Connected Everywhere,

Connected All the Time,

Connected to What?

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> The computer is incredibly fast, accurate, and stupid. Man is unbelievably slow, inaccurate, and brilliant. The marriage of the two is a force beyond calculation.
> – Leo Cherne (1971)

Cherne's statement is still true. Computers are faster than ever, and getting faster. They are even more precise, and while they accumulate more information every day, they still don't know anything in the sense that a person knows things about the world—they still lack understanding. In comparison people are just as slow, inaccurate and brilliant as they were when Cherne made this comment. It has often been said that 'opposites attract.' But marriage of people and machines, what was he thinking? He was probably thinking that people and computers complement each other fairly well because they compensate for each other's weaknesses. When he made this comment computers were used for data processing, they were effectively fast calculators. Hence his phrase 'beyond calculation.' Numbers were feed into the computer and numbers emerged in answer to some question that had been posed. Since that time computers have become smaller, faster and pervasive. More significantly, computers aren't primarily used to crunch numbers any more. They have permeated every aspect of our lives. They are embedded in our companies, our cars, our homes and our entertainment devices. People are using computers to store and obtain information and control other machines. But there is another type of use that has come into prominence in recent years with the ubiquity of the internet, and the Word Wide Web, usually referred to as 'the web', in particular. That is, computers as communication enablers and amplifiers. We are using computers as more than extraordinarily fast calculators. We are using computers to talk to each other in ways that were not possible before. Almost anywhere there is sufficient electrical power, there is a internet connection. As a result, every day more of the world's communication is being done over the internet. Today the marriage of computers and people is looking much different than anything Cherne imagined. Their combined force is having far ranging consequences that are only beginning to be felt. The maxim is that in a marriage two become one, and that's exactly what it looks like is going to happen with people and computers.

What is particularly startling is how quickly computers shifted from primarily being number crunchers to communications mediators. The first fully programmable digital computer, the Z3, was built in 1943 (IEEE, 1996). It wasn't until almost 50 years later, in 1990, that the first web browser and web server were written. In less than 20 years the World Wide Web has changed what we can buy, for no catalogue can

contain the scope and variety of goods available on the web, all purchasable from the comfort of our homes; we now have new forms of entertainment (eg. massively multiplayer games) that were not possible before; we have new ways of communicating with each other through wikis, blogs, and web forums; and never before has so much information been available to so many for so little cost. The speed and extent of these shifts in the fundamental aspects of our society is unprecedented. The expansion of the web is permeating and transforming governments, economies, businesses and education.

Computers' physical form has also changed radically since the 1940s. The earliest computers were large electro-mechanical machines, costing millions of dollars, that filled rooms. They are now in our appliances, our cars, on our desks, and portable enough to carry everywhere (laptops and handhelds). Ubiquitous in the literal sense of the word. Even as these machines shrink in size, they are increasing in complexity and computational power at the same or even less cost (Moore, 1965). Many futurists such as Marvin Minsky (1994), Vernor Vinge (1993) and Raymond Kurzweil (2001) expect that at some point the complexity of computers will exceed that of our brains, and at that point they will become more intelligent and in some sense better thinkers than we are. This is a common belief in the Artificial Intelligence community (Wikipedia, 2009). Once a certain level of complexity has been reached, somehow intelligence will be possible and consciousness will occur. "I am a machine. So are you" (Brooks, 2008). The underlying assumption seems to be that we are our brains. Our brains are what make our consciousness possible, so if we create a computer equivalent, it somehow would have an equivalent consciousness. Furthermore, given the speed at which computer complexity and computational power is increasing, such computers would rapidly outstrip our ability to keep up. This fantastical scenario is known as The Singularity (Vinge, 1993). Singularity University has even been established at NASA's Research Park near San Jose specifically to investigate, promote and prepare for this event (Singularity, 2009).

Is this where technology is leading us? The development of an alien intelligence that will supersede our own. Are we really only electro-chemical processors that can be replaced by electo-magnetic processors? I think this is a naive and flawed interpretation. What if we are not our brains? What if consciousness is something non-physical, but merely represented by our brains? (Noë, 2009) Let's back up a bit because I think a few steps have been missed along the way.

