The Past and Future History of Gnarly Computation

by Rudy Rucker

[This is section 5.5 of my book, *The Lifebox, the Seashell, and the Soul: What Gnarly Computation Taught Me About Ultimate Reality, the Meaning Of Life, and How To Be Happy* (Thunder's Mouth Press, October, 2005). See www.rudyrucker.com/lifebox for more about the book.]

By way of preparing to write these remarks, I reread some of Marshall McLuhan's work, and was reminded of how really funny and off-the-wall he could be. Presenting a traditional, logical argument wasn't McLuhan's bag. He was much more prone to dart in and zap you with a wicked turn of phrase. And he never seemed to worry about sounding silly.

In that spirit, and with much cribbing from the Master, here's my not-quite-serious table presenting the history of human innovation as a history of computation.

Innovation	**Viewed as a Computation**
Speech	Moving from gestures to speech gives people a higher bandwidth channel for communicating their thoughts. Society becomes able to perform more complicated computations.
Hunting and fishing	Knowing where to look for game means mentally simulating animal behavior, that is, it means emulating a computation. Using bait means influencing an animal's computation by applying the proper inputs.
Agriculture	Knowing that seeds compute plants involves insight into the process of wetware computation. Plowing is a form of soil randomization. Irrigation is a way to program the analog flow of water. Crop rotation is an algorithm to optimize yields.
Animal husbandry	Caring for animal requires insight into their computational homeostasis. Selecting optimal individuals for further breeding is genetic engineering on the hoof.
Wheel	Wheeled carts allow long-range glider-like transferal of embodied information, making society's computation more complex.
Law	A legal code is a program for social interactions. Enforcing the code produces high-level determinism which makes the system easier to manipulate.
Surveying	Surveys allow a society to determine simple address codes for physical locations. Space becomes digital.
Calendar	Noting the solar system's cycles marks coordinates in time. Time becomes digital.
Sailing	Sailors learn to simulate and tweak the analog computation of airflow effects. Course planning involves higher-level simulation.
Pottery	The clay and the brushed-on glazes are the input, the kiln is the computer, the pot is the output.

Brewing and fermentation	The vat is a biocomputer, sensitive to the input variables of malt, sugar, and yeast. Over time, the best yeast strains are sought out by tasting and comparing; this is hill-climbing in a gustatory fitness landscape.
Spinning and weaving	The yarn is computed from the fibers. Weaving digitizes a surface into warp/woof coordinates. The loom is the first programmable mechanical computer.
Mining, smelting, and metallurgy	Mining is a form of data retrieval. The blast furnace transforms ore inputs into slag and metal outputs. Metallurgy and chemistry concern the computational rules by which matter combines and transforms.
Writing	Writing translates speech into a format portable across space and time. A written text promotes long-distance information exchange and long-term memory storage.
The alphabet	Using a limited number of symbols digitizes writing. Use of the alphabet also simplifies the algorithm for writing. The democratization of writing allows people to write things they wouldn't be allowed to say.
Printing press	The type letters act as primitive symbols that are assembled into a kind of program — which prints a page. Printing multiple copies of a text enhances class four communication.
Books	The book amasses large amounts of text into portable form. The book is the precursor of the hard drive.
Universities	A university provides a node where adults can exchange very large amounts of information. Given that the students go out and affect the society as a whole, the university is in some sense a central processing unit for the social hive mind, drawing together and processing society's thoughts.
Water wheel and windmill	These devices convert chaotic fluid motions into regular periodic form. The excess information is returned to the fluid as turbulence.
Gunpowder	Bullets are high-speed gliders. Shooting someone allows an individual to do a remote erase. Reckless, catastrophic killing enhances interest in long-term information storage.
Machine tools	By creating precise mechanical tools for making machines, we model the biological process of self-reproduction. The machines come alive and begin evolving towards greater complexity.
Clocks	A finer-scale calendar, a zoom into the time dimension. Clocks use class two systems of gears that do the same thing over and over. Clocks are a tabletop model of determinism.
Steam engine	The steam engine is an artificially alive device that eats coal and transforms it into motion. The chaos of fire is converted into the reliable class two oscillation of the pistons.
Locomotive	When placed upon wheels, the steam engine becomes an autonomous glider. The country-to-city diffusion rate is changed, which in turn alters the Zhabotinsky scrolls of population movement.
Internal combustion engine	An evolutionary advance above the steam engine, and an early example of compressing the size of computational hardware.

