Technology And Progress

Blithering Genius

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1 Introduction

In this essay, I will give my views on technology and progress, focusing specifically on space travel, computers and transhumanism.

Futurism is not just predictive. It is also normative. We are concerned with what we should do, not just with what will happen. So, I'm going to talk about what I think will happen, what probably won't happen, and what I think we should try to do.

2 Space Travel

Let's start with space travel. I don't think we'll be traveling in space very much, even within the solar system. Interstellar travel is way out of reach. I can explain with a few simple calculations.

The nearest stars are about 5 light years away. To travel to the stars in a human lifespan, you have to be going very fast. Suppose that we travel at 1/3 light speed. That would get us to the nearest stars in about 15 years. Of course, we'd have to accelerate and decelerate, so it would be longer: more like 30 years. From the perspective of the people in the spaceship, it would take less time due to relativistic effects. But you have to be going very fast to get those effects. So, let's think about the implications of going very fast.

A moving object has kinetic energy, and that energy has to come from somewhere. So, the kinetic energy of a moving object is a lower bound on the amount of energy required to accelerate it to that speed.

Suppose that we want to travel at 1/3 light speed. The formula for kinetic energy is 1/2 mv2. One kg moving at 1/3 light speed has 5 × 1015 joules of kinetic energy. How much is that? Well, let's translate it into something familiar: gallons of gasoline. A gallon of gasoline has about 1.2 × 108 joules of energy (that's on the Earth where there is free oxygen). Divide 5 × 1015 by 1.2 × 108 and you get 4.17 × 107, or roughly 42 million. So, one kg moving at 1/3 light speed has the energy equivalent of about 42 million gallons of gasoline.

That's a lot of energy.

And that's a lower bound on the energy you would need. There is a relativistic effect that requires some additional energy that is converted to mass. You also need some energy to escape the gravity of the Earth and the Sun. And you would probably have to carry the energy source with you as fuel. So, you would need more energy to accelerate the fuel. Look at the Saturn V rocket, for example. Most of the mass of the rocket is propellant. The payload is very small.

So, the equivalent of 42 million gallons of gasoline is a very, very low estimate of the energy that we would need. And that's just for one kg.

A reasonable sized spaceship would have to be at least 10,000 kg. We would need to bring stuff with us, such as food, water, life support and recycling equipment, etc. We would also need shielding to protect us from radiation and collisions. If you run into a dust speck at 1/3 light speed, it could cause serious damage.

If the spacecraft were 10,000 kg, its kinetic energy at 1/3 light speed would be about half of the US energy consumption for one year. There are a lot of things that we could do here on Earth with that energy. Why would we waste it on a suicide mission to Alpha Centauri?

So, I don't think we'll be traveling to the stars any time soon. Maybe someday we'll send a multi-generational space expedition that would take hundreds or even thousands of years, but that would have many other problems. It would be very difficult to maintain a breathable atmosphere in a small spacecraft over a long period of time. The chemical and biological cycles on Earth take place on a vast scale. They are very difficult to recreate in a small enclosed space.

What about going to Mars? Well, we could go there with some difficulty, but what's the point? It would make much more sense to colonize Antarctica. It is far more hospitable to human life than Mars. Antarctica has an atmosphere that we can breathe, and water that we can drink. It's protected from radiation by miles of atmosphere and by the Earth's magnetic field. Could we create a self-sustaining colony at the center of Antarctica with existing technology? Probably not. So, we certainly couldn't create one on Mars.

There are similar objections to projects such as mining asteroids. The benefits are few, the costs are high, and the energy is better used elsewhere.

We're stuck on this planet for the foreseeable future. So, we'd better focus our efforts on surviving here. The best use of space technology is to protect our planet from asteroid and comet collisions, not to travel to other planets. This planet is really, really nice compared to almost everywhere else in the universe.

3 Stagnation and Frustration

There is an important principle that explains many things. I call it "the principle of frustration".

Most things spend most of their time in stable states. When you look at the world, you see stability, because unstable things (by definition) don't last very long. The things that you see around you are the stable things. This is a kind of anthropic principle.

A similar principle applies to your life. Your life will have short bursts of rapid progress, and long periods of stagnation and frustration. Your emotions make you pursue goals. If you can move toward those goals, then you do so as quickly as possible. The rest of the time you are stuck, either because you don't know what to do, or because something is blocking your way. Frustration is your stable state.