Each day more there are people are connecting to the internet. In some sense, there is nothing new about this, because we are social creatures, we go to where other people are. But the phrase "connecting to the internet" is misleading. People decide to connect for one of two reasons: to access some of the information they can find there, or to be able to communicate with someone who is already available there. In the first case what happens is that they find other people with similar interests. So in both cases what is happening is that people are connecting to each other. "[the t]echnology doesn't make us social, it influences our behaviour"(Armano, 2009). What is new about this is the number and diversity of the people 'on the web'. The network effect (Wikipedia, 2009) is well beyond anything we have seen before in any other technology. We are social creatures and we use technology to aid our communication. Because of this, and the increasing distance between those with whom we wish to communicate, we have developed a variety of technological means to achieve that goal. First we created one-to-another technologies such as signalling systems like semaphores, print and the telegraph to achieve greater range. Later we developed one-to-many technologies such as newspapers, radio and television. While the one-to-another technologies are affordable by individuals, the one-to-many technologies are not. They are owned and controlled by large corporations because their infrastructure costs put them beyond the reach of all but the extremely wealthy. Note that none of these technologies work at all well for many-to-one communication.

The web has some very compelling advantages compared to print, radio and television. Most significantly, the web has solved the "scaling" problem that burdens these technologies. For example, print publishing has two major components: printing and distribution. Rendering a newspaper, magazine or book onto paper is enormously expensive, requiring large quantities of paper, ink and machinery. Once printed the resulting works must be transported to their sale point which takes time and many vehicles. In comparison, on the web, there is no physical print step and distribution is so fast, yet costs so little that there are several companies that provide the service for free, paid for by advertising. This change in the economics permits anyone with access to the internet to publish whatever they want to say, and in turn, enables anyone to read, see and hear whatever has been said by anyone else. Effectively, print, radio and television can be provided on the web. In fairness, they do not transfer directly because the web has different affordances and limitations. Print radio and television are based on a scarcity economic model. Scarcity means there are only so many copies available for only a limited period of time in a restricted area. Or a program is only available when it is being broadcast. These kinds of scarcity are the basis of the business models that drive the

industries based on those media. The internet, on which the web is based, introduces a new economic model: zero-marginal cost. That means that the costs of creating and publishing a work are all up front costs. Once the work has been published on the web, additional copies, one for each person who requests it, are so cheap as to be free. Free is very persuasive from a consumer's point of view. What we have then is an extraordinarily low cost two-way communications network that spans the globe connecting people who have shared interests. It provides text, audio and video, that can be searched and archived. In this network each person is at an end-point where they can reach their neighbour as easily as a person on the other side of the world. "Computing is not about computers anymore. It is about living"(Negroponte, 1995). The web is changing the way we live. These changes are far from complete—they have merely begun. As a result all the predictions based on pre-web society are rendered invalid and need to be re-assessed.

As mentioned earlier, an ever increasing number of people are using the web to communicate with each other. They, that is we, are building social networks which are interconnected networks of people, not just machines as in the past. In contrast to newspapers, radio and television, the communication is bidirectional. Anyone can talk to anyone else. These networks are also self-defining and self-organizing. That is, they grow and die on their own, in response to some perceived need. Anyone who has access to an internet connected computer can find and participate in any group of their choosing. If there isn't one for their desired topic, or if they don't like the way the existing groups are managed, they can create a new one and manage it themselves in the manner they like while belonging to as many other groups as they want. The cost of this power and flexibility? A computer and an internet connection which is becoming easier to obtain every day, or available for free at many public libraries and internet cafes and already present in most of the homes in the developed countries, and increasingly common in underdeveloped countries. The challenge becomes how to find topics and people of interest. We are still figuring this out.

