Robot & Society Paper Draft

1. Introduction

Ever since the Industrial Revolution, automation has been becoming increasingly more prominent, eliminating the need for many types of traditional labour, but also spawning a great number of new industries. While very low-level automation, such as farming equipment, has been present since the 19th century, nowadays automated machines are becoming increasingly more complex, and capable of almost fully replacing human workers in certain industrial domains. Some reports forecast that 25% of jobs are at risk of automation by 2040, which translates to about 12 million jobs in the Europe-5 region (France, Germany, Italy, Spain, and the UK) [9]. The forecast is not bleak about the future, however, as it predicts that a further 9 million jobs will be introduced by automation which could offset the loss of work. However, as workers are displaced from one sector into another, it is essential to investigate the ethical implications of automation - and try to understand if these changes can be a necessary means to a better end, or if their effects are too harmful to the people whose lives they are meant to improve.

Roles focussing on repetitive manual labour in sectors that are ubiquitous across the globe are at highest risk of automation, with operations in package delivery warehouses ('picking and packing') being a clear example. Our paper will focus on this application in order to maintain a narrow enough scope, and as such aims to address the answer to the following research question: *Can automation be introduced into picking and packing operations while respecting human rights and dignity?*

The effects of automation are often seen through a utilitarianism perspective - where the contributions are evaluated mainly with regards to how well they serve the greater good, or the majority. The dangers of purely considering a utilitarianism view are that the minority might suffer if it means *"the greatest happiness of the greatest number"*, as one of the founders of utilitarianism Jeremy Bentham states in his fundamental axiom [3]. Looking at the previously mentioned forecasts, only a minority of people would be displaced due to automation, and automation can certainly improve the lives of the many, from the company stakeholders experiencing increased productivity, to the customers gaining better access to goods.

For this reason, our approach is to investigate this ethical problem from a different perspective - namely one based on deontology and Kantian ethics. Our aim is to evaluate whether and to what level the rights and dignities of the individuals are maintained, where the workers are treated as "an end in themselves", rather than as a means to progress. We will focus on the well-being of the workers in the current stage of automation and the near future; how is it affecting their work and what needs to be done in order to ensure humanistic design of the warehouse.

Our analysis often follows the implications of automation through a case study into Amazon - as they are one of the largest corporations that are in the process of phasing in automation in their warehouses. Parts of the paper will investigate the problem of labour displacement, who will be responsible for training or reallocating the workers whose work has been or will be taken over by the fully automated systems. At the end of our analysis we also briefly delve into "Digital Taylorism", the modern version of the early 20th century scientific management theory into increasing the productivity on the factory floor.

2. Analysis and Evaluation

2.1. On Deontology

One of the main differences between deontology and consequentialist theories is that deontology only judges the morality of the action itself, without taking into consideration its consequences [1]. This is in stark contrast to ethical theories like utilitarianism, where a good outcome could warrant an unethical in itself action. There are two main distinctions within deontology - agent-centered and patient-centered. The former one concerns itself with the duties of people, while the latter focuses on their rights. As our analysis is meant to evaluate how we can maintain the dignity and rights of people that would be displaced due to automation, we have focused on the patient-centered theory as the backbone of our investigation.

duty framework. do that is right, regardless consequences.

specify the area you discuss.
You said that 25% positions are at risk of automation. is that a minority?
In my opinion, it would be more precise if you limit this statement into a narrow area, like one company (amazon). You can say that amazon replace a minority of workers to create more benefits for stakeholders and costumer.

2.2. Current state of automation

Amazon is undoubtedly one of the largest proponents (and users) of automation. Ever since the purchase of the Kiva robotics company in 2012, Amazon's push toward warehouse autonomy has recently culminated in the "employment" of nearly 200'000 robots across its warehouses [11]. The reception of this level of automation from the workers is very mixed. On the one hand, these robots take over some of the harshest labour on the warehouse floor, eliminating the need for employees (so-called "stowers") to push heavy carts across the warehouse, which left them "a broken person at the end of the week" [11]. While this also speaks strongly about Amazon's treatment of their workers, it is nevertheless true that automation can benefit and complement the work of the employees. On the other hand, the same article discusses how the productivity of robots has had a detrimental effect on the expected productivity of human workers - the required pace is so quick that the workers cannot adhere to the safety regulations when it comes to heavy lifting. Furthermore, the risk of injuries in automated warehouses has been shown to be much larger than that of their robot-free counterpart [5].

