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Technological Unemployment, AI, and Workplace Standardization: The Convergence Argument

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Abstract

The current debate over technological unemployment sacrifices significant analytic value because it is one-sided, limited in scope, and sequential. We show that analyzing *technological innovations* in parallel with apparently independent *socio-economic innovations and trends* offers important analytical benefits. Our focus is on socio-economic innovations and trends that standardize education, workplace requirements, and culture. A highly standardized workplace is not only more suitable for international outsourcing; it is also more suitable for machine labor. In this context, we identify five specific research questions that would benefit from parallel analysis and scenarios. We also introduce the concepts "functional equivalency" and "functional singularity" (in juxtaposition to technological singularity) to provide semantic tools that emphasize the importance of an integrated approach, capable of tracking and analyzing two interacting and potentially converging trends.

Introduction

The current debate over technological unemployment[1] sacrifices significant analytic value because it is one-sided, limited in scope, and sequential. The focus of the analysis is almost exclusively upon modeling the speed, potential limitations, and social implications of *technological* innovations in the form of artificial intelligence and robotics. Both enthusiasts and critics, including commentators such as Bill Gates, Stephen Hawking, Elon Musk, Nouriel Roubini, and Larry Summers, have selected this perspective. The longer-term prospects identified by this technological focus, such as superintelligence (Bostrom 2014) or a technological singularity (Vinge 1993, Kurzweil 2005), are tantalizing and receive ample attention. They are, however, also highly speculative and controversial.

Our concern is that the focus on these particular technological trajectories naturally draws attention toward the extreme endpoints, at the cost of distracting from the most accessible policy options available here and now. We will show that analyzing *technological innovations* in parallel with apparently independent *socio-economic innovations and trends* offers a more complete perspective for addressing key policy questions.

The interactions between technological innovations and socio-economic innovations are complex. Technological innovations can drive socio-economic innovations and *vice versa*. Furthermore, there are a number of different socio-technological trends that place a downward pressure on job creation and wage growth. For example, people are living longer and many retire later, thus freeing up fewer jobs for those entering the workforce. Our focus here is on the socio-economic innovation of processes, standards, and regulations that render workers and workplaces more vulnerable to displacement by technology.

Standardized educational, workplace, and cultural norms

We acknowledge that software and robotic technology will create novel workplace functions and that some of these will be more suitable for humans than for machines. Our aim, thus, is not to forecast technological unemployment rates. Instead, we want to emphasize the benefits of a more inclusive methodological research lens.

This lens provides a focus on the *functional equivalence* between human and machine at the workplace. The equivalence, we argue, is not achieved only by the greater technological capacity of software and robotic machines; it is also achieved by rendering workers, jobs, and the workplace more machine-like (more standardized and predictable). A high degree of functional equivalence, no matter whether it is the result of technological advances, workplace design, or both, will result in a greater ease by which technological unemployment can progress. Once machine capacity and workplace requirements become a perfect match, the equivalence has been achieved and the displacement of human labor becomes possible.

Of course, there are other issues such as price points, maintenance costs, adaptability, and so forth that will determine whether the functional equivalence will indeed lead to displacement in the labor market. If the rate of new equivalency events is matched by the rate of the creation of novel workplace functions for humans, then the issue is not job availability; it is, rather, training, retooling, and adaptation. Arguably this has been the situation over the past two centuries as steam engines, automobiles, and robots on assembly lines have replaced human workers. Nevertheless, we ought to pay attention to how education and workplace design interact with the likelihood of functional equivalency events. By doing so we gain an important analytical tool for

evaluating whether the adoption of new technologies is actually contributing to any slowness in recovery or growth in the unemployment rate.

Three examples will illustrate socio-economic innovations and trends that facilitate functional equivalence. The examples address education, the workplace, and cultural norms, respectively:

1. Education is becoming more standardized internationally and locally. An example is the *Programme for International Student Assessment* (PISA) carried out annually by the *Organization for Economic Co-operation and Development* (OECD). This type of performance indicator has the effect that countries adjust their curricula to improve their rankings which, in turn, leads to greater uniformity in the key topics that are taught internationally. Standardized university testing and the education standards enforced by professional associations further this effect. The obvious benefit for employers lies in the improved ability to accept students and workers trained elsewhere, while students and employees gain greater international mobility. A research focus on functional equivalency, however, would question whether the greater emphasis in education toward measurable qualities will diminish the training of "human qualities" such as creativity, care, communication, and touch that remain harder to achieve by machines.

