The Technological Singularity

Louis Othen  
S21002027  
North Wales Management School  
Wrexham Glyndŵr University  
Wales, UK  
s21002027@mail.glyndwr.ac.uk

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*Abstract*

*There is a widespread debate regarding the new supposed revolution known as the Technological Singularity in both academic and commercial settings. The purpose of this paper is to determine what the Technological Singularity is, based on various versions seen, what different perspectives there could be, the relevant technologies that can fuel or hinder it from occurring, as well as what impacts outside of technology on the Technological Singularity on the world as we know it. In addition, literature reviews are conducted on disparate sources to research related information to determine what information is available. Current findings indicate factors such as Artificial Intelligence and Machine Learning, 3D Printing, and Robotics are some found thus far, c the Technological Singularity. It is also uncovered that the Technological Singularity could potentially impact society and the economy as we know it presently. Finally, more work is required to explore this topic in more detail further to uncover other impacts the Technology Singularity could have within politics, ethics and the environment; as well how to further technologies could be explored to see how this impacts its progression or hindrance, in particular, the potential influence data has upon it.*

Keywords—Technology, Artificial Intelligence, Impacts Technological Singularity,

# Introduction

This research paper investigates the widespread debate and varying elements regarding the Technological Singularity (TS). Firstly, due to the varied perspectives and concepts proposed, this paper reviews different authors on what TS refers explicitly to and what aspects of TS are creating public speculation from the differing views found. Secondly, attempts are made to uncover what technologies are either contributing or causing hindrance of TS from occurring. Thirdly. This research paper endeavours to examine the impacts of TS outside of technology from societal, economic, and political standpoints. Before going further, the definitions of TS are explored in greater detail.

# What is TS?

## Different definitions

Pandya states TS as an intelligence revolution in machines, where its disruption alters the anthropogenic processing of information [1]. However, Strickland suggests the definition as the development of superhuman intelligence by advancements in Artificial Intelligence (AI), changing how humans interact with technology [2, 3]. Conversely, Tzezna and Newitz describe TS as a set of ground-breaking technologies, which completely changes people’s lives to the point of no return [4, 5]. Furthermore, Zola describes TS as a hypothetical future where growth in technology drastically transforms reality as we deem it to be at present, where a post-singularity world is unrecognisable [6]. Finally, Grout states TS as an upgraded intelligent agent that can improve upon itself, eventually passing human intelligence [7].

Based on the statements presented in this paper thus far, we aim to see whether these authors have a consensus with each other on what TS is and see if claims are credible or convincing on the most concrete definition of Technological Singularity.

## Different Perspectives

Taking the first statement recorded by Pandya, Their viewpoints comes with some nuances to raise. Firstly, the standpoint here is mainly from a risk-based perspective regarding security, speculating about what risks could come from TS [1] rather than detailing any low-level information. Secondly, some self-referencing bias could be flagged, referring to their expert from the same company about TS; instead, multiple speakers could have been presented, from alternate views, that could have formed a more balanced conclusion.

Stickland, Tzezana, Newitz, and Zola [2, 4, 5] appear to have similar views, based on the views shared by Vinge [3] and Kurzweil [8] that involves a period of technological growth that changes how society may function in future. This concept provides confidence that this definition can be a more high-level term associated with TS. Now that we have established a definition of Technological Singularity, this paper will aim to uncover what types of technology will factor into the progression or delay of TS from occurring.

Whilst Grout [7] provides an extensive paper within this area, there are many references quoted from science fiction; whilst this can allow the reader to assume what TS could have been, these cannot be determined as sufficient to support claims since these novels cannot be used as academic resources.

# Technology impacting TS

## Artificial Intelligence (AI)

With notions referring to the Technological Singularity, which technologies out there – now or in the future - influence TS, one re-occurring element in many articles is the use of AI and Machine Learning (ML). With Knowit.eu, Duggal, and Marr all quote that it has already impacted the way we live and learnings that can determine how we act in the future [9, 10, 11]. Though one could debate how AI and ML could influence our future, there seems little argument that it will undoubtedly be a driving factor in TS becoming a reality.

