FRACTAL, FRAGMENTED, ATOMIZED: THE SINGULARITY FROM A COMPETITIVE PERSPECTIVE

Roberto Domingos Taufick

Abstract: One can wonder how much could we have avoided if only we depicted today's dilemma decades before. Having that in mind, this paper looks at long run developments in science in the so-called "Singularity" to shed light on how the future might look like. This work shows why it is likely that we will achieve not only one but many Singularities. It also claims that the atomization of the economy and more equal access to information will lead to fractal competition at the level of the algorithm, helping raise a society with more choices but also more fragmented.

Keywords: Singularity, competition, atomization, fragmentation, fractal

***Palavras-chaves**: Singularidade, concorrência, atomização, fragmentação, fractal*

I

Legal experts have been showing great concerns over how network effects can affect competition and, as a consequence, innovation in the 4th industrial revolution. Fear from the impact of today's design of the digital economy on the future generations is necessary to pave the way to an efficient but also more generous society. However, one can wonder how much could we have avoided if only we depicted today's dilemma decades before.

Certainly, companies at the forefront of technology like Google and Amazon not only have made this exercise long before but have also invested heavily in its implementation and in speeches that have long shielded their businesses from further antitrust and privacy scrutiny. So far, law enforcers have been scrutinizing algorithm neutrality as a way to avoid deceit and more recently as a way to prevent discriminatory bias and to protect people from bulk unauthorized data collection. But how much of such concerns would still apply some decades from now in a world where phenotypes, sexual orientation and privacy are no longer issues? This paper

does not deny the relevance of caring for the welfare of today's community, but how many problems can we avoid in the long run if only we plan better? Taking the example of network effects, how much more competition and and how much more welfare have we denied ourselves only because we -- in particular scholars and public authorities -- are short-sighted? Why does it takes us so long to understand the path paved by those who are at the forefront of technology?

For a few decades now, a fraction of the scientific community that is deeply involved in the creativity process of contemporaneous technological progress has devoted time to explain the roadmap to the gold of today's entrepreneurs. In any case, public officials only achieve the necessary degree of understanding of the technological progress so as to design smart solutions long after the entrepreneurs have already deployed the technological developments they had been investing in and reached market power -- not rarely, relying on abuses of market dominance.

As the progress in artificial intelligence becomes more accelerated and the path to innovation seems unconstrained, it seems however the gap between the technological progress of cutting edge innovations and the understanding of said knowledge by the public officials is shortening. Maybe for the first time in history widespread and free flow of relevant information can help scholars and authorities address the pitfalls of tomorrow by preventing bottlenecks from emerging.

That notwithstanding, a great divide between the entrepreneurs' taste for the unlikely and the authorities' exacerbated realism risks throwing away our ability to prevent abuses of market power: The public officials and the traditional academic community have shown but skepticism about the world that futurists depict and entrepreneurs along with them invest in. Unwisely, we have been shutting our eyes to the very minds that have across history leapfrogged ahead of regulators and society in understanding where we are heading to.

The soft human-machine integration that nanotechnology, robotics and artificial intelligence have already made possible is just a breeze that converges with broader DNA mapping, cloning and other developments that put the scientific community ahead of dilemmas that will drive humanity towards a future where self-determination reaches unprecedented levels. And with the power to redefine who we are -- first, our phenotypes, then our genetics and eventually our brain support -- comes an array of opportunities alongside the risk of doom.

Today's quest for the ability to replicate the human intelligence in the computer is as groundbreaking as the abilities we developed in the past: The ability to change sex, voice tone, do implants, save lives by chemical processes and give birth by artificial insemination have had their own 15 minutes as groundbreaking facts in the evolutionary process, all in this never ending process of challenging and deconstructing dogmae. William Nordhaus (2015) also makes this point, as he quotes Gordon:

> "Two issues arise here. First, we should ask how the value of the unmeasured value of IT compares with the new products and services of earlier periods. Gordon (2012, 2015) persuasively argues that the unmeasured value of inventions of the 19th and 20th century dwarfs the value of IT. We might point to examples like indoor plumbing, anesthetics, electricity, radio, motor vehicles, lighting, photography, antibiotics, and even the lowly zipper as examples of goods with vast unmeasured consumer surplus."

At different levels, we have not been able to understand that where we sit is just somewhere in the middle of a trajectory -- and that by understanding that we are a stage to achieve another stage (and so on) we fail to solve today the bottlenecks of tomorrow.