Factory assembly line	The factory represents a computing system that codifies the procedures of a given craft. The possibility of mass production allows us to view physical objects as information, as abstract procedures to be implemented as many times as we please. Three dimensional objects can now be reproduced and disseminated as readily as books. Mass-produced devices become plug-ins for the computations embodied in people's homes.
Movies	A temporal sequence is modeled by a series of discrete frames. An early form of virtual reality.
Automobile	The personal vehicle allows individuals to control transportation. A formerly centralized technology is now in the hands of the people. Meetings and markets can be freely arranged, making the economy's computation more class four.
Electrical generators and motors	Electricity collapses the length of society's computation cycles. The system clock speeds up. Electrical lights disrupt the cycle of day and night; computation becomes continuous. There is now less of a border between the media and the human nervous system. People begin to view themselves as components plugged into the hive mind.
Telegraph	Writing is transmitted as a digital binary code. Society begins to grow its electrical network.
Telephone	Unlike the telegraph, the telephone is a peer-to-peer medium — you can make a phone call from your home without having to deal with a telegrapher. People are free to exchange "unimportant" information, that is, to talk about their moods and emotions, thus in fact exchanging a much higher-level kind of information than before.
Plastics	By designing new materials, chemists begin to program brute matter. Deformable and moldable, plastics can take on arbitrarily computed shapes. Objects are now programmable.
Radio	While books could broadcast digitized thoughts, radio broadcasts analog emotion. The hive mind gains power, as listeners form realtime virtual crowds.
Airplane	When riding in a plane, one can look out the window and see a landscape as an undivided whole, gaining a notion of a nation as a unit. With familiarity, people stop looking out the airplane windows, and air travel becomes a hyperlink, a teleportation device. In the United States, the "flyover" states become invisible to the cultural powers, promoting a schism in the hive mind.
Television	Since moving objects are important, our eyes have evolved to stare at flickering things; therefore we find TV hypnotic. Watching TV is work, our minds labor to fill in the missing parts of the virtual reality. Society gains a stronger hive mind than ever before. But at the same time, the hive mind is debased by ever more centralized control.
Atomic power	The physicists complete the chemists' work, and even atoms become programmable. We see the must fundamental units of matter as information to be manipulated.
Computers	Billed as the universal machine, the computer is brittle and hard to use. The digitization of essentially everything begins, in most cases degrading and corrupting the information.

Email	Email spreads the workplace into the home. The upside is that you don't have to commute, the down side is that you can't leave the office. Email is addictive, and people become ever more plugged in. Yet email provides an alternate to the centralized news network, and many smaller hive minds take form.
The Web	The hive mind expands its consciousness. And at the same time the subhives' minds gain further definition. The web page does for publication what the automobile did for transport — the gatekeepers lose importance. The Web becomes the ultimate global information resource, the universal data base. Social computation becomes nearly frictionless; people can interact at a distant every more effortlessly.
Biotechnology	Biologists begin to program life. Society tries to apply legal codes to life, with unpleasant and confusing results. Real biological life continues anyway, still managing to avoid control.
Cell phones	A tight, personal, peer-to-peer medium that approaches telepathy. As people coordinate activities in real time, short-lived spontaneous mini-hive minds emerge.
Wireless gizmos	The pocket-sized cellphone-webviewer-digicam-organizer-notepad. These over-featured products are in some sense like small pets, requiring that their keepers spend substantial effort in tending and programming them. The point is no longer to make things easier for the owner, but to give the owner a hobby. These gizmos are artificially alive and parasitic.

Table 1: History of technology as a history of computation.

Although I'd always supposed McLuhan to be a cheerleader for progress, I recently found out that the opposite was the case.

> I am resolutely opposed to all innovation, all change, but I am determined to understand what's happening. Because I don't choose just to sit and let the juggernaut roll over me. Many people seem to think that if you talk about something recent, you're in favor of it. The exact opposite is true in my case. Anything I talk about is almost certainly something I'm resolutely against. And it seems to me the best way to oppose it is to understand it. And then you know where to turn off the buttons.

I found the quote in Paul Benedetti and Nancy DeHart, eds., *On McLuhan: Forward Through the Rearview Mirror*, (Prentice-Hall Canada, 1997), p. 70. This book is a collection of quotes from McLuhan and comments on him by his peers. The quote in question was taken from a 1966 Canadian Broadcasting Company TV interview called *This Hour Has Seven Days*.) It's also illuminating to read the excellent biography, Philip Marchand, *Marshall McLuhan: The Medium and the Messenger* (Ticknor & Fields, New York 1989). McLuhan didn't even drive a car — he said he didn't want to be a servomechanism for a machine!

Although I appreciate the spirit of McLuhan's remark, I don't fully agree with it. Do

note that when he speaks of "turning off the buttons" he's not talking about changing *society*. That's pretty much hopeless. Society's class four changes don't have buttons that we can control. If something bothers you, the best you can hope for is to change how you react to it — and turning off your *own* buttons is one approach.

Turning off my own buttons vis-a-vis a social change involves trying to ignore it. That is in fact my strategy for handling the mind-manipulation of TV. I watch the tube very sparingly, generally limiting myself to commercial-free channels, and above all avoiding the so-called news.

Opening my heart and accepting change is another approach. I kept digital cameras at arm's length for many years, but finally I let them into my life and I'm glad. In the past I looked down at digital photographers, at their tendency to be staring at their device's tiny screen instead of directly looking at the world around them. But now I find that having a camera in my pocket means that I look at the world harder and more deeply. If I can use a technology in a creative way, I feel like it hasn't got the better of me. But sometimes this is an illusion.