Prior to the web, access to information was limited to those who had the ability to pay for it. Newspapers, magazines, journals, books, radio and television were the primary sources requiring subscribers, and single issue purchasers, to contribute to covering those costs. Due to the size and weight of newspapers, magazines, journals and books, their distribution is necessarily limited and time constrained. Generally speaking, only the most recent versions of each publication are available at any time. Older copies of local newspapers and some magazines and journals might be kept for a time in a community library. Radio and

television don't have those advantages. Their strengths are in their immediacy. Radio and television have extremely short production lead times in comparison to print publications. They also, have subscriber costs and up front costs to pay for each radio or television set. As we have seen, the web in contrast has a completely different economic model. Access to the web, while not completely free, is comparatively low cost and available to almost anyone who wants it. This is not to say that it is available to everyone today. As William Gibson observed, the future is not evenly distributed. There are large numbers of people in the world for whom the internet is an unaffordable luxury. But their numbers are decreasing rapidly, and the point that completely changes the game is that once someone has access to the web, with very few exceptions, they have access to all of it. This brings up the issue of the "digital-divide" (Digital Divide, 2009).

The digital-divide refers to the imbalance that exists between those who have access to the web and those who do not. The reason the digital-divide is significant is because the web provides access to opportunities, information and resources that those without access to the web do not have. Generally speaking, this divide runs along economic and racial lines which exacerbates the existing imbalances between races and classes. A variety of groups and policies have been formed specifically to ensure that libraries and schools provide computers with web access in order to limit the size and spread of the divide. This is a very well-meaning endeavour, however, it is probably only a short term measure. As the cost of computers continues to fall and they become more portable, an increasing number of people will have them. The role of libraries and schools is likely to transition to providing network access points for personal wireless devices. Providing free access in so many places is a huge undertaking that serves to emphasize how significant the web has become. Those who have access to the web have advantages over those who do not.

"The tools we use to think change the ways in which we think" (Turkle, 2004). One of the affects of having access to computers with web access is that it changes how people think, and what they think about. "As one 15-year-old schoolboy said of the Internet, 'it feels as if the world is actually at your finger tips'" (Livingstone, 2001). People who do not have access to the internet would not say this. They do not have the world at their finger tips—and yet, having the world, or even a large part of it at least, readily accessible is a very powerful thing. It opens up new opportunities. It creates new challenges. It changes one's perspective. Children raised with video games, computers and the internet Prensky calls Digital Natives

(Prensky, 2001). Everyone else he calls Digital Immigrants. The provocative language notwithstanding, he has a point. The cultures are different and so the understandings and relationships between people are necessarily different. Different experiences lead to different development emphases lead to different associations and finally different expectations. The Native's and the Immigrant's brains are fundamentally the same, because evolution simply doesn't work that fast. "Human nature doesn't change. Human behaviour does" (Armano, 2009). It's as if someone from rural Canada were set on their own in Manhattan. There's something that looks vaguely familiar (Central Park), but the rest is different. Much of what they know, and has served them well for years, is suddenly useless. Worse, everyone around them knows far more than they do, and they don't know how, or if they can, catch up.

For hundreds of years, education has been about asking questions such as: How do we stay warm? How do we protect ourselves from our enemies? How do we obtain enough food to eat? How do we transport merchandise to market? How do we make better tools? What weather should we plan for? The answers improved our understanding of the world enabling us to improve our situation. From a practical point of view people lived more comfortably and more safely yielding a better quality of life. From a philosophical point of view, the better understanding enabled us to ask more far reaching and more subtle questions. This created a virtuous circle that supported ever more complex behaviours and understanding of the world that is, reality. But perhaps, this is not as simple as it appears.

> What I call Integral Reality is the perpetuating on the world of an unlimited operational project whereby everything becomes real, everything becomes visible and transparent, everything is 'liberated', everything comes to fruition and has a meaning (whereas it is in the nature of meaning that not everything has it).
> Whereby there is no longer anything on which there is nothing to say....
> The reality that has invented itself over recent centuries and which we have elevated into a principle is now dying out. To wish to revive it at all costs as a reference or a moral value is a mistake since the principle is dead. What we see now, behind the eclipse of the 'objective' real, is the rise of Integral Reality, of a Virtual Reality that rests on the deregulation of the very reality principle. (Baudrillard, 2005)