The inability of most of us to understand our place in history as we ride the evolutionary wheel has a lot to do with imperfect information. As we achieve greater access to qualified information, our ability to understand market trends are enhanced. Still, the more distant the reality we are trying to envision, the tougher it is for the community to understand it. To put another way, people find it easier to believe in incremental changes to today's systems than in revolutionary changes that turn today's features dysfunctional.

The ongoing debates over the effects of biased algorithms and network effects in artificial intelligence are in line with this mindset: Autonomous machines and their constant progress has been followed up by a large academic community and family of public officials. But that is not the case of innovations expected to happen somewhere later this century and which rely on radical changes of the perception that the common human has about who he or she is and therefore depend on higher levels of abstraction. That is the case of the Singularity.

Only a few scholars are aware that the Singularity may be right at the corner. As Kurzweil points out (1999), even brilliant minds are more concerned with answers to immediate concerns and are not aware that the speed of innovation is an ever accelerating process according to the law of accelerating returns[1]. In "Are we approaching an economic Singularity?"[2], William Nordhaus asserts -- and we reiterate now -- that "[t]here is remarkably little writing on Singularity in the modern macroeconomic literature".

The absence of studies on the Singularity and the niche discussions on the subject are important proxies of how marginalized more abstract discussions perpass the scholarly interests of most academics. And even futurists[3] commit the sin and rely too much on today's parameters to believe that the scarcity of resources available for us in the universe will eventually lead to diminishing returns and to the doom of innovation. So it is quite possible that when the answers to today's problems -- like the liability of men for the acts of artificial intelligences -- come up, we will already be too close to the Singularity in order to discuss in advance and preemptively its implications on many fields, including the law and economics of competition.

I propose in this paper that competition will still be the driving force that will create different -- not only one -- ways to embrace the Singularity and emerge as a new species. Competition will not only be the driving force for the perpetuation of the law of accelerating returns, but also for forging less biased and more democratic intelligences, if we are to sustain the universalization process that has also accelerated in the last hundred years. As Hanson (2016) point out wisely, the values of today will not be shared by our descendents[4], so we can never be sure which way the evolutionary wheel will keep moving.

---

[1] "After all, it took me forty years to be able to see what was right in front of me, and I still cannot say that I am entirely comfortable with all of its consequences." (Kurzweil, 2005)

[2] 2015.

[3] Hanson (2016).

[4] To have in mind a clearer idea, by the end of the century my daughter's (who is now 5) grandchildren will be about to bear children if all of them procreate at the age of 30.

II

Competition forces have been driving human evolution towards the Singularity just as they have done for the Universe forces in general since the Big Bang. Competition has guided us so far by means of the survival of the fittest -- no wonder Kurzweil (1999) and Hanson (2016) often point out that those who do resist the new epoch (or era) are doomed to extinction as the Singularity arrives (or destined to be marginalized in the age of Ems). Competition and evolution are closely tied not only when biological evolution concerns, but when the digital revolution is explained as well. As well pointed by Kurzweil (2005), "[w]e would have to repeal capitalism and every vestige of economic competition to stop this progression [of 'high tech' in the business community]."

More intense levels of innovation is promised for future designs where machines take control of the economic life. Both Kurzweil and Hanson converge on that competition will grow exponentially to unprecedented levels right after Singularity or the Age of Em is reached. Actually, the Singularity is named after the (Cosmology) idea that evolution will grow to unheard-of speed nearly -- but never -- touching infinity. Hanson, however, not a Singularitarian, claims that the volume of available resources will at some point in the future drop considerably and net economic growth should fall to very low rates. According to him, 'for the vast majority of future history, growth and innovation are probably mostly imperceptible, and thus irrelevant for most practical purposes'. The end of technological innovation is an important indicative that in Hanson's future competition will have limited effect on the efficient use of resources. For him, other sorts of innovation, like legal innovation, will become more important.

