Will Robots Steal My Sense of Worth?:

Measuring Which Jobs Workers Would Like to See Automated

Introduction

The Jetsons, the 60's cartoon, showed us a world in which a robotic housemaid took care of all domestic labour, leaving the other characters to pursue their education, creativity and a high skilled managerial position. In 2019, technology and automation have significantly impacted almost every area of society, but have they given us the lives promised in the 1960s?

Any discrepancy between the automation desired by the general public and the automation that has come to exist is explained by the motivations of organisational structures that guide and facilitate the development of new technology. Put simply, the economic drivers which circumscribe almost all technological research are rarely aligned, and often diametrically opposed to the human desires of individual workers.

Capitalism dictates that there is a high incentive to automate skilled work. In a capitalist society, the primary driving force in bringing technology into widespread usage will always be the opportunity to gain a commercial advantage. The biggest drivers for the implementation of automation are the overall reduction of required labour and the lowering of skills required in a labour force, both in turn leading to the reduction of production costs. Furthermore, the competitive imperative of capitalism dictates that the jobs which demand the highest pay are those that require the least common skillsets. With some exceptions, 'higher' skilled jobs that require training, education or experience, can be fulfilled by fewer people and so demand higher salaries. It follows from these two facts that there is a greater commercial incentive to automate high-skilled jobs than low-skilled jobs.

So it is of little surprise that a PwC report predicts that in the coming wave of automation, the financial services and IT sectors will both lose more jobs to automation than transport or construction[1]. Furthermore, the sector reported as least susceptible to automation is 'accommodation and food services'. In the three waves of automation that PwC predicts, occupations requiring low levels of education are least likely to be automated in the first wave and less likely than medium education jobs in the second wave. It is only in the

[1] PwC, "Will Robots Really Steal Our Jobs?," 2008, https://www.pwc.co.uk/services/economics-policy/insights/the-impact-of-automation-on-jobs.html. p4

third wave, when technology will replicate human's dexterity and ability to manoeuvre in unstructured environments, that automation predominantly targets jobs requiring low levels of education.

In stark contrast to this, a survey of 6000 UK workers, shows a clear correlation between the nature and complexity of work and perceived job quality [2]. In a calculated 'Job Quality Index', 'the nature of work', a metric which encompasses autonomy at work and being appropriately skilled, has a higher impact on 'job satisfaction' and 'enthusiasm and effort' than 'pay and benefits' does. Job complexity has a more significant impact on enthusiasm and effort than any of the metrics measured, including 'health & well-being', and 'terms of employment'. Fundamentally, workers enjoy skilled work, yet the economic conditions of capitalism incentivise the automation of skilled work.

It is clear that working conditions are not felt equally among all citizens and so neither will be the effects of automation. While in the UK on average 1 in 17 people are in insecure work, vulnerable to job loss, for black employees that figure more than doubles to 1 in 8[3]. Similarly, the subject of automation is a gendered issue, with females predicted to be impacted most heavily in the first two waves, but less in the third[4].

These statistics only briefly illustrate the fact that which occupations become automated is an overtly political question. More so, that acknowledging the distinction between the aims of workers and of commerce is critical to an informed and socially just industrial policy.

Research Question

This proposal hypothesises that the current direction of the development and application of automation technology, as determined by market forces, is not necessarily aligned to the wishes of society. The research will test this hypothesis by asking the following question:

What aspects of their jobs would workers like to be automated and how does this compare to the jobs forecast to be automated?

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[2] CIPD, "UK Working Lives," 2018, https://www.cipd.co.uk/Images/UK-working-lives-2_tcm18-40225.pdf. p45- 46

[3] TUC, "Insecure Work and Ethnicity," 2017, https://www.tuc.org.uk/sites/default/files/Insecure%20work%20and%20ethnicity_0.pdf. p2

[4] PwC, "Will Robots Really Steal Our Jobs?." p4

Literature Review

There are many positive arguments for automation, but also many against. In this section I wish to show only that the arguments are complex and affect many people in different and disproportionate ways. The fact that impacts may be negative and will be unevenly distributed society provides the justification for this research, which seeks to give voice to those unrepresented in the discussion so far. I will consider three arguments to illustrate the fact that each of them is complex and has legitimate counter-arguments; productivity, ecological and liberation.

