this energy consumption is only going to go up.

computers and other digital technologies are subject to the same social forces that promote a use-and-throw attitude towards resources. And so, we find that the Internet and the electronic World Wide Web on the Internet is held together by a physical web of interconnected material resources, their associated resource, production, and waste generation cycles, and so on.

In recent times, I have noticed an increasing fascination with the e- prefix: e-governance, e-learning, e-communities, e-democracy, etc. I don't find anything inherently wrong with this as long as these concepts are rooted in the underlying practices and systems: governance, learning, communities, democracy, etc. Do computers have a role in governance, learning, fostering and building communities, fostering democracy, etc.? Absolutely. But, if our focus is on governance, learning, community-building, democracy, why are we talking about e-governance, e-learning, e-communities, e-democracy, etc.? Do we talk about tele-governance, paper-governance, in-person-governance, etc.? The overuse of these terms indicates to me an overemphasis on the technology and a potential underemphasis of the endeavours within which these technologies are being deployed. Stepping back a little and without discounting any of the power, politics, and possibilities engendered by electronic and computing technologies, the increasing use of these e-terms also indicates to me a certain form of emancipatory hope placed on electronic and computing technologies.

As a more concrete and potentially controversial example, automation and computerization are often proposed as solutions to tackling corruption. But, fundamentally, I see corruption as a problem rooted in human beings. Attempting to eliminate corruption by eliminating human involvement is hardly a solution. It merely shifts corruption to other places and to other human beings, from lower levels of the bureaucracy to higher levels, from petty corruption to scams. Human beings in governance and decision-making processes are not going away any time soon. It seems to me that the real solution to tackling corruption in governance processes relies more on understanding the real reasons for the sources of corruption and addressing those and less on using computers as a tool to edge out humans. In that sense, the Right To Information Act passed recently is a better solution to the problem of corruption – and this is a solution rooted not in computers, but one rooted in increasing transparency in governance. Thus, computers have a role in this, but they are not the answer.

Corruption is not the only arena in which computers are increasingly being deployed to automate and minimize human involvement. They are being used to cut costs, to increase efficiencies, to eliminate human errors, to eliminate human discretion, and so on. On the one hand, increasing automation is the logical progression of how industrial technology has been deployed. On the other hand, to use a somewhat trivial example, I often find myself frustrated stuck at the other end of an automated telephone service unable to get through to a human being. Mindless automation simply to eliminate human involvement, increase 'efficiencies' and cut costs makes me wonder how far we are willing to go along that path. While I don't think that the scenarios laid out in the movies Matrix, Minority Report, or I-Robot are going to come about any time soon (or ever indeed), those movies do raise important questions that I ponder over – what does it mean to build machines that can deploy brute computational power, that are coldly rational and logical, what is uniquely human about being human, and so on.

Fundamentally, all compassionate human interaction is based on exercising our uniquely human qualities, our judgment, wisdom, discretion, and experience, not all of which can be captured through rules, laws, and algorithms. The problem with computers is that they are rule-bound. And, therein lies a core mismatch between how computers function and how human beings engage with each other and with the world. Even though some degree of adaptability and 'learning' could be (and is being) built into computers, these techniques are fundamentally limited. Cold reasoning, even if adaptive, is nevertheless limited. And, therein ends my childhood fascination with 'thinking machines'.

These days, with increasing amounts of computing power, digital storage space, and network bandwidths, a lot of different kinds of data is migrating to the internet (documents, news, photographs, music, video, etc.). There is an increasing amount of social interaction taking place on the internet via email, chat, blogs, forums, social networking sites, and almost any website worth its salt that includes an interaction component. Additionally, almost all of our travels on the internet leave trails behind – in the form of IP addresses, email addresses, cookies, blog posts, comments, friends, acquaintances, articles we read, things we shop for, things we search for, questions we ask on forums, and so on. With an increasing interest in 'personalization' of web services, piecing together our trails into coherent pieces of our identity and our interests makes for great business. With the increasing availability of computing resources (processing power, storage, network bandwidth), combined with an increasing consolidation of web services (eg: Google and its various offerings), it is increasingly possible to do this. What this all means is unclear – but, that this is not all for the good should be obvious! The effects can range from the pleasantly surprising (recommendations and unexpected connections), annoying (I don't need a dumb machine telling me what I should buy), worrisome (violation of privacy), to the serious (government surveillance, monitoring, and arrests as in the case of a Chinese journalist turned in by Yahoo).

There are other unintended consequences of how the Internet functions. The things we post on the Internet, once posted, escape to places beyond the places we posted them (caches on and off the internet with various longevities, backups, mirrors, blogs, forums, emails, etc.). Therefore, after according me some space for hyperbole, the Internet carries the potential of perennial longterm memory (even as, paradoxically, any individual item on the Internet is fragile – for example, I irretrievably lost a bunch of files when my hard drive crashed recently). The implications of this are once again unclear. All of us do and say things that we sometimes come to regret in later years. In the non-internet medium, the effects are somewhat contained, and at some level, there is a natural forgetting that takes place. Except for the limited range of material that gets preserved for the long-term via published books, in the pre-Internet days, a lot of our histories get forgotten except in the form of memories preserved amongst friends, family, and acquaintances, and which are only accessible, if at all, through painstaking research. It seems to me that forgetting and erasure from the public domain is part of the process of our growing up. Yet, on the internet, that luxury no longer seems to be there. What I might have said 5 years back, or what I might say or write today could potentially be dug up, collated, filtered, sifted out, and presented to the sufficiently curious, even though I might have moved on in life, changed opinions,

and so on. What are the implications of this 'unforgettableness' of information on the Internet? While it might seem that this is not very different from other public domain mediums, with computers and their inherent computational and recall potential, the situation is vastly different because it is not just the formal publications that get dug up, but every little piece of information that is somehow associated with me. It is likely that we will all adapt to these dynamics, but, there is something unsettling about this.

So, to come back to the recurring theme of this essay, it is no longer possible for me to look at technologies in isolation. Even as I am still grappling with what it means for technologies to be intimately embedded within our social fabric and our highly interdependent world, I am permanently disabused of the notion that computers and various other technologies are the primary answers to the various problems that afflict us as a world and as human beings. I have become skeptical of single-minded technological fixes to our problems, because they often seem to introduce new problems in place of old ones.

I cannot really conclude this essay without addressing the obvious question that may occur to some readers. What do I really think about the role of technology generally, and computers specifically? Am I a techno-cynic (advocating that technologies are fundamentally bad, technologies have no role to play)? Hardly. That is a false question in my opinion. Entertaining the notion that we can even live in a technology-free world is absurd. Isn't paper technology? Hatha yoga is also technology, in the strictest sense of that term. My questions have more to do with the kind of technological paths that we walk on. Even as we arrive at personal decisions to these questions, this will always remain contested terrain with different interest groups advocating different technological paths. As for me specifically, at this time in my life, I am trying to focus my attention on how computers can play a role in projects that are expressly rooted in the public interest and where there is some clarity as to what role computers can play in the project. This is not to mean that the answers are obvious. Even here, I am having to grapple with questions. For example, how far am I responsible for my technological creations and their unintended uses – if I develop a web service for enabling researchers and non-profits to aid their tasks of news monitoring, and it gets used for information censorship in other contexts, am I responsible for those uses?

The result of becoming aware of technology-society interactions seems to have made it harder for me to work with technology without asking questions, even if the answers themselves are never obvious. I don't know what to do beyond keeping a focus on the problem, cultivate an awareness of different technological paths and their consequences, and make as informed a decision as possible. Even then, there is no getting around the rule of unintended consequences, at which point, I have to make peace.