Suppose that you want a girlfriend. If you can get a girlfriend, then you will soon have a girlfriend. That problem will be solved, and you will move on to other problems. On the other hand, if you can't get a girlfriend, then you will put a lot of time, energy and thought into solving that problem. You will be frustrated.

It is inevitable that you will spend most of your time working on the problems that are hardest to solve. Thus, most of your life will be spent in a state of frustration. So, get used to it.

The same is true of other types of progress. Science has periods of rapid progress, followed by periods of stagnation and frustration. Technology also lurches forward in the same way. Easy problems get solved, and hard problems remain.

In rare cases, there is an extended period of progress in a scientific or technological field. We've seen that with computers in recent history. That was due to a virtuous cycle. The better computers got, the more people used them, and the more energy was invested in research and development. It requires a much bigger investment of time, energy and intelligence to make a processor faster now than it required 10 years ago. We are only willing to make that investment because the demand for computers is still growing. At some point, this virtuous cycle will reach a physical or economic limit.

For most of human history, technology didn't advance much from one generation to the next. We are living in an exceptional time, when progress is the norm. That probably won't last. In fact, we might be at the end of that period now. I think we are entering a period of stagnation and frustration.

4 Computers, Virtual Reality and AI

During the dot-com bubble of the late 1990s, there was an IBM commercial about a hypothetical future technology: the wireless wearable computer. It showed a guy sitting alone on a park bench, talking to his computer, shouting "Buy!" and "Sell!" and scaring a flock of pigeons. He was wearing a little headset with a tiny screen in front of one eye, headphones, and there must have been a mic somewhere. He was supposedly day-trading stocks. That commercial wasn't on the air very long. Soon after it came out, the dot-com bubble burst, and day-trading was no longer cool.

Fifteen years later, we don't quite have the wearable computer, but we have the smartphone, which is similar and probably a lot more useful. Of course, most people don't use it for day-trading stocks. They use it to text each other, find directions, play games, browse twitter, listen to music, look at porn, etc. Wireless technology is everywhere now. People don't sit on park benches shouting and scaring pigeons, though. They look at a little screen, and use their thumbs to text and manipulate touch screen controls. The technology works because it fits human preferences and abilities. It makes use of the human eye, hand and brain.

Years ago, even before the dot-com bubble, there was a lot of talk about virtual reality. Maybe that was because of Star Trek: The Next Generation and the holodeck concept. Whatever the reason, the idea of virtual reality was popular. Many computer scientists worked on that problem, trying to create a simulated environment in which you could have experiences that mimic real life.

It never worked, for two reasons. One is that it is very hard to create a realistic virtual environment. Simulating reality, even approximately, is computationally expensive. The other reason is that we don't need virtual reality. We already have something like virtual reality: the human imagination.

So, instead of virtual reality, we use computers to watch videos and play computer games. We immerse ourselves in the story or the game using imagination. Instead of trying to replace imagination with technology, we enhanced it.

Today, some people believe that we will meld with our technology to the extent of having it physically implanted in our bodies. That is a step beyond the wearable computer or virtual reality. Would a direct physical link to a computer have any benefits?

Melding with technology is nothing new. We naturally meld with our technology. Your brain has the ability to adapt to new technology, to make it almost an extension of yourself. Sometimes, I go on long canoe trips. After a few days on the water, the paddle feels like an extension of my body. In a sense, it is. It is an instrument of my will that obeys my conscious directives and sends information to my brain through my hands.

A lot of your cerebral cortex is dedicated to your eyes and hands, so most technologies plug into that interface. They send information through your eyes, and receive information from your hands. We don't really need to physically plug electrodes into our brains to interface with technology, and I doubt that it would be more efficient anyway.

So, we have already melded with our technology in what is probably the most efficient way, by using the highest bandwidth channels in and out of our brains: our eyes and hands.

What about AI? Where are the robots with human intelligence?

AI is another one of those things that was widely predicted, but never really happened. The reason is that neural architecture is fundamentally different from computer architecture. The cerebral cortex is a generic pattern-abstraction and recognition device that learns from embodied experience. A computer is a device that reads and writes symbols on some storage medium according to programmed instructions. A computer is very different from a brain, although both process information.