For the Em world, Hanson bets initially in extensive -- and thus cheaper -- innovation. As he puts it, because "ems are based on computers, which have tended to innovate faster than most forms of capital, em labor is likely to become more cost-effective faster than kinds of capital that are not computer-based". As mentioned, he claims that one of the most important innovations will be in the legal field, by improving intellectual property rules, especially independent discovery as a legal defense for patent infringement and the protection of the intellectual property of innovations. But eventually software and hardware designs for implementing brain emulations will reach diminishing returns and only minor improvements will

take place. It is not yet clear when innovative forces will succumb. It is not clear either which resources are those that halt innovation but do not prevent Ems from consuming and even becoming innovative out of technological markets. After all, one of the great qualities of innovation is using available resources -- whichever they are -- in a new and unexpected fashion. If Ems do not need as many resources as we do to feed them up and humans will go back to a more modest life, efficient recycling and cloning should help Ems spare natural resources and have enough to use as input for innovations.

Predictions are[5] that we will achieve the Singularity by the end of this century. Believe it, or not, no one has however devoted time to understand the role that competition will play after the new epoch is inaugurated. The most prominent voices of competition are one step behind, discussing the effects that artificial intelligence will have over cartel persecution. This ongoing discussion is quite relevant for the understanding of how competition will develop in Singularity -- it shows a path and a mindset that help us better understand what kind of Singularity we are keen to experience and how much competition we are likely to embrace then. Nevertheless, there is no reason to stop there: Economists, lawyers and other antitrust experts should look with interest at their hard sciences' counterparts -- and on how they use the prospects of technological advances to propose new and more abstract sets of ideas that reflect back on how innovators of today will use technology -- and follow suit. Futurists help ideas about the future mold how technologies of today will be developed.

Those discussions also involve how inextricably linked competition and privacy are in the technological ages: Because we are now helping mold the moral standards of the intelligence that will help us reach levels of knowledge that are inconceivable today, the delimitation of how deep artificial intelligence can go to collect data will be decisive to design the rules and the bias that will drive us forward after the Singularity is reached. Putting it another way, the levels of tolerance and the amplitude of the understanding of reality will depend on how much the algorithms of artificial intelligence and future superior computational intelligence have been exposed to the thinking and culture of today's minorities. That said, I am not necessarily proposing that we do not protect privacy today: What I claim is that we should first look into the future and see how different levels

[5] Kurzweil (1999).

of privacy implemented today would reflect back in building up unbiased algorithms in the future.

Something has already been discussed about the roles of bias and economic power in the design of deep learning algorithms that will end up leading to the superior computation intelligence that inaugurates a new epoch and a new human species[6]. Much has already been said about liability of humans for the acts perpetrated according to the decisions of algorithms that men are smart enough to understand, oversee and alter. All that is relevant because is happening now and for their effects over algorithms that have been built to offer better public security, better headhunting and better interactive content, just to mention three hot topics. But as we distance from the present to see how much intervention is in fact necessary to build a better place and how much competition is desirable in a world of big data and superior intelligence, the level of complexity grows and scholars -- particularly legal scholars -- try not to invest too much time in prognoses.

III

Most futurists are scientists and their concern is to explain, inspire and contribute to the design of our future. They claim based on laws of physics, mathematics and even economics, but little has been written on how competition will drive intelligence. Hanson, for his background in economics, explores at a lesser degree competitive concerns. He points out (2016) that Ems -- whole brain emulations -- will compete against each other as workaholics and that more competitive or faster Ems will be more costly to humans.

But he also claims that, if the last technology to be ready before the appearance of Ems is cell modelling, then the first mover will have substantial market power that might last longer if the secret to cell emulation is hard to discover. He also claims that, if only a few investors are able to follow and foresee the new developments, a concentrated winning coalition of investors is likely to arise. Even though he does not go further, he probably suggests that before innovation halts, the world will already be a monolithic economic place dominated by a monopoly. Even though he does not make it

[6] Ito (2017).

clear how long it will take for innovation to halt, the stop in innovative forces may have a lot to do with the lack of competition.

Hanson claims that competition will be fiercer both because of the workaholic mindset of the Ems and the strong offer of qualified employees. However, he expects "Em firms to focus more on cost and less on novelty. This suggests that Em firms have higher market shares, lower markups and profits, fewer layers of management, and less "innovation, employee initiative, and pay-for-performance." Also, "the em economy has less product variety, and innovation matters less for growth in the Em economy."

Also an economist, Nordhaus (2015) uses data (i) on all non-farm business sectors to conclude that the acceleration in output exists, but places the Singularity many decades later than estimated by the most optimist (the middle of the 21st century), (ii) on private fixed assets to conclude that prices are declining but not at accelerating speed, (iii) on information capital stocks vis-à-vis output to show that overall capital-output ratio has been rising at modest rates and (iv) on the share of informational capital in total private assets to indicate that it would not approach 100% within the next one hundred years. He also acknowledges that, at least in theory, "improvements in material use and miniaturization can overcome the physical limitations on accelerating growth".