This implementation of automation clearly goes against the very idea of Kantian ethics. While the consequence of these practices is record high profits for the company, and perhaps easier accessibility to Amazon's goods for most people, it undoubtedly steps over the rights of the workers with a complete disregard for their lives.

Other studies show that different levels of mechanization (lowest level of automation) of warehouses does influence the workload of warehouse workers. Three systems were studied, namely the highly mechanized (HM), moderately mechanize (MM) and slightly mechanized (SM) systems[7]. The result was that the workers in the HM system had shorter working days and less problems with recovery from work than the workers of the other two system. However they do note the importance of ergonomic design of the operated machines to avoid bad working postures[7]. This goes to show that automation is able to improve the working conditions, when its designers take the well-being of the warehouse workers into consideration. It also implies that Amazon is not designing its automated warehouses for the workers, but mainly with economical benefits in mind. This further explains the increased risk of injury in Amazon's automated warehouses mentioned earlier[5]. We believe that automation can improve the working conditions, where the engineers have the moral obligation to act with respect towards their co-workers.

A recent study by the Harvard Business Review meant to investigate the feelings of warehouse workers and supervisors towards automation [10]. Some of the main implications of the interviews were that the workers feared job loss due to automation, were worried about inadequate training to adapt to the automated workforce, and had concerns regarding the reliability of the technology. On the other hand, the workers believed automation would increase the safety in the warehouse. Furthermore, the employees were excited about their increased productivity due to the help that the robots would provide. By looking at the previous example, one could see this optimistic view in the face of automation as very naive. It does, however, serve to show that there is a way to implement automation that is not only in the benefit of the majority, but also keeps the workers' dignity in tact and does not tread on their rights.

2.3. Displacement of Labour

A large scale loss of jobs is probably the most common anxiety expressed in relation to the introduction of automation. How should this fundamentally disruptive potential outcome be viewed in the Kantian framework? Our viewpoint is that an employer has a clear obligation to workers who are made redundant - what plainer example could there be of treating someone as a means than to discarded them once they are no longer useful?

At this point, it is worth noting that despite decades of similar predictions amid increasing waves of technological advancement, mass unemployment has yet to eventuate, both in a global sense [6], as well as specifically in relation to Amazon's warehouse operations where, in the words of one manager, "...the real machine is the human: everything is done manually." [2]

That said, it would be naive to assume that there isn't the potential, or likely the intention, for Amazon's automation efforts to lead to a downsizing of its entry level operations workforce. The use of mobile robots in some warehouses to bring goods to stowers and pickers is a well documented first step on this path. Were the remaining manual handling functions to be automated as well, a large labour surplus would certainly emerge, which Amazon would have a responsibility for in our framework. An ethical option in this situation might be to reassign employees within the business, especially to better roles that might be afforded by the transition to automation, and ultimately this could result in better outcomes for both the company and employee. However it seems unlikely that they would be able to absorb the complete workforce in this way; one of the main drivers for automation adoption is, after all, personnel reduction, and as Fleming [6] mentions, the flip side of high unemployment levels not yet emerging

certainly emerge? why

due to automation is that neither has the often promised widespread upskilling of the workforce. Of course, there are other ethical ways to deal with redundancies, such as providing training or external recruitment, but this becomes a question of industrial relations ethics in general, which we will not go into depth on here.

2.4. Transition to Automation

We can also analyse a less distant future in which automation does not replace these jobs wholesale, but is partially introduced, whether on a transition to complete automation or not. Delfanti and Frey [4] provide an analysis of Amazon's publicly filed patents, which leads to some interesting insights into how this might unfold, taken with appropriate skepticism given the nature of such information. As the authors note, it is clear that significant human involvement is likely to be part of warehouse operations for at least the near future, based on the scale of their research into hybrid human-cyber technologies in the space.

New technologies tend to automate tasks rather than complete jobs ([6]), as in the case of mobile robots replacing the need for Amazon's pickers to walk to and from shelves. So far, human involvement has remained critical to the actual picking and stowing however, due to the arbitrary size and shapes of objects being handled at this stage of the logistics chain, making it a much more complex task to automate.