2. An increasing number of workplaces are also becoming standardized internationally. An example is the success of the ISO 9000 series of quality management standards issued by the *International Organization for Standardization*. These standards facilitate international outsourcing of labor and greater consistency of production. Noteworthy is that information technology facilitates the implementation of these standards through Computer Business Systems (Head 2014) and that human competition as well as machine competition is driving workers to deliver ever-greater consistencies (they become, in a manner of speaking, "robotized"). It is easy to appreciate that the creation of a workplace quality system, once it exists, will facilitate the development of machine labor fitted exactly into what the performance measurement system requires. These socio-economic innovations, thus, facilitate "engineering for functional equivalence."

3. Cultural norms are also trending in the direction of greater standardization. In the public sector, New Public Management is characterized by a greater emphasis on performance measurements, often justified by the demand for greater accountability. As in the case of education, many performance indicators are simplistic and provide an incentive to optimize behavior toward a narrow standard. Another cultural trend is the increasing acceptance of surveillance technology, in concert with the ubiquity of smart phones, both of which can easily monitor workplace behavior that is not "by the book." Finally, cultural norms are trending toward speech codes, which have paved the way to the regulation of acceptable speech in some workplaces. Soon we may even have functionally equivalent robotic politicians whose answers to all issues are scripted to respond to the attitudes of their party's base constituents. Arguably we already have human robots running for office. We believe that the strong self-censorship of speech to conform to company or cultural norms is relatively recent and, like workplace standardization, facilitates "engineering for functional equivalence."

These examples show that education, workplace behavior, and even speech are in some contexts becoming more automated and scripted. We do not deny the strong justifications for these socio-economic innovations, such as efficiency gains or accountability standards. We are, however, concerned that they reduce or even erode creativity and personal judgment while facilitating technological displacement at a grand scale. If creativity and opinion are becoming such a threat to job security, and if strict self-censorship becomes the norm, then we not only lose our humanistic ideals, but will likely also underuse the full potential and breadth of human abilities in

the workplace. However, it is possible, that the new work functions created by novel technologies will make up, or even over-compensate, for this potential void. Our argument is not about numbers, but about methodological perspective.

Convergence and research questions

The integrated consideration of, on the one hand, the capacity of machines to do human labor of all stripes (their "humanization") and, on the other hand, the socio-economic drivers of increasingly standardized workers and workplaces (their "robotization") will lead to more inclusive debates, more credible scenarios, and better justified policy responses. Specifically, we argue that this parallel focus improves the understanding of the drivers of technological unemployment and also opens the door to analyze co-evolutionary effects such as feedback loops. Instances of the crossover of the functions of "robotized humans" with those of "humanized robots" are already evident in your local coffee shop. The most productive establishments feature employees who behave like mobile animatronics that speak pre-recorded sentences, while their increasingly competent and compatible machines produce the goods that are then delivered with a mandatory human smile. Creativity and personal judgment are not forbidden, but are also not encouraged.

Note the precedent for a parallel analysis in the methodological development of the scenarios for climate (Moss et al. 2010) and biodiversity (Pereira et al. 2010). In these contexts, too, the focus was initially directed at physical attributes but, as the fields matured, the approach changed from sequential approaches to the integrated assessment of both physical and socio-economic components. We should learn from these analogous insights and better integrate "The Two Cultures" (a term coined by Snow 1961). At the least we need to integrate a scientific analysis with a sociotechnical one.

The adoption of an integrative perspective has practical consequences for research and policy agendas. Five key research questions will help illustrate this point. They each would benefit from an integrated assessment model that includes drivers of and responses to both technological and socio-economic innovation:

1. *Which jobs are most vulnerable to displacement in the near future?* Technological unemployment will vary from work context to work context as noted in the much-cited Oxford Martin School paper by Frey and Osborne (2013). The authors estimate that 47 per cent of human jobs in the U.S. are at high risk of "computerization." In their analysis, telemarketers and accountants are extremely vulnerable while athletic trainers and clergy remain resilient to the risk of technological unemployment. We should also note that markets rapidly adapt, that human abilities and demographics (including life expectancies) are changing, and that it is next to impossible to reliably forecast future job functions and numbers. However, forecasting will and should continue, and the analysis of which job functions will become vulnerable to technological unemployment is more complete and robust if both predicted technological capacities and workplace standardizations are included. With such an analysis the percentage of jobs subject to computerization may prove to be significantly higher or lower than Frey and Osborne's estimate, and actual computerization might proceed very rapidly or quite slowly.