The neo-classical economic argument for automation is that it increases productivity. Described simply, the effect of technological interventions in occupational activities is to turn complex processes into a series of simple tasks. The simple and routine nature of these tasks lowers the barrier of entry for conducting this work. The prototypical example of this process was seen in the advent of industrial knitting machines. While this meant that skilled weavers could no longer command their original fee, it simultaneously resulted in a boom in clothes manufacturing which created more jobs. Alongside this, an entirely new industry in the design and manufacture of the machinery used for such production was born. Many argue that this essential process is replicated by all manufacturing innovations [5].

However, the transition between modes of work can be damaging. Often referred to as Engel's pause[6], changes in industrial technologies usually result in a period of job losses and unemployment while the new industry develops and people retrain. As long as people's lives are inextricably linked to their employment it is inhumane to rest on the argument that in the fullness of time any disruption to employment will be beneficial to all. This truth becomes more significant when recognising, as Marx did, that capitalism "cannot exist without constantly revolutionising the instruments of production"[7].

The notion of productivity gains is crucial to a capitalist economy because, ostensibly, it allows for the living standards of everyone to continue rising. That is, the poorest can become richer without taking resources from the rich. Essentially, the continued growth facilitated by technology means that the economy is not a zero-sum game and so one group can benefit without another being penalised.

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[5] Deloitte, "Technology and People: the Great Job-Creating Machine," 2015, https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/finance/deloitte-uk-technology-and-people.pdf.

[6] Robert C Allen, "Engels' Pause: Technical Change, Capital Accumulation, and Inequality in the British Industrial Revolution," *Explorations in Economic History* 46, no. 4 (n.d.): 418.

[7] Karl Marx and Friedrich Engels, *The Communist Manifesto*, (Penguin UK, 2015). p7

However, the reliance on continued growth into new industries is an economic strategy which is severely criticised from an ecological standpoint[8] [9]. Infinite growth on a finite planet is logically untenable, but the empirical evidence is clear that we have already reached the practical limits of this strategy [10].

At the same time, there is often an ecological argument in favour of automation [11]. This argument says that if we are to put the necessary hard caps on the use of planetary resources by reducing our energy usage, but without seeing a drastic reduction in global living standards, then we require significant efficiency gains, gains that automation and AI can offer.

However, in a role reversal of the productivity argument, the negative consequence of this approach may be increasing inequality [12]. An imposed scarcity of resources means an increase in the volume of assets that are not easily replaceable, which in turn leads to an obvious increase in rent-seeking opportunities. All other things held constant, it is hard to imagine that an overall reduction of required labour brought about by the increased use of machinery does not reproduce and magnify existing structural inequalities. Without radical reforms of ownership, it is inevitable that the financial benefits of any efficiency gains would be reaped by the owners of the machinery.

A more fundamental, philosophical argument for automation is that it has the potential to liberate us from necessity. Hannah Arendt tells how the Greek Polis was uniquely free to engage politically in the public realm, with true agency in building the world around them, but that this freedom was predicated on their freedom from the necessities of the private domain [13]. She posits that it is not possible to fully engage in life as a citizen when you are constrained by the requirements of survival; in a modern context, this represents work and domestic labour. Her view is somewhat wistful: In the Greek Polis, this freedom was granted only to free men and was achieved through the domination of slaves and women. That said, maybe automation offers the opportunity to have machines fulfil that labour, releasing all people into the public sphere?

Counteracting this argument is the realisation that the route to full automation is via AI and machine learning which arguably negate the value of such liberation. As well as automating physical activities, AI

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[8] Giacomo D'Alisa, Federico Demaria, and Giorgos Kallis, *Degrowth*, (Routledge, 2014)

[9] Rob Dietz and Dan O'Neill, *Enough Is Enough*, (Routledge, 2013).

[10] IPCC, "Global Warming of 1.5℃," 2018.

[11] Anna Coote et al., *21 Hours*, 2010.