Nordhaus fails, however, to realize that price cannot capture most cutting edge improvements in technology (for which there is no monetary price), that an increasing replacement of goods (hardware) by software is taking place and that -- as I claim below -- the Singularity will not happen at the same pace for everyone. Also, the study is wrongly based on projections of currents rates of growth -- a flaw anticipated by Kurzweil in 1999 that the Nordhaus himself recognizes as he closes his text.

Above all, his study is already proved wrong vis-à-vis computers' increasing ability to mimic human behavior and taking into consideration that it counts on many skills that computers will not need in the Singularity, like reading bedtime stories to children. But the major flaw in his work is the absence of any explanation as to how the speed of technology transformation has already been accelerating so drastically under the conditions that he describes and which according to him would curb the achievement of the Singularity at the pace that futurists propose. In any case, it matters that even pessimistic scientific approaches like his lead to human kind reaching the Singularity -- or an Em-like world -, if not by the end of this century -- like Kurzweil claims -, somewhere not far beyond that.

I also beg to differ from Hanson's idea of world. Taking the history of the universe as a proxy, the Singularity will not be monolithic. The exclusivity that monopolies and monopsonies carry prevents both divergence and the innovation that combined drive evolution. The degree of sophistication that the law of accelerating returns requires will demand increasingly more -- not less -- competition.

That does not mean that the Singularity will arrive at the same pace for everyone, but it will be democratized at the usual pace of product discrimination. That also seems to be the idea shared by Google's chief economist Hal Varian. As he emphasizes (2019), firms cannot simply outcast everyone but the 1% wealthier because they need the rest to purchase their products -- even at zero price. That rationale is also present in his book with Carl Shapiro (1998), where both show how products can at the same time be democratized, but also price discriminated.

Neither will the Singularity offer the same kind of experience to everyone. From our perspective, competition will lead to a fractal, fragmented, atomized Singularity. That starts with tackling today's foreclosure to essential input (data). Ongoing discussions around big data and network effects inevitably lead to open access to information and ubiquitous access to knowledge. A recent report from the British Digital Competition Expert Panel recommended that:

> "Second, the digital markets unit would be charged with enabling greater personal data mobility and systems with open standards where these tools will increase competition and consumer choice. Some companies are already making substantial efforts in this regard, like the Data Transfer Project that includes Microsoft, Google, Facebook and Twitter. [...]
> Third, the digital markets unit would be able to advance data openness where access to non-personal or anonymised data will tackle the key barrier to entry in a digital market, while protecting privacy."

At the same time, the low costs to produce and deliver[7] has already revolutionized the services industry and triggered the transformation of former products into services by 3-D printing -- a trend that will only get more robust. Universal access to decent network services -- including

[7] Lemley (2015).

education -- and the progressive merger of computational intelligence with our own will offer the ability to force "self-made humans". Education will help competition grow by means of atomized programming units and tailor-made services.

The law of accelerating returns is also a key aspect of the democratization of technology and the democratization of knowledge that will eventually lead to more equal opportunities to thrive: The pace of innovation will shorten the gap between the rich and the poor. Although the richer 1% may earn as much as they do as compared to the bottom 50%, cross generational alternance in the list of the wealthiest will lead to a larger number of families and communities involved in the circulation of money. That, together with the atomization of services will allow the perpetuation of a diverse universe for the Singularity, with different sets of experience based both on the choice of people and on the degree of bias of the algorithm one chooses to purchase.

The immediate question is what kind of bias exists when phenotypes no longer matter. The answer is not so obvious, but still straightforward: The genetic memory will influence the way people choose the experience they want to live in the Singularity, corroborating the prospects for a dispersed market of computational intelligence environments.

Atomization is the inevitable output of the falling costs to distribute, to code and the decentralization of power that both the Internet and cryptography bring about. 3D printing, blockchain and distributed autonomous organizations (DAOs) are proxies of the atomization that is still at its early days now and tends to escalate in the future. The sharing of data — the great bottleneck we fight against today — will, as mentioned, likely be addressed in the next few years by means of mandatory open platforms[8]. At the same time, blockchain traceability as well as nudges will help users understand the benefits of the portability of data backlog and, because hard forks allow one to take a copy of all the competitors database in a spin-off[9], create the necessary incentives for peer-to-peer sharing of prospective data.