2. *What are the interactions (such as positive feedback loops) between technological and socio-economic innovation processes?* Ongoing automation and computer support often render associated human jobs more standardized and thus displaceable. For example, employee interaction with software often reduces the elbowroom for judgment and creativity because the interfaces only permit a narrow set of actions. The software that makes it possible to outsource a

call-center to a country with lower wages also renders the behavior of the workers more robotized because they spend a lot of time reading English sentences from their computer screens. The technological and socio-economic innovations that enable the replacement of domestic workers with teleworkers (and, subsequently, the replacement of those teleworkers with machines) represents a complex technological and social feedback loop.

3. *Are technological acceleration, the great decoupling, and jobless growth inevitable?* Brynjolfsson and McAfee (2011, 2014) have suggested that we are facing "the great decoupling" – a period when labor productivity gains are no longer coupled with gains in employment or family income. They recently authored an *Open Letter on the Digital Economy* in the *MIT Technology Review* (Brynjolfsson et al. 2015) that included a set of policy recommendations. We agree with the policy recommendations, but we argue for the inclusion of a parallel analysis of the convergence of technological and socio-economic innovation.

4. *Where should the attention for policy debate be directed and where is governance action most urgent, important and feasible?* The tantalizing technological possibilities of artificial intelligence and robotics can easily become a distraction from the important analysis and policy debate over how we should design education and workplace practices and over how we should evaluate our cultural standards. In the broader field of technology governance, ideologies clash between those who want to strictly control emerging technologies and those who point to the inevitability of technological progress in a globalized world. In the context at hand, the latter position is bolstered by the belief that all complex problems will become computable – the position of "Technological Solutionism" (Morozov 2013). Assuming that education, workplace quality, and culture should matter to everyone, parallel analysis of socio-economic innovation will lessen debate and improve the discussion between ideological camps, lessen techno-fatalistic views, and broaden the toolkit of possible mitigating and adaptive policy options.

5. *How should education and workplace practices adapt to the forces of technological innovation and the trend toward standardization of human abilities?* Let's not neglect what is of direct interest to academics: science policies and university curriculum. Taylorism (Taylor 1911) and performance measurement are now an integral part of funding allocations and teaching evaluation. The universities are also very much affected by the uncertain potential of massive open online courses (MOOCs) and new expectations from students who have not experienced the world before the Internet. Both technological and social innovations influence university practices including education, funding, hiring, and promotion, and the convergence of the two trends should be researched.

From functional equivalence to functional singularity

The introduction of meaningful labels can provide a useful service to the research community. The issue we highlighted above is the convergence of two separate trends, both fostering the functional equivalence of the current requirements at the workplace and the increasing capacities of software and robotic tools. Thinking ahead, one can take this point further. We really cannot predict if the techno-optimists or the neo-Luddites are more credible forecasters, and we remain skeptical of both. Nevertheless, we have argued that the dual focus on the technological and the cultural is better than a singular focus on either the technological or the cultural in isolation.

Conversely, we see Kurzweil's *technological singularity* and Bostrom's *superintelligence* as the result of a relatively singular focus on the technologically possible (in the context of exponential growth). A dual focus would suggest an additional label for an event that resembles an event horizon – a future time characterized by exponential growth in the displacement of current

workplace functions by machines coupled with the increasing inability to forecast and agree on policy directions. Following the focus on functional equivalence, this term would be a *functional singularity*. A focus on functional equivalence and a potential functional singularity are of greater policy relevance than research focused on the technological singularity or superintelligence. Indeed, societal disruption from a functional singularity, necessitating policy responses, will occur long before the advent of superintelligence and may well dictate future developments in artificial intelligence. While it provides a useful label, however, the idea of a functional singularity lacks analytical specificity and its occurrence may be recognized only in retrospect.

Our goal is to direct attention to factors leading to the functional equivalencies of labor performed by humans and machines, which will pay off in forestalling a functional singularity and mitigating its socially destabilizing impact.

Note

1. A term coined by John Maynard Keynes in 1930 in the wake of the Great Depression (Keynes 1963).

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