[12] Beth Stratford, "The Threat of Rent Extraction in a Resource-Constrained Future," n.d.

[13] Hannah Arendt, *The Human Condition*, (University of Chicago Press, 1958).

necessarily standardises and proceduralises decision making. It is only through broader access to knowledge and decision-making powers that the physical world can be manipulated without human input. Arising from this recognition comes a question; is there value in liberation from necessity if the world we are released into is no longer ours to build?

This brief analysis shows that any discussion of automation is entwined in discussions of national economic strategy, of class, gender and racial inequalities, of ecological threats and philosophical notions of freedom and agency. But while commerce, governments, ecologists and academics all have a voice in this debate, one voice is consistently absent: that of workers. This research aims to consider that voice, to establish a metric of how well the direction of progress aligns with the desires of those it affects.

Existing Research

The bulk of notable, empirical research that considers the impact of the current wave of automation primarily addresses what developments are technically possible. The first major empirical study in this area came from Frey and Osbourne (FO)[14] and became a foundation on which much other research has been built [15] [16] [17]. Although FO spawned a plethora of papers, this section will limit its scope to outlining the research of FO and one other paper. The two papers described are foundational to the proposed research in that they provide a methodology for taking data relating to a relatively small number of occupations, and from that constructing equivalent conclusions for an exhaustive catalogue of occupations.

FO's research begins with the use of O*NET, a database of 702 US job descriptions. They had a team of experts assess 70 of these occupations as to whether they can be 'sufficiently specified' to be performed by state-of-the-art computers; in other words, can it be automated. Taking the binary decision for each of these 70 and comparing their descriptions to the rest of the database, they developed a machine learning algorithm which assigned a score to all 702 occupations in the database. This score is effectively a likelihood

[14] C b Frey and M a Osborne, "The Future of Employment: How Susceptible Are Jobs to Computerisation?," ed. M a Osborne, *Technological Forecasting and Social Change* 114 (2017): 254.

[15] C Brzeski and I Burk, "The Robots Come. Consequences of Automation for the German Labour Market," *ING DiBa Economic Research*, 2015.

[16] Mika Pajarinen and Petri Rouvinen, "Computerization Threatens One Third of Finnish Employment," *Etla Brief* 22, no. 13 (2014): 2014.

[17] Melanie Arntz, "The Risk of Automation for Jobs in OECD Countries.," ed. Terry Gregory, *OECD Social, Employment & Migration Working Papers* no. 189, no. 189 (2016): 2.

of a given occupation being automated using existing technology. A startling conclusion of this report was that 47% of US jobs could be automated in the next 10-20 years, or 34% of UK jobs [18].

This number was revised down to 9% for the US in research of OECD countries by Arntz et al. [19]. Although based on the methodology of FO, this report developed a novel approach which recognised that many occupations consist of a wide range of tasks, some of which are easily imagined as automatable, some not. Shifting their unit of interest from 'occupation' to 'task', they assessed the automatability of a series of task types based on the Programme for the International Assessment of Adult Competencies database (PIACC) [20]. The PIACC surveyed 200,000 people across 33 countries to determine various skill levels across different occupations and nations, but also what skills their occupations required [21]. By understanding the task composition of respondent's occupations, and how that varies between individuals, between occupations and between countries, the paper estimates the risk of job loss to automation in individual occupations and countries.

The difference in results that these methodologies produce is illustrated by looking at "bookkeeping, accounting and auditing clerks" occupations. FO estimated that these roles faced an automation potential of 98% [22], this number is high because these jobs deal with very well structured, numerical data which is easily processed by machines. However, as Arntz points out, only 24% of people in that occupation can perform their entire job without group work or face-to-face interactions[23], both tasks that are resistant to automation, tasks that FO call "engineering bottlenecks". The overall effect of this change is that where FO estimate large numbers of occupations with very high or very low chances of being automated, Arntz has almost the inverse outcome, large numbers of occupations which are partial automatable, and very few that are entirely or not at all automatable. This difference reflects the original observation that most occupations consist of a variety of tasks which inevitably span a range of automatability.