The evolution of the Internet of things and the use of blockchain to develop unique digital identification will also enable deliveries and supplies to and from each individual -- so every transaction information will also be stored with the individual herself in such a way that portability will prevent

[8] Digital Competition Expert Panel (2019).

[9] Ehrsam (2017).

input foreclosure in the digital economy. Atomization is also possible because unheard-of collaboration will supersede integration or internalization: Blockchain lowers the transaction and agency costs together by means of the escalation of trust, basically eliminating the costs for collaboration. Complementary and more specialized suppliers will deliver cheaper and more efficient output.

The atomization is, to a certain level, also envisioned by Hanson, who claims that, if help is needed, Em engineers may create a team of copies and train them. Help from different clans may also be asked if skills other than those that the individual engineer can build *in loco* are still needed. Hanson sees the atomization in a more limited instance than we do, though. For him, atomization does not happen at the level of brain emulations -- especially if technology innovation is not determinant in the future he depicts.

It must always stay clear, however, that even though competition is a rule that levels the playing field, it does not afford equalizing people's wealth -- whatever wealth means in the future, be it money, or most likely something as intangible as reputation. Nor will everyone have access to the same level of knowledge. As claimed by Joichi Ito in his Manifesto (2017), the Singularity will not solve and might even widen the gap between the wages of the rich and the poor -- it will all depend on how intelligence will evolve towards cooperation. The path has not been tread yet. But the good part lies in that the poor will have easier and faster access to the knowledge detained by the rich -- which may improve social mobility at unheard-of levels. And, as anticipated, social mobility leads to greater distribution of wealth.

That is also the extent to which I disagree with Ito: even though -- opposite to what he claims In Resisting Reduction -- the Singularity is not an environment designed to promote equality and we are not likely to have a Singularity that will embrace us all as equals, the Singularity will, at the same time and like never before, level the playing field and reward those who excel at the coin that each Singularity platform values the most. Today, the most prominent coin for Singularity enthusiasts -- as he highlights -- is knowledge in digital computation.

But better coding is also attached to taking decision-making out of subjective human control and turning it as objective as possible. Naturally, a world free from surprises has its ups and downs and we expect many tech-

savvy groups to diverge and create their own coins. The beauty of the Singularity lies precisely in making it possible to decentralize to the individual the choice to design the best solutions for herself in each aspect of her life, based on an array of alternatives. And because people will stand the right to choose, it is even possible that, aside from the Singularity and contrary to Kurzweil beliefs, a world of flesh and blood human lingers. The Singularity, in many levels, can make it possible to have multiple parallel microsystems living side-by-side on Earth -- hopefully in a cooperative environment.

IV

It may seem very obvious, but we usually fail to note what stands right in front of us. That is why it is so important to highlight that the kind of environment we will observe in the Singularity is to be designed as we build the path to a higher intelligence. The values that we share, the freedoms we cherish can be -- if we do our job right -- inextricably linked to the code that we want to be used as input to make automated decisions.

That is not an easy task. Scholars like Roland Vogl have dedicated their scholarships to understanding innovation benefits and harm. And yet, most of the rights that he addresses as prone to receive legal protection in our era[10] -- privacy, property, body harm -- may not survive the century as we reach the Singularity. So what is to be protected tomorrow is not necessarily what we protect today, but the principles that make it so straightforward and consensual to protect certain things.

Free will as we know it has moved us towards a world where we want to hold the power to arbitrate as much as we can in every aspect of our lives. Clearly, full control over what we desire is not feasible while there are other conflicting interests -- that is in fact why we project so many aspects of full free will in games and virtual reality. But the degree of self determination improved by technology may leapfrog -- not today, not even tomorrow, but when it does it will inevitably be due to improvements of technologies that we develop now.

As technology evolves, we must also guarantee access to essential facilities, killer applications and other sorts of inputs that are necessary to

[10] Edgell, Robert and Vogl, Roland (2013).

avoid lock-ins, foreclosures and any other option that may halt mobility. Access to big data today is seen as essential to prevent network effects and tipping. In the future, access to other rival and exclusionary goods, like specific sources of energy, may be even more vital. If correctly addressed, tackling foreclosures will allow the perpetuation of competition and its emergence at every level of coding. Competitive atomization of AI will become possible and with it we can design a path to multiple fractal solutions to superior intelligence in the Singularity.