The issue of computers is a particularly vexed one for me. In his later life, McLuhan recast his adage "the medium is the message" as "ignore the figure and watch the ground" — meaning that that the best way to understand the effects of a new technology is to look at how it changes its surroundings.

Thus, in the case of computers, rather than talking about what computers do or what computation means, we might look at how they change people's behavior. It's not a pretty picture.

I think of the toll my machine has taken on my wrists and my back. I think of the never-ending hardware and software upgrades — as *The Lifebox, the Seashell, and the Soul* has grown larger and more heavily illustrated, I've had to upgrade everything just to stay afloat — and of course each upgrade ushers in fresh incompatibilities and unhappy days squandered in battle with obscure bugs. I think of the lost opportunities for conversation with my family and friends, me sitting hypnotized at my keyboard. Even when I mean to take a break in a coffee shop, often as not I bring my laptop and sit isolated behind my portable screen. Although I wonder how it would be to live in a world where my time was my own, I'm hooked on the power and expressiveness of my PCs.

But that's enough frowny-face fretting over my accelerating dehumanization! ☹

Let's see what fresh wonders the future might bring! ☺

Here's a table of computation-related inventions that might show up over the next two thousand years or so. The table is adapted from my widely unread Y2K work of futurology — which I unwisely saddled with the title *Saucer Wisdom* (Tor Books, 1999).

Future Technology	**Description**
Piezoplastic	Plastic whose colors and shape are dynamically controlled by electronic inputs. Usable as a soft, floppy computer display that you can stuff in your pocket like a handkerchief.
Lifeboxes	Artificially intelligent simulacra of people. A combined blog and video diary with a search engine that's able to answer questions.
Limpware Engineering	We'll learn how to program piezoplastic like silicon chips. The whole computer can become soft and floppy as a banana slug.

Dragonfly cameras	Insect-sized flying cameras, individually owned (or rented) so people can see whatever they want. The whole world becomes accessible on the Web.
Radiotelepathy	It becomes possible to electromagnetically send thoughts from brain to brain. The use of lifebox databases for individual "contexts" makes this possible.
The uvvy	The ultimate wireless device; the piezoplastic uvvy sits on your neck and gives you web, email, phone, and direct thought access.
Recording dreams	A side-effect of the uvvy. There's a culture craze for dreams, society becomes more surreal. If you sleep with your uvvy on, you can record your dreams. People can arrange to share dreams. A significant down side is that the flow can go the other way, with dreams now containing commercials trickling in over the uvvy.
Knife plants, House trees	Genetically engineered plants begin producing consumer goods, for instance knives. A largish specialized seed can grow you a house. Machines as we know them go away. In every instance, it's cheaper to grow a living device. Think of house flies — all they need to replicate is water and garbage. Now suppose that the flies are doing something useful for you like acting as dragonfly cameras, or picking bits of trash from your floor.
Pet construction kit	People can program their own pet characteristics. Pet dinosaurs are very popular. Animals are now fully programmable.
"Aug dog"	People bioengineer their bodies, these changes are called augmentations; thus the popular term for a body changers is "aug dog." The body becomes more virtual, less real.
Archipelago people	You can have several disconnected hands or eyeballs that move about independently from your main body; you stay in touch using uvvies. "I seem to be a network."
Mermen , mermaids	Bioengineered people move into new niches like under the sea.
Programmable clones	You can speed-grow an adult clone of yourself in a tank and program its brain with the contents of your lifebox file, creating a person very much like yourself. Given the class four nature of your computation and the differing initial conditions, the clone wouldn't be identical to you, but its behavior will be exploring the same strange attractor.
Femtotechnology	It becomes possible to transmute neutrons into protons and vice-versa, allowing us to change the atomic makeup matter. A device called the alla can turn, for instance, dirt into air. The age of direct matter control arrives and we can change anything into anything. Matter is now fully programmable by the average person.
Space migration	People use allas to live in asteroids, turning their stone interiors into dirt and air.
3ox	A new technology for identically copying existing objects. Living bodies can be 3oxed as well. The process works around the quantum mechanics no-cloning theorem.

Ooies	Uvvies become bioengineered internal organs, so that people are constantly in contact. Society truly becomes a hive.
Colony people	Some individuals 3ox or clone hundreds of copies of themselves, with the copies connected via ooie. It's a new kind of human mind.
Spacebug people	Still more advanced bioengineering allows people to live in the hard vacuum of outer space, and to propel themselves like rockets.
Teleportation	Insight into fundamental physics gives people the ability to jump to arbitrarily distant space locations.
People free to move in higher dimensions	Travel to the other worlds beyond our space and time.

Table 2: Milestones in an Imagined Future History

We might suppose that the dates run from about 2050 to 4050.

By the way, you can find my drawings of many of these inventions on the *Saucer Wisdom* web site, www.saucerwisdom.com.