We might be able to replicate in software something like the way the cerebral cortex processes information, but would it be useful? Human intelligence has to be learned from experience. Would you want a computer that had to be trained slowly and tediously how to do something? Maybe, if you could save that knowledge and transfer it to another computer. There are programs today that learn from experience, and often they ship with pre-learned knowledge. We have algorithms that learn from experience in limited ways. But so far, those algorithms have only been applied to relatively simple problems. Most of the intelligence in computers comes from the people who program them, and I don't think that will change for a long time.

Even if we develop computer intelligence that is as powerful as human intelligence, it would still be very different. Human intelligence relates to our sensory inputs, motor outputs and emotions. Computer intelligence would relate to its own sensors, effectors and motivators. We might someday have artificial intelligence, but it would be very different from us. It would be like an alien species.

5 Transhumanism and Immortality

I don't know much about transhumanism. It seems to be the idea that we can and should transcend the human condition by using technology. For example, a transhumanist might believe that future technology will make us immortal, thus creating a radically different human condition. So, let's think about that. Could we use technology to become immortal?

Before we can answer that question, we have to understand mortality. Why do we die?

In a way, death is a consequence of sexual reproduction. Our bodies are colonies of cells with the same DNA. Those cells replicate by mitosis, but only a certain number of times. They can't reproduce independently in the long run. A brain cell or a liver cell can only pass on its genes by helping the body to reproduce sexually. If our cells could reproduce by mitosis indefinitely, then they would compete to reproduce independently, instead of working together. Cancer is what happens when cells start reproducing independently. Death is necessary to make the cells of the body work together. The longer you live, the more the coherence of the body breaks down.

Our cells die for various reasons, but one reason is that they are programmed to die. At the end of every DNA strand in your chromosomes there is a repeated sequence called a "telomere", which causes the strand to fold on itself and prevents it from unraveling. The telomere gets shorter each time the DNA strand is replicated. The length of the telomere limits the number of times that the cell can replicate. (This is a slight simplification.)

We could probably use genetic engineering to turn on the gene that produces telomerase in all of our cells. That enzyme adds telomere sequences to the end of the DNA strands, so it allows cells to replicate indefinitely by mitosis. But that would probably increase the likelihood of cancer. It probably wouldn't extend your lifespan by much, and it might even shorten it.

Sexual reproduction and multicellularity make death a fact of life. Immortality as a single body is not realistic. If your body existed for a very long period of time, it would eventually become a battleground of independently reproducing cell lines. Mutations would create different genetic variants within your body, competing with each other. Your body would lose its genetic coherence — its "esprit de corps", so to speak. It would destroy itself.

One way to cheat death is by cloning. Your DNA is your essence. It is the only thing that is constant about you throughout your life. Your body and your memory have a kind of continuity, but they change over time. You are a colony of cells with the same DNA. You could cheat death, in a way, by creating a clone that would be an extension of your cell colony, and then pass on your accumulated wisdom to him. After your death, your clone could carry on your identity. That's not what most people mean by immortality, but it's the closest thing that's biologically feasible.

There is a problem with cloning, however. Genetic errors would accumulate over multiple generations of cloning, eventually destroying the genotype of the clonal line. Sexual reproduction, by shuffling genes and mixing them up, allows good genes to escape from permanent association with bad ones.

So, the best way to achieve immortality is the old-fashioned way: have kids. It's not perfect, but it's the best we've got. It's been working for over a billion years.

Generally speaking, I don't think we can transcend the human condition in any fundamental way.

We will continue to evolve, of course. We are always evolving, and the more we change our environment, the faster we evolve. So, in that sense we will transcend the human condition. Human

nature is not a constant. It is an emergent form, shaped by evolution. But human nature doesn't necessarily evolve in the direction that we view as better. Evolution only selects for what we consider to be virtues if they improve reproductive fitness.

If you want to know what humanity will be like in the future, or at least what direction it is currently heading, look at who is having babies and who isn't. That will tell you which traits are being selected for, and which traits are being selected against. For example, religious fundamentalists have more children than atheists or religious moderates. So, people in the future will be more religious and conservative on average than they are today.

6 The Problem with Progress

We have been raised to believe that progress is simply a matter of advancing science and technology. But that's not really true. By themselves, science and technology don't solve any problems. They give us knowledge and power, but knowledge and power are not sufficient to create progress. Progress is a matter of how we use that knowledge and power, as individuals and societies.

