The Technological Wavefront

From X-Risks to W-Risk

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Keywords—technological wavefront; societal complexity; societal collapse; existential risks; whimper risks

I. Introduction

Since the invention of the lever, the wheel and the counting bead, humans have been consistently and successfully finding means of transferring chores, both physical and mental, to tools. Today, we have programmable computers that perform complex functions by evaluating different variables in order to carry out executive iterated and well-coordinated tasks. These programs take on the traditional, intellectual work of sensing and observation, judgement and analysis, and lately, decision-making, which were once the preserve of human beings. The downside of this tendency, however, is that every time we transfer responsibility to a tool or machine, humans lose the impetus to pursue higher goals that require enhanced dexterity and deeper intelligence. Each step up makes us lose something. As this simple loss of information is cumulative, and therefore detrimental to our knowledge wellbeing, and given that present information is scattered across different persons and storage cloud or vault facilities, then a sudden, massive loss of information, resulting from a catastrophic event, would be a colossal setback for humanity.

II. Background

However, over the course of human history, technology has proliferated in many areas of endeavor. The ancient world flourished with phenomenal technologies, some of which exist today in modified forms, some are known today but elude our understanding, and others have been lost forever. Concrete used in ancient Rome *remains* more durable than what we produce and use today. The Romans were able to apply incredibly thin metallic films to objects, technology that is comparable to current electroplating or vapour deposition. They successfully made use of nanoparticles, measuring 70 nanometers in diameter [1], in technologies that still elude our understanding. Also, the best swords used in the Middle Ages were composed of carbon nanotubes/nanowires, and the solar compass used by the Vikings is comparable to the modern magnetic ones [2]: they demonstrate an ingenious use of double refractive crystals. The ancient Chinese successfully drilled 2000 feet deep boreholes to mine salt, struck natural gas and created a network of bamboo pipelines, covering hundreds of kilometers to reach factories and dwellings [3]. Humans have achieved all of these feats, and a lot more that have not been mentioned here, prior to our modern rule of deductive experimentation. Drawing on these phenomenal achieve-

ments, one wonders whether scientific method prevents us from making vital inventions and discoveries by following our intuition. The pertinent issues that need redress, therefore, include, the things we are forgetting, those that remain hidden in plain sight, and of course, those that we are on the brink of forgetting.

III. Technology and the modern challenge

Half a century ago, countries such as India were on the brink of succumbing to an unprecedented Malthusian catastrophe. A team led by Norman Borlaug devised the so-called Green Revolution in the mid-20th century through the development of of initiatives designed to enable technological transfer to the agricultural sector. For instance, innovation led to high-yield, disease-resistant crops, which in turn increased global agricultural production. Naturally, the general rule is that an increase in population of any species results in increased resource constraint. For humans, as a society becomes more specialized, its complexity increases. But complexity necessitates more diverse and larger amounts of resources. Over a long period, as society expands, these effects become increasingly intertwined, and tend to continue as long as environmental conditions remain favorable.

A technological (organizational complexity) wavefront exists that harbours the possibility of successfully catering for the expanding resource needs before the requirement reaches critical levels. So long as humans develop initiatives to meet the needs just in time, societies will continue to become ever more complex. An example of an initiative geared towards meeting resource needs just in time is the National Institute of Advanced Industrial Science and Technology's [AIST] Robo-bees, which are capable of accurately pollinating the planet's flora [4]. The invention comes in the wake of the disappearance of many insect species, following the disturbance of their ecological systems through human activities [5], which, if unchecked, portends an ecological Armageddon. However, a society beleaguered by an inescapable bottleneck will experience wavefront failure, leading to its eventual collapse. Such collapse will be a step down in societal complexity to a level that is sustainable.

Today, such a bottleneck could be a global financial collapse catalysed by derivative markets, or a series of environmental catastrophes forerun by such events as the calamitous disappearance of insects currently underway. Other orchestrating factors could include a Malthusian Catastrophe, overpopulation, or the depletion of certain vital resources. In fact, the diverse evolutionary forms exhibited within a society also dictate the diversity of avenues of failure. Depending on the levels of simplifications that exist, any failure or societal collapse is likely to result in the loss of a great deal of knowledge. Despite the colossal amount of data available in contemporary society, the data largely remain contingent upon servers located in a small number of key clouds. A huge number of books currently exist in digital formats so that, if the battery that powers the system were to reach its end-of-life today, it would be impossible to retrieve a single book.

Exacerbating the possible massive impacts of such a loss is the fact that today, no single person posseses the entire knowledge pertaining to the process of manufacturing a vehicle or an electronic chip. Huge amounts of implicit knowledge exist in people's heads and in procedural memory of a slice of a single generation. So unstable and bizarre are these stor-

age forms that a coder might find understanding a simple code that they had written a few years ago extremely puzzling. If that is the case, then trying to repair systems whose sources are irretrievable or were lost a while ago would be a futile exercise. A responsibility for keeping the light of enlightenment burning steadily provides our momentum as a species. Should we ever lose this momentum, regrouping a few generations hence and starting afresh would be impossible. We would have forever lost the intermediate resources necessary to develop the present technological capabilities. For instance, once the cheap and easily accessible energy is depleted, humanity will be unable to rebuild the knowledge and capacity to leap into the realm of photovoltaics (PVs) and thorium fuel-cycle molten-salt reactors. Currently, the latter is the only accessible energy resource with sufficient EROEI (Energy returned on energy invested) to rebuild the current complexity.