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[18] ONS Digitial, "The Probability of Automation in England: 2011 and 2017," March 29, 2019, https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/articles/theprobabilityofautomationinengland/2011and2017#findings-from-the-office-for-national-statistics-ons-approach.

[19] Arntz, "The Risk of Automation for Jobs in OECD Countries.."

[20] OECD and Organisation for Economic Co-operation and Development, *The Survey of Adult Skills*, (OCDE, 2013), doi:10.1787/9789264204027-en.

[21] OECD, *Skills Matter*, (OECD, 2016), doi:10.1787/9789264258051-en.

[22] Arntz, "The Risk of Automation for Jobs in OECD Countries.." p14

[23] ibid.

Research Design

This research aims to mirror Arntz's methodology, but rather than considering which tasks are *likely* to be automated, ask which tasks workers would *like* to be automated. The distinction between FO's occupation-based and Arntz's task-based methodologies is relevant to the proposed research. Just as it is that specific tasks that an occupation is composed of will be more easily automated than others, so will specific tasks be more desirable than others. Just as it reductive to ask only if whole occupations *can* be automated, it is reductive to ask workers if they would like whole occupations to be automated. It is critical that this research provides workers with the opportunity to discern between elements of their jobs that they would like to keep; for two reasons. Firstly, because it increases the fidelity and reliability of the data, but more importantly because it creates a clear cognitive distinction between a task and their job. In other words, it establishes that they are not being asked about losing their means of income.

Mimicking this methodology will entail conducting a large N survey asking workers, of the tasks that their job is comprised of, to what extent they would like each of them to be automated. The survey will be preceded by qualitative research to determine what categories of task types are listed on the survey.

The research can, therefore, be considered as a qual→QUANT [24]mixed methods cross-sectional study, however, by replicating an existing methodology, the findings will also be used as part of a comparative study alongside previous research. The particular mixed method approach could be referred to as 'instrument development' [25], that is the qualitative part is informing the design of the quantitative part, but the data collected in the two parts is never directly combined or triangulated.

The fundamental strength of FO and Arntz research is that it allows the analysis of a small number of cases to generate results for a much larger set of occupations, based on an existing dataset of properties. Beyond this, the decision to emulate Arntz in using tasks as the basis of a survey provides three benefits:

1) It will allow workers to answer as to the parts of the job they would like to be automated, while separating that question from the notion of losing their entire job and income.

2) It allows a direct comparison between the desirability of automation to previous research on the possibility of automation, increasing ecological validity. As absolute values, any measure of 'desirability' is only an indicative expression on an undefined scale, and so is of limited use. As a direct comparison to

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[24] David L Morgan, "Practical Strategies for Combining Qualitative and Quantitative Methods: Applications to Health Research," *Qual Health Res* 8, no. 3 (July 2016): 362–76, doi:10.1177/104973239800800307.

[25] Alan Bryman, *Social Research Methods*, (Oxford University Press, 2015). p651

previous studies, this measure will illuminate the differential between the emphasis of technological development and the wants of workers, giving vital insight into the question of whether market forces are aligned with a societal view of improvement.

3) It will allow comparison of the desirability of automating similar tasks, between occupations and as a function of the portion of an occupation that task represents. While a criticism of cross-sectional studies is that they have weak internal validity[26], that is, the causality of these relationships may not be clear, it is felt that causality is not relevant to the research question.

Methods

"All models are wrong, but some are useful".

- George Box

Focus Groups

The above statement concisely surmises the ontological position from which this research begins. Described as a 'Weberian' approach[27], this research recognises the critique that all explanations are selective, but that they can still offer useful insight. This approach could also be considered one of critical realism. It accepts a natural world existing outside of human knowledge and accepts the existence of causal relationships between things that inhabit it, but, understands that the outcomes of such relationships depend heavily on the way in which the world is socially constructed. Because of this position, and in line with the assessment that technological progress is heavily influenced by commercial interest, it is essential to begin by interrogating the ontology on which previous research has been based.