As the World Wide Web becomes ever more pervasive, it draws in more of our observations and communications; as it becomes the repository of our learning and developing understanding there is the potential that people will develop the expectation that if something is not available on the web, then it doesn't exist or the event didn't happen. In this scenario the web becomes the "lens" through which we

view reality and thus it becomes our reality. "Immersion, immanence and immediacy – these are the characteristics of the Virtual" (Baudrillard 2005). It is precisely these things that the web provides and it feeds back on itself as the virtuous circle implies. People turn to the web for the information it contains, and people contribute to the web because of the other people who are there. But who, or what, are they connecting to that is this web of networks? The short answer is humanity in a place where "[f]reedom has been obliterated, liquidated by liberation; truth has been supplanted by verification; the community has been liquidated and absorbed by communication" (Baudrillard, 2000).

This scenario seems to be the end result of our focus on efficiency. I say efficiency because throughout our history we have suffered from scarcity of one kind or another. Eg. scarcity of food, shelter, information, and time. So it's worth asking: What are we optimizing for? In many cases, it's time. Getting more done faster so we have more time to do something else. Or another way of looking at it: accomplishing the same goals with less effort. I've come to see technology, as having two aspects: efficiency and effectiveness. Efficiency is all about optimizing for some limited resource. Reducing time involved or the cost of materials for example. Effectiveness is all about relationships. The number of connections or intensity of connection between people. It's easy to see that these two things are often in conflict. If one values efficiency then that can come at the expense of effectiveness. Efficiency tends to improve self-reliance, it provides a sense of control. However, that comes at the expense of reducing one's reliance on others potentially diminishing those connections. Effectiveness tends to strengthen relationships increasing interdependence. Interdependence accepts a giving up of control (power if you prefer) in favour of some other benefits. Control permits predictability (more control) and self-indulgence which tends to feed the desire for control and so becomes self-perpetuating. Breaking this cycle is difficult and often requires some kind of crisis to initiate the change. Even at that point, the change won't be immediate. It still takes time to work through. This is the stage I think we are at right now.

No one person, or even group of people, controls the web. It exists because of a set of shared agreements, called Request For Comments (RFCs), that stipulate how things work. "The Web follows Internet tradition in that its important interfaces are defined in terms of protocols, by specifying the syntax, semantics, and sequencing constraints of the messages interchanged. Protocols designed to be resilient in the face of widely varying environments have helped the Web scale and have facilitated communication across multiple trust

boundaries" (W3C, 2004). No one has to obey those protocols. Anyone can define a new set at any time and build a competing system. That is how the web came to be. The web protocols were defined in an environment of existing and competing protocols, eg. remote procedure call, usenet, telnet and gopher. In comparison to them, the web provided a much more useful and compelling system. Today, there is no contest. The web is where everyone is already and so its rules are what apply. Kevin Kelly observed that the internet, and the web in particular, can be thought of as one machine. It is the largest, consuming 5% of the world's electricity, and most reliable machine we have ever created (Kelly, 2007). Incredibly, it's getting larger, as more devices are being connected, and smarter, as more people are contributing more information to it, everyday. In a sense, the collection of web servers make up the "core" of this machine while our client desktop, laptop and handheld devices provide access interfaces to it. Alternatively, the servers can be considered as the "brain" and the access devices as the "body."

Earlier I said that people "connect to the internet." This not entirely accurate—that's not really how it works. What really happens is devices (hardware) are connected to, and become part of, the internet by people. Each of these connections is made at a network access point. Once connected, the device communicates (software) with other devices, signalling its presence and sending requests for information and receiving responses in return. Over top of these hardware and software layers are people initiating the connection to the network and controlling the actions of the device. Strictly speaking, people do not connect to the internet, their devices do. People connect to other people through these devices. In traditional Artificial Intelligence, the intent and expectation is that computers could be made that are as, or more, intelligent than humans. But rather than make machines that think like humans, or humans that think like machines, what if we put the two together? "Married them." What would we have then? Is that what we have been doing? Are we (becoming) cyborgs?