Having that in mind, there are more subtle fights that also constrain self-determination. The fight against bias may reverberate in more important discussions concerning the incorporation of biased superior intelligence by different countries (sovereignty issues), different genders (gender issues), different races (racial issues), different backgrounds (cultural issues). The urge for the Holy Grail of unbiased algorithms or group-specific algorithms may lead to the creation of competition at the level of specific features of the algorithm.

Making myself clear, firms may compete in specific lines of the algorithm that design personal characteristics -- sex appeal, strength, character, personality -- or community values -- software backdoors, restoring and healing. It may even be that intrabrand competition at the algorithm level progressively become as relevant as interbrand competition at hardware is today. Intrabrand competition will have unprecedented improvements if, as Hanson predicted, intellectual property is improved in the first place to make it easier to incorporate new technology into old products.

Because previous to the Singularity we are so different -- not only in our minds, but also in features that will no longer be relevant afterwards -, the pace to the popularization of and the massive incorporation into Singularity rely heavily on how fast we algorithmically drop behind those differences, at least in the perception of the people. Designing better unbiased programming at the level of the algorithm will therefore demand either intensive use of minorities as coding engineers or massive access to data.

Because the unauthorized sharing of personal data is unlikely in democratic countries and insofar as alternative solutions -- like designing opt in mechanisms -- are not acceptable (also in democratic countries) when one leaves the field of financial information and cross the line into personal data,

we see ourselves before the inexorable call to foster social inclusion in the next decades. According to our understanding of the universalization of the access to information, we bet that access will grow steadily as soon we follow initiatives like Elon Musk's satellite constellation[11] -- which promise to take us to unprecedented level of access to the Internet and to the democratization of knowledge.

After all, reaching an *inclusive* Singularity -- meaning a future where all the people can voluntarily take part and have real opportunities to thrive, not where most people are financially equal -- will depend on how fast we converge to equivalent access to data and less biased algorithms. Because the digital economy revolutionized the industry by lowering the costs to distribute[12], thus helping atomize the economy, equal access to the digital education depends basically on the universalization of access to broadband and to quality information. Digital inclusion is key to raise the level of education of the today's outcasts, helping build less biased codes and by consequence a less biased law[13]. Competition at the algorithm level will be key to achieve that.

Code will help you determine what you excel at. Competition at every level will preserve self determination (due to budgetary restrictions everyone will have to choose which lines of coding are more relevant to them and spend more money in those solutions) and the perpetuation of plurality (different sets of people with different understandings of life). Thanks to competition, the central moral dilemma of today may be the same as tomorrow: To choose between code that brings more success but is more biased, or code that is neutral-oriented but leads to lower levels of competitiveness.

Codes that combine both will likely be possible, but too expensive. Some open access code will be made available by people who put more value on reputation/soft power instead of hard power. However, access to relevant hardware and relevant updates will not differ from today: They will still be first available to a few who will be able to take better advantage of the program. But because universal access to data and education will allow that anyone improve one's own code, initial access to cheaper algorithms whose

[11] The Verge (2019).

[12] Lemley (2015).

[13] Lessig (2006).

performance is inferior in key skills can be overcome by one's ability to rewrite and improve the code.

Competition at every level of the algorithm will then be responsible for a future where people can join Singularity platforms with certain basic features and choose specific features that will turn one's own experience unique. The beauty of a competitive Singularity is a different sort of inclusiveness: a fractal, fragmented and atomized world where people will have greater control over which reality one wants to experience, but at the same time be insulated in such a way from those who share other preferences that evolution may eventually create a hard fork in the human code and give birth to different species.

V

Finally, strong algorithm competition by line of coding -- triggered in our way towards the Singularity -- should be accompanied by fierce competition at the hardware level, where, as Kurzweil[14] describes, things are likely to get smaller and smaller.

As Ito claimed, the Singularity will not make us equals. Actually, as this paper tried to explain, even though the Singularity may be able to provide us with better chances to induce a level playing field where wealth is not the main ingredient that determines the fittest to thrive, the Singularity will also lead to a fractal, fragmented and atomized world that may eventually lead to a hard fork in the evolution of humans.