One serious criticism of FO and Arnzt is that they both arrive at an ontology which categorises tasks in terms of the technical obstacles to achieving them. For them, the task of bricklaying would sit alongside food preparation because it requires precision motor skills and dexterity but would be distinct from moving a pile of bricks, which primarily requires strength. In contrast, to a human, the working environment of a building site as opposed to a kitchen might be a far more significant distinction between tasks. To a worker

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[26] ibid. p54

[27] Liam Stanley, "Using Focus Groups in Political Science and International Relations:," *Politics* 36, no. 3 (May 5, 2016): 236–49, doi:10.1177/0263395715624120.

with the aims of improving their own experience of work, the dividing lines between tasks to be automated or retained do not necessarily correlate to the physical requirements of those tasks.

An ontology based on the technical limitations to tasks inevitably aligns research with the aims of those developing technology; it groups tasks into those that can be achieved by a machine and those that cannot. As well as facilitating the design of technology to expand the boundaries of what can be achieved, this ontology also encourages the tailoring of manufacturing and business practices to minimise the number of jobs that cannot be performed by a machine. An alternative ontology, which delimits tasks based on worker's willingness to perform them would naturally facilitate the design of business practices which avoid undesirable tasks.

For the reasons described above, before replicating the methodology of Arntz, it is critical to establish a more relevant ontology. The initial qualitative part of this research will aim to establish such a system of categorisation, one that better represents worker's internal ontologies, and that is useful for discerning between tasks that they would like to continue doing and those they would like to be automated.

In order to achieve this, a series of focus groups will be conducted to discuss what characteristics usefully differentiate the tasks workers would like to see automated from those they would be happy to retain. The focus group has been selected as the most appropriate methodology for this part of the research for three main reasons. Firstly, it allows access to more participants in a given period that individual interviews would.

Secondly, the group dynamic reduces the impact of a power dynamic between interviewer and interviewee. Social desirability bias, discussed in more detail later in this paper, is extremely relevant to the subject of 'work'. It is important to the research that participants feel able to express their true feelings about the topic. While there is still a risk of social desirability bias within a group, external validity is improved in comparison to a one-to-one interview because the primary dynamic is between a group of other 'workers'.

Most importantly, because focus groups involve multiple participants, a particular view of one person is less likely to go unchallenged and more likely to lead to a discourse. For this reason, focus groups are naturally suited to the "joint construction of meaning"[28]. The ability to "reveal group consensus"[29] is vital because the research ultimately needs to settle on a single system of categorisation that adequately captures

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[28] Bryman, *Social Research Methods*. p501

[29] Jennifer Cyr, "The Pitfalls and Promise of Focus Groups as a Data Collection Method:," *Sociological Methods & Research* 45, no. 2 (February 5, 2015): 231–59, doi:10.1177/0049124115570065. p234

the views of a wide range of people. Cyr further notes that the use of focus groups with the group as the unit of interest - as opposed to the individual – are commonly and effectively used to 'pre-test' the validity of a survey. Focus groups are useful in this way because they alleviate those to be surveyed of the cognitive burden of more complex debates[30].

The explicit aim of the focus groups will be 'knowledge construction', rather than 'knowledge collection'[31]; in other words, there is a specific outcome required from the sessions. As such, the focus groups will be conducted and guided in a reasonably active manner with the intention of guiding the participants back towards the subject of which tasks they would rather see automated and why. That said, as Morgan notes, the interaction between participants is the most valuable characteristic of a focus group[32], so this guidance will be towards open discussions and consensus building.

As the ultimate aim of the focus groups is to build a system of categorisation that is relevant to workers in any occupation, the composition of the groups must broadly represent a range of occupations. The ONS consistently refer to nine high-level categories of occupation, as shown below. Purposeful sampling will be used to ensure that over six focus group sessions, each session has representatives from multiple categories and that each category is represented multiple times across the sessions.

- Managers, Directors and Senior Officials
- Professional Occupations
- Associate Professional and Technical Occupations
- Administrative And Secretarial Occupations
- Skilled Trades Occupations
- Caring, Leisure and Other Service Occupations
- Sales and Customer Service Occupations
- Process, Plant And Machine Operatives
- Elementary Occupations)

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[30] Jon A Krosnick, "Response Strategies for Coping with the Cognitive Demands of Attitude Measures in Surveys," *Applied Cognitive Psychology* 5, no. 3 (May 1, 1991): 213–36, doi:10.1002/acp.2350050305.

