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By John Mauldin

Last week we looked at how technology has the potential to slow and possibly reverse aging within the next two decades. Marvelous cures for the main reasons of death like cancer, heart disease, dementia and Alzheimer's, not to mention the potential to manage weight, are in our future. Amazing innovations in communications are rapidly coming at us, as is an increased ability to process information. Hunger and malnutrition are in our sites, as we increase the ability to find harvests which yield more, as well as biotech and nanotech processes to manufacture food.

Further down the road, the ability to manipulate molecules at the quantum level will mean we can produce the materials we need at much lower costs. As we map and reverse engineer the software which runs our brains, powerful new software can be developed on machines which can aid in the development of whole new technologies, as well as allow us to directly access information and communicate with each other. It will mean I can get rid of this annoying keyboard, which is bouncing around as the plane I am on is in a little turbulence.

(At the end of the letter, I will speculate about how we invest in these trends. Next week, we get back to our usual beat of finance, but judging from the letters I am getting, a lot of you are enjoying the speculation about the future.)

Ray Kurzweil, in his latest book, *The Singularity is Near*, writes of an almost Utopian future. For him, as well as others, such a future of marvels cannot come too soon. They see a slow transition to a world where we merge with our machines, allowing us to think and work at far faster speeds than our unaided biological "wetware." And we do it from bodies which do not succumb to disease or aging.

There are many objections to his work from a variety of quarters. To his credit, he does not dodge or ignore them. He spends almost a hundred pages outlining the various criticisms of his view of the future and then rebutting them.

Ray sees us approaching a "singularity" or point in the future where humanity and machines evolve into something we would call distinctly post-human. At that point, things change in ways we cannot predict or comprehend. And since the pace of change is accelerating, much of that last bit of change happens in only a few years. Ray sees this event as happening around 2045, with life extension from biotech and nanotech happening in the 2020s and 2030s.

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Will at least the early parts of his vision happen? I tend to think it will, although on what time pace and what scale we have no real clue. His estimates are as good as any, and his track record suggests we should take them very seriously.

And for the arguments I make today, the matter of timing and pace are not really relevant. The key is that we are going to go through a period of dramatic change, and this week we look at some of the negative consequences, the Dark Side, if you will, of the growth of our technological abilities as a human race.

(For readers who are reading this series for the first time, I might suggest you go back and read the previous two letters. Read the last half of the September 23rd letter and then last week's letter.)

Are We Men or Are We Mice?

David Brin, the noted science fiction writer (I highly recommend his books), wrote me this week, noting that while he is certainly a proponent and enthusiast for the growth of technology, when compared to Ray, he is cast in the role of curmudgeon. It is one thing, he notes, to map the human genome. It is another thing altogether to understand the proteome, or how proteins work and the genes "talk" with each other. He notes it is many orders of magnitude harder, and such an understanding is required for Ray's vision to be fulfilled.

Further, while there is a great deal of our human genome that is the same as that of a mouse, there are significant differences. We have been disappointed time and again with things that work in mice but have no value when applied to humans.

Now, if I can put words into Ray's mouth, he would argue that is exactly what was said in 1990 at the start of the genome project. Our ability to attempt such projects increases with time, and the speed of technology needed for project completion increases at an exponential rate. Thus, looking at today's pace of technology is of no use in evaluating whether or not we will be able to complete such an ambitious project. What one should do is look at how long it takes for knowledge or speed of the process in a particular area to double. If it is 1-2 years, as it is in many areas, then in 10 years, using an average, our speed or ability will be 64 times as fast, and only a few years after that will be 128 times current capabilities.

Can we keep up such a pace? Maybe. I think it is more like a case of when, not if. Maybe things slow down. Maybe they don't. As Ray pointed out, even with two major world wars, lots of small wars, conflicts and setbacks, technology continued on a steady pace throughout the last century. There will be lots of setbacks and disappointments along the way. But even with plenty of wrong turns and dead-end alleys, we will move toward an increase of knowledge which will change our world in powerful ways.

A New Definition of the Haves and Have-Nots

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One of the more personally troubling aspects of this seemingly relentless march of technology is how such technology is distributed. I suppose in one sense it will be no different than today. The rich will get access to life extending technologies first, and then as they become cheaper it will filter into other parts of human society. But when such treatments are available, when we are not only treating Alzheimer's and Parkinson's, but actually extending natural life apart from the fact that we have halted the progress of major life killing diseases, I think it will create a profound discomfort in society in the transition process. It is one thing to cure disease. It is another to extend life in general, or to halt the aging process.