Such incapacity would render us stuck; marooned Neo-Edwardians harboring dim memories of a golden age past, one in which we altered the genetic makeup of organisms simply to make them glow and dared to extend human lifespans, even as we came up with machines capable of replicating human behaviour. Yet we restricted them to mundane tasks that did little for our intuition, let alone the progression of our knowledge and capabilities. If only we could make walking on the moon a steppingstone for much space progress, or the objective progress of human knowledge, our technological wavefront would continue propagating. The greatest existential risk to humanity's future meaningfulness and excellence may not be something akin to a bang, but rather something benign whose effects accumulate over time.

Moreover, threats to the society not only emanate from the existential risks, X-Risks, but also from W-Risks, Wavefront Risk (or Whimper Risk). For instance, back in 1859, the Carrington Event, also known as the Solar Storm of 1859 induced so much current in telegraph lines that they could function without power. The event led to massive auroras that were visible as far south as Turkey. Note that such events tend to occur frequently, only that most of the time they miss the planet Earth. For example, the 2012 solar storm, which missed the Earth, was an unusually huge outburst of coronal mass ejection [6] with a strength comparable to the Carrington event of 1859. Had it hit the planet, our electronic systems would have suffered greatly. Should a solar storm of such magnitude strike the Earth in the future, the impact on our electronic systems will be so massive that the wavefront will collapse.

However, unlike X-Risk whose impacts are likely to be felt over a short period, W-Risk is incredibly daunting because it may result in a lasting, transgenerational lament. The current means of mitigating, or recovering from, the impacts of W-Risk include the Svalbard seed vault for genetic stock in Norway, intended to preserve important seeds should there be a global catastrophe. To complement this, hard backups of nearly all the existing technology catalogues would be necessary. We do not believe that merely pasting what currently exists in a post-apocalypse world would be sufficient. On the contrary, consider the need to not only preserve manuals from our time, but also those from decades and generations gone by, so that the post-apocalypse world can have a wide

range of tech levels. The emphasis should be on directly applied procedural knowledge and the principles often learned during practice sessions, using simple, non-technical language. For this, hard physical copies (or microfiche) are the most suitable.

In addition to the vaults of hard and soft data, it would be useful having modified schematics of modern thorium reactors that a WW1-era industrial base can successfully build, along with detailed refining processes and any locally available sources of fuel. With the right technology, studies have shown that it is possible to create similar miniature reactors that fit on a truck, but which have the capacity to power a small town. It is also noteworthy that widely used modern fertilizers are products of petrochemicals, which literally means that we are turning oil into food. But if we had a better understanding of terra preta, a dark, fertile anthropogenic soil found in the Amazon basin, then we could successfully replace inorganic fertilizers with organic ones. Primarily, such knowledge would allow humans to overcome food shortage following a global collapse, but our knowledge in this area remains limited.

IV. Conclusion

Existential and whimper risks, threaten doom for humanity and society as we know them today. The possibility of an unprecedented loss of information, which has often happened in the past, remains real. For instance, while the Neanderthals of the El Sidron cave had discovered natural analogues of aspirin and penicillin about fifty thousand years ago, the specifics of this discovery were lost to history. Moreover, the simple human inclination towards allocating jobs to tools and machines implies that our capacity to further existing knowledge continues to dwindle, and with it the prospect of recovering prior machine-assigned jobs. To counter this possible knowledge loss, we need to focus on knowledge preservation that covers both current and past technologies. The likelihood of encountering W-Risk, which seems greater than that of X-Risk, necessitates enhanced focus on the former, which is currently lacking. As difficult, challenging and important as these concerns are, we continue to treat them without the urgency and enthusiasm they deserve, either because our preferred scientific methods make us complicit, or because we are already sliding down the long, whimpering slope.

References

[1] D.J. Barber, I.C. Freestone, An investigation of the colour of the Lycurgus Cup by analytical transmission electron microscopy, 1990, Archeometry, 32, 33-45.

[2] B. Bernath, A. Farkas, D. Szaz, M. Blaho, A. Egri, A. Barta, S. Akesson, and G. Hovarth. How could the Viking Sun compass be used with sunstones before and after sunset? Twilight board as a new interpretation of the Uunartoq artefact fragment. *Proceedings of The Royal Society A,* 470 (2166), March 2014. DOI: 10.1098/rspa.2013.0787

[3] O. Kuhn. Ancient Chinese drilling. *Canadian Society of Exploration Geophysicists,* 29(6), June 2006.

[4] S. Kostarelis. *Japan has just invented Robo-bees that can legitimately pollinate the earth.* February 2017. Retrieved from https://www.techly.com.au/2017/02/10/the

se-robo-bees-may-one-day-pollinate-the-earth/

[5] J. Mikanowski. 'A different dimension of loss': inside the great insect die-off. *The Guardian.* December 2017. Retrieved from https://www.theguardian.com/environment/2017/dec/14/a-different-dimension-of-loss-great-insect-die-off-sixth-extinction

[6] R. Sanders. Fierce solar magnetic storm barely missed Earth in 2012. *UC Berkeley News Center*. March 2014. Retrieved from http://news.berkeley.edu/2014/03/18/fierce-solar-magnetic-storm-barely-missed-earth-in-2012/