Cyborg is short for cybernetic organism. That is, a life form that has both artificial and natural parts (Wikipedia, 2009). On the face of it, this seems an incorrect application of the term. We use computers and the internet as forms of cognitive-offload. As mentioned earlier, people do not directly connect to the machines that comprise the internet and so neither are those machines a physical part of a person. It is a matter of time. Consider the development path of the general purpose computer: from large rooms, to dedicated floor space, to desktop, to laptop and now handheld. People carry their handhelds everywhere so

that they are always available. Does this mean the handheld is the final form factor? Or, is it possible to embed a transceiver in a person's body that could facilitate two-way communication with a computer? The short answer is yes, it has already happened. (Warwick, 2003) The connection so far is comparatively crude, and it's a long way from full text/audio/visual experience, but the interface will only improve over time. In my reading it seems that the majority of the literature has focussed on the the physical benefits of the cybernetic additions/enhancements to the human body. But what of the mental aspects when millions of people *are* directly connected to the internet, and thus to each other? We have a hard enough time getting along with each other in the physical world, how will it be any better when we are full-time in the virtual world? "Do you think the current concerns over privacy violations and personal autonomy are large and complex? You haven't seen anything yet" (Norman, 2001).

Kevin Kelly (2005), postulates that what life wants are:

- ubiquity
- diversity
- specialization
- complexity
- socialization

It certainly appears that technology is leading us in these same directions. Technology, computers in particular, are everywhere in modern life. They are an integral part of how we live. We are finding new uses for them as we seek to automate the drudgery parts of living. Computers require an operating system that makes them function. There are basically three operating systems for desktop and laptop computers. However, there are a variety of other kinds of operating systems used by handhelds and as more types of devices are developed they will have new operating systems as well. Over time the variety will increase. Each operating system is designed for the expected use of the computer device on which it is installed which fits nicely into the specialization characteristic. Computer operating systems are highly complex pieces of software comprising millions of lines of programming in which controls what they can do and how. The operating systems also provide application programming interfaces so that applications can take advantage of the features provided by the device. (The application talks to the operating system which directs the systems interaction with the external environment.) Lastly, computers in themselves are not social, but really it is people and computers we are talking about. People certainly are social and are increasingly using

computers to facilitate their social communications. The mapping of people and technology to the directions of life is unmistakable. Is technology (an expression of) life? Or is the correlation simply co-incidence? "Lynn Margulis (in [(Margulis, 1986] and elsewhere) has made strong arguments that mutualism is a great driving force in evolution" (Vinge, 1993). Mutualism seems to be what is going on here. People and Technology are working together to jointly advance their evolution.

"There can be no simple way of cataloging whether any particular change is good or bad. That is contested terrain. At every step we have to ask, as educators and citizens, whether current technology is leading us in directions that serve our human purposes. Such questions are not technical; they are social, moral, and political" (Turkle). There are several questions we will need to resolve if we accept this path of development. The first is, as with any new technology, its availability will initially be limited. The wealthy will have it first, and as costs come down the availability will spread. The digital-divide will take on a whole new meaning. Which leads directly to the questions of who should have it, and when? And possibly, for how long? As we have seen with today's web, just having access to such a vast storehouse of information, and networks of people doesn't necessarily make anyone smarter – they just have a larger memory. Learning to navigate it takes time. Understanding the rules of the various social groups takes time as well. This highlights the one of the major differences between people and machines: the physical characteristics of a machine connected to the internet it is largely set. Its physical properties will remain unchanged over the device's useful lifetime. However, its software maybe changed, to provide new features or perhaps alter or remove some features. People on the other hand, are not as flexible as that. New features can't just be downloaded like a software update. Or will that change? Once one person knows a new thing, how quickly will the rest of the people connected to the web know it? It will be immediately available to everyone, just as a new published web page is today.

As Catron observes, "[w]hatever we immerse our minds in, is what our minds will be full of" (Catron, 2009). It bears asking, what would this joining of people and technology think about? What would it care about? What questions would it ask? What is learning in such an environment? Would it have a heart of compassion? The answers can only be speculation at the moment. But we need to start talking about them now so that the marriage will manifest our best interests. Pre-marital counselling, to stretch the analogy. So we can insist on what we want, rather than taking what we get.

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