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Computers of Generation Omega and the Future of Computing

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1 Philosophy of Optimism

Why we need a philosophy. It is difficult to predict what will happen to computing in 100 years. Extrapolations do not work well. Just imagine that someone tries to predict the future of computing in 1917. What would they predict? Better slide rules? More reliable arithmometers – mechanical devices for addition and multiplication?

Why we need optimism. So what they would predict in 1917? Just recall that 1917 was the the fourth year of a devastating world war. Millions are dead. Civilization is ruined. A brutal communist dictatorship has just taken power in a multi-million Russia after a short period of promising democratic government. There seems to be no end to the senseless war. What will happen in 100 years? Computing seems to be the last thing people will care about. Optimists will predict reluctant peace among the smoldering ruins, pessimists will predict the same war going on and on. And they were both wrong. In comparison to their gloomy predictions, the world in which we live is almost a paradise on Earth – no world wars, longer lives, better level of living, and unprecedented successes in computing.

One does not need to go as far as 1917 to promote optimism. When I lived under the communist dictatorship of the Soviet Union, with my former advisor in exile for reading Orwell and other "illegal" books, with several of my classmates in jail for the same crime, with no possibility to attend any conference abroad and with KGB reading all my letters, we all liked the songs of Alexander Galich, an underground anti-dictatorship songwriter. In one of his saddest and gloomiest songs, he described how a hostess would play a tape recording with Galich's songs, and guests would say that the songwriter is too brave to make such statements, that he could be dragged to jail – to which the hostess would reply that the author had nothing to be afraid

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of, since he died 100 years ago. That was the mood in 1970s, and what happened? Where is the communist dictatorship, where are our fears? Gone.

People tend to be pessimists. Koz'ma Prutkov, a pen-name of a group 19 century Russian satirists, had a funny poem about a young man who wants to shoot himself because the sun went down in the evening, and he is afraid that it will never go up again. How many young people think that their life is over just because the person who loves them loves them no more?

So let us be optimists. Let us be extreme optimists.

What does it mean to be an extreme optimist? Being an extreme optimist is to believe that all our dreams, all humanity's desires will eventually become true. Maybe they will become in 100 years, maybe longer, let us view 100 as simple meaning "in the bright future", and let us dream what this bright future will look like.

So what are humanity's dreams and desires? Humanity has many dreams and desires.

Many of these dreams and desires are, in some sense, technological, meaning that in principle, we know how to achieve them, it is a question of effort and resources. For example, we would like to go to Mars. Yes, there are many technical problems that need to be solved to be able to do that, but in principle, we know how to do it, we have ideas, we have experience, we have the technology – and if we devote enough resources to this problem, we will do it.

We want to go to the distance stars. This is definitely more complicated, but again, there have already been designs and plans, and, in principle, in 100 years or 200 years, we think it is doable.

We want to overcome diseases, to find cures for them. The question is to find the right medicine, we – the humanity – are working on it, and eventually, we will find chemical or genetic or whatever way to fight each known disease.

Optimism means believing that we *can* do it and that we *will* do it. In the future, there will no wars, no hunger, few diseases – and everyone will have access to as much super-computing as technology can afford.

But there are other dreams too. And there are also other dreams and desires beyond what is, at present, technologically possible.

Some of these dreams and desires come from the impossibility to change – or even know – the past. We have all made mistakes in the past, would not it be nice if we could go back and correct them?

Even without changing: would not it be nice if we could visit the ancient Rome and see for ourselves how life looked like in the past – just like now we can we go to Rome now and see how people like there, and just like – hopefully – in the future we will be able to go to Mars and see for ourselves what the Martian landscape looks like.

We would like to do all this, but there is, at present, a barrier of time: according to modern physics, we cannot go to the past, we cannot change the past.

Can these desires be fulfilled. As we have mentioned, in the traditional physics, it is impossible to go to the past. However, physicists have already considered alternative

physical theories in which causality violations – i.e., movement of information and materials into the past – are possible. This research became mainstream in the 1990s, when Kip Thorne, the world's leading astrophysicist, published several papers – and a popular book – explaining that in such areas as cosmology, string theory, etc., variants allowing time travel to the past are quite possible; see, e.g., [1, 2, 3].

What will happen when these desires are fulfilled? Let us analyze what will happen when it will become possible to travel to the past – and thus, it will be possible to travel to the future and come back (or at least to send the information back).

Let us start with computations. It will not matter how fast or how slow we perform computations – we can always set up a computer in such a way that after it finishes computations, it will send the results of these computations back to the past, to the moment when the user started these computations. From the user's viewpoint, he or she will get the computation results right away, without having to wait any amount of time at all. This means that from the user's viewpoint, it is as if the computer is computing with the infinite speed – finitely many operations m performed in 0 time, so computational speed is $m/0 = \infty$.

This is the ultimate limit of what we can expect from the computers in terms of their computation speed. From first to second to third to forth etc. generations, this speed has been steadily increasing. From this viewpoint, a computation scheme involving trips to past, a scheme that allows for infinitely fast computations, can be viewed as a computer of the infinite generation – generation omega.

But in this optimistic view of the world future, the effect of the possible time travel goes far beyond fast computations. Indeed, we have assumed that all dreams will be eventually fulfilled, all knowledge will be eventually acquired. But with the presence of a time machine, eventually means it will become available now! Thus, once the time machine is invented, the humanity will achieve the state of Ultimate Knowledge – we will know everything about the world, all its laws, all the ways to use these laws to make things happen.

In particular, this means that we will learn how to travel from one end of the Universe to another – and since there is no causality limitations, there is no longer the speed-of-light limit on how fast we can travel.

We will be able to cure – and prevent – every disease. Indeed, in our optimistic viewpoint, eventually, for every disease, a cure will be found. So, by traveling to this eventual future and coming back, we will be able to use this knowledge now. All the methods of extending human lifetime will be eventually invented and thus, available right now – so people will be, in effect, immortal.

So what will these immortal all-knowing creatures, able to travel from one side to the Universe to the other, these real-life "angels", what will they do? What will be *their* dreams and desires?

What will be their dreams and desires? In addition to technologically feasible dreams and desires (like flying to Mars), and to time-travel related desires, there is also another class of desires which are even more difficult to fulfil: overcoming the *barrier of I*.

People like to communicate, but communication is not easy. I would like to describe to you my ideas about the future of computing but so far, the only way to do it is by using words – and everyone knows that this is not a perfect way to communicate:

- some meanings are lost,
- some meanings are misinterpreted,

etc. A poet or a musician would like to convey her feeling, but is limited by the corresponding media.

Optimism means believing that this barrier will eventually be overcome, and overcoming this barrier is what the all-knowing creatures will do.

Final stage. What will happen when the I barrier will be overcome? People will communicate so deeply, they will become so close to each other through this communication that, in effect, they will form one single entity – consisting of several sub-entities ("people"). If I can feel exactly like the other person, if I can think exactly like the other person – in some sense, we are one.

And, to the risk of sounding blasphemous, this united humanity (and alien-ities, of course), all-knowing, all-powerful, in control of the Universe, using all the Universe as a large computer to decide the fate of the Universe through all the times – maybe this is what our ancestors meant by God?

When will all this happen is difficult to say. When will all this happen, in 100 years, in 1000 years, in a billion years, it is difficult to tell, but being an optimist means to believe that this will eventually happen!

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