Let's pose a situation. Let's say that scientists develop a process to start replacing your genetically aged organ cells with newer, younger cells, so that over time your organs grow younger. (We replace a significant portion of the cells in any organ (heart, liver, pancreas) each year.) Such a thing is now being researched. But when it is first made available, it will initially be quite expensive. Let's say it costs \$200,000. If you have the money, you quickly pay it for an extra 10 or 20 years of life, assuming somehow you can get to the head of the line. But what if you don't have it? Is life extension covered in your insurance policy? Will Blue Cross make it available?

Eventually, such procedures will become less expensive and a normal part of medical practice. But from that initial beginning, it seems to me that we will be going through a lot of societal angst.

Do rich countries get to adopt such medical procedures first? Obviously the answer is yes. But this is going to increase the divide between the haves and have-nots. Perhaps it will be no different than it is today. Studies clearly show that people with more money and education live longer.

But somehow I think it will be viewed as different when we are talking about radical life extension and not just medical procedures. Let's say it can be done cheaply. Even the logistics of making it available will be daunting. Who gets to be first in line? We will of course wait until it is a problem before we have this debate (that is what humans do), but those who develop such new drugs and procedures should think hard and long about the impact.

By the way, if such advances are made, it has the potential to lower medical costs. How much does it cost to maintain an Alzheimer's patient? A cure would be a fraction. Heart disease? Cancer? Prevention is much cheaper.

The Problem of Gray Goo

Trying to figure out how to make the new medical procedures affordable and available are good problems to have. But the problems posed by Bill Joy and others about the dark side of biotech and nanotech are not so easy.

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Bill Joy is Chief Scientist for Sun Microsystems. As such, he is no Luddite. But he is profoundly disturbed by Kurzweil's vision. For those interested, you can read his rather long, but very readable and thought-provoking analysis at <http://www.wired.com/wired/archive/8.04/joy.html>. Joy essentially proposes that we proscribe, or seriously regulate certain technologies. For instance, a self-replicating nanotech device which produces an endless supply of some form of energy or important material could be a very good thing. But what if the process gets out of control? This is called the Gray Goo problem among nanotech aficionados.

Essentially, the process is not controlled, and everything gets turned into whatever the nanobot is programmed to do. And what if some rogue group creates a specific nanobot to attack certain types of people? Or destroy an area or region? Weaken concrete foundations? Kill anything biological? You can get paranoid very quickly.

The weapons of mass destruction in the future will be far more deadly and potentially powerful than today's "simple" viruses or anthrax. Whether by mistake ("oops, sorry, I didn't know" will be a poor excuse) or by design, the negative implications of nanotechnology are very scary.

But simply proscribing such research is pointless. It is going to be done, whether in labs manned by people of hopefully good will and sound procedures, or it will be done underground. Long time readers know I have a decided libertarian market bent, but the dangers of these technologies call for the establishment of ethical and procedural guidelines for research. We should not proscribe the research. But we should know what is being done.

Why not just proscribe it? Because it is going to be done somewhere. We have opened Pandora's Box. Hopefully, the leading edge will be in friendly hands and able to deal with terrorist elements. Significant enforcement protocols and sanctions must be in place for countries that do not adhere to the guidelines. There should be no exceptions. If you want to participate in human commerce, you should be part of the process of protecting human existence. Open labs, open inspections and a clear sharing of responsibility must be mandated.

Essentially, Ray thinks that if the good guys can stay on the edge, they can create a Blue Goo to control the Gray Goo. That doesn't really leave me feeling all that happy, but it may be the best we can do. It is not a real problem today, but we are close. As a world society, we cannot afford to wait until it is a problem.

The Cutting Edge

Ray envisions a world where there are computers and machines (robots?) that have become self-aware. He sees us slowly becoming part of our machines, where nanobots and other technologies are part of our bodies. Where we can access information and computer power to enhance our capabilities. Ray sees a time where the difference between an ordinary human brain and an enhanced one is on the order of several

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magnitudes. Ten times more powerful? A hundred? A thousand? (Ray actually uses much larger numbers, but these are scary enough.)

Computers from 20 years ago are toys compared to what we have today. And in 20 years, we will all have affordable computers with as much processing power as several human brains. How will we use such power? Will it just be better and faster than it is now, or will Ray's vision of such power being available to directly augment our intelligence be a reality?

Forget the end game. What happens when we can augment our intelligence by "just" 25% or 50%? How much of an advantage will that be? It will be huge. What happens when we can simply access huge databases and have even halfwit software programs to help us sort through information we need.

Far-fetched? There are several drugs in late stage trials which are designed to augment our memory process. Given my sadly increasing episodes of "senior moments," they can't come too soon. But these first drugs will be baby steps to what comes in the latter part of the next decade. And when we can be wired into our computers, accessing what will be cheap, but immense, processing power in 15-20 years?