## 3D Printing

Another technology that has been introduced that could bring closer the idea of TS is the concept of 3D printing, which involves building three-dimensional objects [12]. Alexander takes the view that 3D printing will be equally as disruptive as AI, which could change the way homes, cars and other products could be built, cheaper, and less time consumed [13]. An example of how 3d printing has been introduced already comes from Lang, on how NASA is looking to use 3D printing to fix items out in space when you do not have the same resources to hand on earth. [14,15]. However, whilst there could be issues, it appears to be something being worked on for future exploration endevours[16]. Another statement comes from Kohut, elaborating on the further future impacts 3D printing can bring in construction. Recycled plastics can be used for parts in many places within healthcare for prosthetics, organs and human tissue, and the environment [17]. The concept of 3D printing seems feasible, as the technology could revolutionise how items are produced, how quickly, and anyone with access can produce an array of objects at pace.

## Robotics

The increased use and complexity in robotics are arguably a current, emerging, and future technology that will drive us to the Technological Singularity. Presently, robots are being utilised worldwide at an increasing rate throughout the developed world [18]. Moreover, robotics has been known to help humans manage more things with greater efficiency across sectors such as agriculture, manufacturing, and assistive technology, to name a few [19, 20]. As well as this, robotics has been predicted to become more advanced by increasing AI capabilities, to the point in which humans and robots could work further together in a shared workspace, handling many tasks with similar or shared intelligence to humans [21].

# The Wider impacts of TS

As well as the technological impacts TS could potentially have on life that is currently known, this paper also considers the ramifications TS could have within other areas outside of technology.

## The societal impact of TS with increased digital use

TS could develop in us as humans by communicating with each other and holding others accountable. One blog post from Murdoch University discusses how the increased percentage of the population with access to a digital platform and democratic activities becoming more transparent in their actions when viewed by the public [22]. However, it would seem unwise to assume that would be the case, to quote Einstein, “I fear the day that technology will surpass our human interaction. The world will have a generation of idiots” [23]. This quote arrives at the subsequent potential impact of TS on society, the increased spread of misinformation. This topic in question could be even more widespread than before, with folks accepting everything they see as ground truth, which could not only be incorrect but incorrect throughout its lineage before even reaching the consumer with this information, with such instances of fake news, post-truths and other fabricated information that would be harder to determine what information for the average individual should be deemed to be true, particularly where it can be argued that things are easier to believe when they share with a person beliefs, rather than objective truth.[24,25,26,27,28]. It would be easy enough to be sceptical of this idea; however, we have already experienced this within recent times, and without additional controls or governance in place to police this, it can be imagined to be an increasingly alarming reality. This shall bring onto another impact TS could have, how the information around technology could impact the economy.

## Economic impacts of TS

One element in which the Technological Singularity can affect the future outside of technology could be the economy. Gortz suggests that future technological advances and opportunities announced could impact future growth in Gross Domestic Product (GDP) and the stock market. [29,30]. However, as Gortz also suggests, this may cause fluctuations in both booms and recessions, depending on how these new technological advancements are viewed by society, which could reflect the stock market itself.

Another potential economic impact of TS comes from a view taken from Metcalf, suggesting that the economy can be impacted in terms of income distribution, for example, where humans are replaced by intelligent machines which can perform the same activities and could find difficulty in finding new jobs where a higher-level skill is required to become employed [31]. This theme seems to be echoed by Tugui and Gheorghe, where they elude a link between TS and imbalance technology will apply within the research and development field, where technology will take over the human employment ratio [32].

# Conclusion

This paper aimed to learn about the term known as the Technological Singularity, what definitions are out there, what technologies could drive us further to it, and what impacts it could have for the future.

Based on the information gathered within this paper, it can be determined that - at least on a high level - that the Technological Singularity is a point in time in which the way we view and interact with the world will alter and progress, with technology as the driver for this. Furthermore, human activity will forever be irreversibly changed, with communications and further human development, fundamentally altered.

From this paper, it is also concluded that some of the significant factors that will impact the Technological Singularity as they advance in the future will involve the use of Artificial Intelligence and Machine Learning, manufacturing by way of 3D printing and robotics. However, this paper only scratches the surface as to what else could have been covered regarding the Technological Singularity.

Further topics for future discussions can include more exploration in AI, the Internet of Things (IoT) and cloud computing, or how TS will impact from an ethical, environmental, and moral standpoints. Finally, one pertinent topic around TS that should be explored beyond the limitations of this paper is data. Without the use of data, it is arguably not possible that TS cannot exist otherwise, as well as data both being able to progress or hinder technological advancements.

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