Often this is the promise of automation - take the repetitive, menial and potentially damaging tasks off the human's hands so that they can focus on the more complex, engaging ones. This can be successful; workers scan barcodes instead of manually searching through and inputting product information for example. At this stage however, it is not necessarily the case, as much of the higher level problem solving has already been taken over by computer algorithms, and the human is kept in the loop mainly for their manual dexterity in removing and replacing objects in an unstructured environment. This too may not last though, as several patents detail technologies for capturing workers' movements to use as training data, accelerating the potential for this remaining human task to be automated as well. What this enables is a future where, if humans are still required at all for the job, it is in a capacity converging towards performing only machine-like tasks themselves, given just enough information and authority to execute actions prescribed by the higher level planning system to make up for limitations in its physical reach. At the same time, they provide input for the training task leading to their eventual replacement.

While not exactly unprecedented in this type of work setting, this 'ever more pervasive form of digital Taylorism' [4] would certainly be several steps further from the warehouses of the past. Contributing to this are mentions of other technologies which provide increasingly rich data and tracking of employee performance, including through facial or other body language indicators, which can be fed back to supervisors. An optimistic reading of this might suggest it could be used to efficiently assist if an employee is having issues at work, on the other hand, the risk can't be ignored that it further abstracts humans and human labour as numbers to be controlled. If implemented not with the interests of the workers in mind, but purely those of the stakeholders, then it has the highly possible potential of furthering the transition of human workers into standardised cogs in a complex machine - where they are replaced as soon as their performance drops or a better replacement has been built.

so much guess about future. talk more about now. lack examples to talk about workers rights.

This idea again is in stark contrast to the main axioms of Kant's ethics. While one might argue that this has been the case since the advance of industrialisation, with the classical Taylorism and Fordism [8] theories pioneered in the early 20th century with the aim to standardise and optimise every part of factory work, eliminating any personal contributions and dignity in their work that the employees might have. Nevertheless, the purpose of our reflection is not just to ensure that automation does not harm the workers - it is also aimed at investigating how it can improve these deep-rooted practices.

On a final more positive note, the authors of [4] mention how employment opportunities that were previously difficult to access for some groups can be opened up through new technologies. Perhaps here the introduction of digital interfaces at the management level could be more amenable to those having difficulty finding work, for example due to language constraints, and result in a more equitable labour market.

positive example

Automation has, and will continue to change the nature of work in warehouse operations. It is not clear that it will necessarily lead to the removal of human labour, whether due to technical challenges, optimistic factors like productivity driven demand, or external factors such as aging workforces. If opportunities for work remain stable, or even increase, this is not the end of the story - as anticipated in the above discussion there are still some potentially disastrous outcomes from an ethical viewpoint in which it appears the human element, but not dignity, might be all that is retained.

3. Conclusion

Warehouses, like Amazon's, clearly have a long way to go, in order to implement a fully socially responsible system. Humility and responsibility should come from the leaders, managers and engineers that are shaping these systems. We propose a ranking of these warehouses according to the model of Khargonekar and Sampath as seen in the figure below. The ultimate goal is socially responsible automation (SRA), which demands good jobs and prosperity among all employees. This vision should be shared among all and implemented with great rigour.

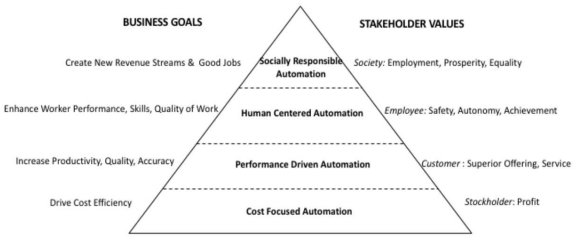

Figure 1. The pyramid of SRA [12]

The vision of Khargonekar and Sampath for SRA is however still a vision[12]. Companies are frequently stuck on the lowest level where the only reason to automate is for profits and not to increase the well being of the workers. That means that automation is likely to lead to layoffs; but even then, there's a right way and wrong way to handle the process. Would companies grow and ascend with their motivational rationalism to include the workers to help build that socially responsible automation in the future? Or do authorities need to set red lines and strict rules to force companies in that direction?

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