That is going to create a huge advantage for those on the cutting edge. Just like performance enhancing drugs make certain athletes able to perform above their peers, these new advances will allow those who avail themselves of them a real edge.

As a simple analogy, what if you could bring your laptop computer into the Las Vegas black jack pit, letting it analyze each bet and card played. How much edge do you need to be able to take the house over time? Think Caesar's is going to allow you to do that? But that is exactly what we are talking about. At first, it will be a small edge, but over time, it will be much larger.

Bluntly, being smarter does not guarantee you a place in the world or that you will succeed in a venture with those less intelligent, (as measured on a simple IQ basis), or that you will succeed at all. How many brilliant people have we all met who cannot work their way out of a hatbox? Experience, resources, character and a host of other things make a lot of difference. That is a good thing, as guys like me who have to deal all the time with people who are quite a bit smarter need some way to play the game.

But let's make no mistake, intelligence is an advantage. Which is why people will actually seek out ways to wire themselves (actually, it will be wireless) into their machines and augment their intelligence. While some in my generation may resist, my kids and grandkids (when I get them) will see it as quite natural. Why would you not want to take advantage of something which can make you perform better, get better grades, etc.? The growth of such innovations will be slow - a little bit here and a little more there. It will not happen all at once, but will keep advancing until some of us end up with significant amounts of artificially augmented intelligence and access to a great deal of computer processing power.

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How does this all work out? No one knows, really. There is a whole genre of science fiction being written which is speculation about such a future. One excellent one is “Kiln People” (<http://www.amazon.com/gp/product/0765342618/103-7223786-2039051?v=glance&n=283155&n=507846&s=books&v=glance>) by David Brin. (David should be required to write at least one novel a year.) Some of them are much darker visions, like the novels of William Gibson (a recent excellent work is “Pattern Recognition”), which are part of the cyber-punk sub-genre.

Some Investment Themes

In the past, in any new innovation cycle, there are clear winners and losers. Sadly, we cannot know most of them in advance. If we did, Wang would never have been such a hot stock in the 80's. But we can know the trend. The next first huge trend is going to be biotech. I know, you are telling me that biotech has already been a big deal. I suggest it is just getting started. There is still plenty of time to get on this train, and the really big moves are in the future. We haven't really seen the first true mania yet.

Wait until a few new drugs really hit, like one which can fix Alzheimer's or heart disease or obesity. Those stocks will create Microsoft like wealth, or at least Dell. Then everyone is going to want to start up a new company. It will be just like the internet boom. Anyone with a doctorate in genetics from a major school and an idea will find he/she gets funding. It will be fun. A lot of money will be wasted, but some very good ideas, drugs and procedures will be developed.

If you want to catch this wave, I would start studying now. It is not too late. Give yourself a year or two to get started, or find some managers/advisors that are knowledgeable in the area. Ease into your investments and take a long term view.

It is really too early to think about investing in nanotech. Robotics is in its infancy. But biotech is going to be the big deal in the next decade. This is going to be a trend we will all want to be involved in.

We should also keep an eye on Virtual Reality technologies. This will be a huge area. There are some small start-ups (none public yet that I know of) that are working on systems that will allow people to meet in a virtual space. Right now, it still has that “non-real” feel, but it will get better. And when it does, I think it will be a big deal. Full immersion virtual reality? It will be the hottest entertainment stock ever when it becomes reality (pardon the pun). Computer gaming will be the lead in this area.

Brussels, Denver, and New York

I am in London as I finish this letter. I am staying at the Petersham Hotel, which is in Richmond-on-Thames, a suburb of London. My partners in Europe, Absolute Return Partners, have moved their offices here, and it is quite different from downtown London. I look out from my room balcony and see cattle, pastures and the Thames River. It is

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quite the idyllic scene. Not what I normally think of when I think about London. I leave for Brussels on Tuesday and then fly back to Texas. I am looking forward to dinner Monday night with Charles and Louis Gave of GaveKal, and dinner Sunday night with London partner Niels Jensen and his wife, who always manages to find some really great wines. I will be in New York around November 15. Plans still being made, but I will have some time to meet with clients and potential clients.

After that, I am at home for almost two months, with no currently scheduled travel. I am sure something will come up, but I am looking forward to being home for some time. Being gone does make me miss family, but it is not like the old days. Cheap phones and internet do help us keep in touch. And it is easier to stay in touch with teachers about kids and school.

This has been a grueling week, and I am looking forward to some rest this weekend. Have a great week. Next week we will be back on our usual beat, but it has been fun thinking about the future. Thanks for indulging my interest in and speculation about the future, and I hope you enjoyed it.

Your just enjoying the day analyst,

John Mauldin