Hardware is a key part of this process. That is so not only because software may for a long time still depend on the the use of (at least minimal) infrastructure, but also because our abilities to find new habitats and deploy new civilizations therein will vary according to what each Singularity platform prioritizes. In plain words, a fragmented Singularity will be the conclusive step towards a scission in humanity that may end up leading each community to a different place in the vast universe as we assimilate the ability to establish colonies in space.

[14] 1999.

From what we have discussed, it must be clear that this unlikely and distant future looking from where we sit now may not take that long as we look at it from the new steps that we climb in the evolutionary process according to the law of accelerating returns. It must also be clear that, however distant we may think it is from us now, the Singularity and its developments cannot be seen as another story. Because we live in a continuum, all there will be depends on how we started at a certain point in the past. And here lies the importance of developing futurists in antitrust: There cannot be a fractal, fragmented and atomized Singularity where our ability to choose and self-determinate are rampant if we do not start from now engaging in solutions that will serve well the future we project and aspire.

References

Ammori, Marvin. The Singularity ... and Government in the Future. Disponível em https://www.huffpost.com/entry/the-singularity-and-gover_b_1006573?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS5ici8&guce_referrer_sig=AQAAAAMo_1VbKidKL_h3aPV4AyIBQyeEzs7On6pQTANQJznF82H6GMD0c_3DuxvYyBg6GTGphszDLxv560mnbsTpfoeagZU6ULuLTa6VTfn1XJdu1hzeT2tpdYJw3lq_0x0-s8tEYREuA6BKIhjbLlnfkiJXNjbLlhXhCa0wM-8mIz9O. In HuffPOst (updated on December 12, 2011). Accessed on May 27, 2019.

Digital Competition Expert Panel. Unlocking digital competition. PP. 5 e 6. March, 2019. Available on https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/785547/unlocking_digital_competition_furman_review_web.pdf.

Edgell, Robert and Vogl, Roland, A Theory of Innovation: Benefit, Harm, and Legal Regimes (November 1, 2013). Edgell, Robert A. & Vogl, R. (2013). A theory of innovation: Benefit, harm, and legal regimes. Law, Innovation and Technology, 5(1), 21-53.

Ehrsam, Fred. Blockchain Governance: Programming Our Future. November 27, 2017. In Medium. Available on

https://medium.com/@FEhrsam/blockchain-governance-programming-our-future-c3bfe30f2d74. Accessed on July 22, 2019.

Hanson, Robin. The Age of EM -- work, love, and life when robots rule the Earth. Oxford, 2016.

Ito, Joichi. Resisting Reduction: A Manifesto -- Designing our Complex Future with Machines. October 13, 2017.

Lemley, Mark A. IP in a World Without Scarcity. New York University Law Review. May 2015. PP 460-515.

Lina Khan (histórico do antitruste). The Amazon Antitrust Paradox.

Kapur, Arnav. A breakthrough device that combines mind and machine. In TED.

Kurzweil, Ray. A Era das Máquinas Espirituais. Tradução: Fábio Fernandes. São Paulo: Aleph, 2007. Edição original de 1999.

Kurzweil, Ray. The Singularity is Near: When Humans Transcend Biology. Viking Penguin, 2005.

Kurzweil, Ray. Como Criar Uma Mente -- os segredos do pensamento humano. Tradução: Marcello Borges. São Paulo: Aleph, 2015. Edição original de 2012.

Code -- version 2.0. Lessig, Lawrence. New York: Basic Books, 2006.

Nordhaus, William D.. Are We Approaching an Economic Singularity? Information Technology and the Future of Economic Growth. NBER Working Paper No. 21547. September 2015.

Varian, Hal R.. Room for Discussion. University of Amsterdam. March 20, 2019. Available on https://roomfordiscussion.com/interview/hal-varian-chief-economist-google/. Accessed on July 22, 2019.

Varian, Hal. R. and Carl Shapiro. Information rules: a strategic guide to the network economy. Boston: Harvard Business School Press, 1998.

Wired. Barack Obama on Artificial Intelligence, Autonomous Cars, and the Future of Humanity. Available on

https://www.wired.com/2016/10/president-obama-mit-joi-ito-interview/. Accessed on July 22, 2019.

The Verge. SpaceX successfully launches first 60 satellites in massive Starlink internet constellation. May 23, 2019. Available on https://www.theverge.com/2019/5/15/18624630/spacex-elon-musk-starlink-internet-satellites-falcon-9-rocket-launch-live. Accessed on July 22, 2019.