Consider the invention of nuclear weapons. Those weapons helped the US defeat Japan in WWII. They made the United States the dominant world power. But eventually other countries acquired the ability to make nuclear weapons. Now the world has a new problem: the threat of global nuclear annihilation. The solution to one problem created a new problem that is much bigger.

When people are starving, we try to increase food production. If we succeed, then there is abundant food for a while. But eventually the population grows until it exceeds the food supply again. Technologies of abundance don't create abundance in the long run, because life is fundamentally unstable. It grows by amplifying feedback. It eventually consumes all available resources. Limits have to be imposed on life. Life does not limit itself.

But what about birth control? Doesn't that solve the population problem? For a period of time, people might choose to have fewer children, thus lowering population. In the long run, however, that doesn't work. The birth control pill selects for those who don't use it, and it selects against those who do use it. Voluntary birth control is self-defeating: it eliminates itself.

These technological solutions don't work, because they don't address the underlying fundamental problem that life is a competition for limited resources.

There are problems of social conflict and control that cannot be solved with technology. Preventing war on a global scale requires a global government. Stabilizing population is also a social problem: it requires social control of individual reproduction. Both problems require cooperation to solve. They require coordinating the actions of multiple agents to produce a better collective outcome. They are social problems, and they require social solutions.

See Game Theory and Society.

Technologies also create problems for individuals, and again, they create problems by solving problems.

Suppose that we had very good virtual reality technology, something like the holodeck or the Matrix. Instead of one blue pill, there would be lots of blue pills, and you could choose which one to take. Take one pill, and you are having sex with a beautiful woman. Take another pill, and you are climbing Mt. Everest. Take another, and you are falling to your death from a plane. You could experience anything that you want, without real-life consequences.

If you could experience anything in virtual reality just by taking a pill, or plugging a USB cable into your head, would you bother to do anything in reality? Would you seek an education? Try to advance your career? Go to the gym and work out? Try to meet a girl at a bar? Go on a hike or a road trip? Or would you just immerse yourself in a fantasy world?

Virtual reality is science fiction, but we have lots of existing technologies that provide us with artificial substitutes for real experience and real action.

We create technology to satisfy our desires: to make it easier to get what we want. That creates new problems. When something is too easy to get, we tend to overindulge in it, or we eliminate the physical and mental exercise that we used to get by pursuing it. To make matters worse, technology can give us artificial substitutes for the natural objects of our desires.

Emotions are there to make you work hard to get things that are usually hard to get. In an environment where the objects of desire are abundant or fake, our emotions are detached from their functions.

There is a very old technology that can satisfy any desire: opium.

Opium is the ultimate blue pill. If you take an opiate drug, such as heroin, your desires are erased. Anxiety, discomfort, hunger and lust all fade away. You feel warm and fuzzy.

The feeling doesn't last, however. When the drug is metabolized, your desires come back, and then you feel bad. You want another hit. Taking the drug can become a substitute for functional behaviors, such as eating. It is easier to just take a pill than solve all the little problems of life, such as making dinner.

In a way, information technology is similar to opiate drugs. It is an artificial substitute for real experience. Pornography, computer games and social media are the equivalent of junk food for our brains. They are junk information. We get addicted to these easy substitutes for real experiences. We did not evolve in a world where we could get any kind of information on demand. Now that we have that ability, we are not using it wisely.

Birth control is another technology that detaches our desires from their functions, and thus makes them easier to satisfy. The function of sex is to make babies. Birth control makes sex much energetically cheaper, because you don't have to take care of a kid for 18 years afterward. Birth control makes sex into a simulation. It feels like real sex, but it lacks the function of real sex: reproduction.

These days, instead of having kids, people buy cute little dogs that resemble human children. Their cute little faces are designed to plug into our parental instincts. That is a type of biotechnology, and again an old-fashioned one. Puppies and poppies are both addictive substances.

More and more, we are immersed in illusions, pursuing fantasies, detached from reality, and detached from each other. We are already in a futuristic dystopia, a Matrix of our choosing. It feels like progress, but we are just spinning our wheels.

Deciding how we should use technology is not a problem that technology can solve. It is a problem of values. The big problems of the future are philosophical and political.