[31] S Kvale and S Brinkmann, *Interviews: Learning the Craft of Qualitative Research Interviewing*, 2009.

[32] D L Morgan, *Focus Groups as Qualitative Research*, 1996. p15

It is a common criticism of focus groups that they generate a lot of data and are there for more difficult to analyse than other methods[33]. This challenge will be minimised by having a clear research question and analysis strategy. Transcriptions of the sessions will be coded, and tested for intercoder reliability, specifically by mentions of characteristics of tasks which impact a participant's desire for a task to be automated. The clear purpose and strategy of data analysis will make the analysis itself easier.

Another criticism is that group effects sometimes means that a small number of, or even a single, dominant voice in the group can prevent other voices from being heard. As Krueger suggests, this issue can be alleviated by the moderator making it clear that it is important to hear all voices and actively facilitating that principle [34]. The moderator's impact on the group will be otherwise minimised by having an explicit stance of neutrality towards automation, with only the goal of assessing which tasks should be automated, if automation is necessary.

In terms of ethical considerations, as long as all data is stored securely and appropriately anonymised when reporting, this research does not pose any uncommon challenges. The topics discussed could be sensitive if seen by participant's employees or potential employees, and this possibility may impact on the reliability of the data gathered. Therefore, the informed consent process, as well as making clear the purpose of the focus groups and how data will be used, will make clear that all data will be completely anonymised.

Social Desirability

It is difficult to overstate the extent to which modern notions of virtue are entwined with employment. Max Weber famously links the rise of capitalism to Protestantism, a religion which accepted the required work ethic as virtuous [35]. In recognising the oppressive nature of the factory, the Marxist tradition birthed the trade union movement which, while demanding better working conditions and even a reduction in work-time, still fights for the right to work. Post-Fordism offered a compromise to the conditions of the factory: autonomy of the individual in the workplace in return for adoption of that work as a defining component of their identity. As Gorz explains, in polemic terms, "the subject's lifeworld is circumscribed by the company's

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[33] Bryman, *Social Research Methods*. p521

[34] Richard A Krueger, *Moderating Focus Groups*, vol. 4, (Sage Publications, 1997). p59

[35] Max Weber 1864-1920, *The Protestant Ethic and the Spirit of Capitalism*, ed. Talcott Parsons 1902-1979 and Anthony Giddens, (London ; New York: Routledge, 1992).

system of ends and values" [36]. Furthermore, against this option of self-motivation, the threat of unemployment is wielded, "Post-Fordism produces its elite by producing unemployment. The latter is the pre-condition of the former" [37]. Whichever paradigm one conforms to, the notion of work is central to our perception of ourselves and each other.

Research of 'work centrality', a measure of the how people consider work to be a 'central life interest', shows it is independent of the circumstances of a particular job [38]. Studies of the so-called 'lottery question', whether or not respondents would continue working in the absence of financial necessity, gives some indication of the strength of work centrality. Across eight nations, the lowest proportion answering that they would remain in work was 69%, the highest 93% [39].

Given all of the above, it is unsurprising that an empirical study showed a clear impact of social desirability bias on the subject of work. When asked the 'lottery question', the proportion of respondents answering positively dropped from 85% to 73% when in a situation that reduced social desirability [40].

Several approaches will be taken to try to both reduce and account for social desirability bias. As mentioned previously, a focus on tasks rather than complete occupations will make it clear that participants are not discussing their desire to work in the abstract. Research shows that an effective method in reducing social desirability bias is to use indirect questioning, that is discussing what task 'someone' might prefer to automate, rather than directly framing the participant as the subject of the question [41]. Finally, the discussion will be prefaced by explicitly stating that it is based on accepting the hypothesis that some level of automation is inevitable. It will be made clear at the start of the sessions that this research is merely intended to help guide the direction automation takes if and when it comes, this can be re-enforced if necessary by the moderator.

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[36] Andre Gorz, *Reclaiming Work: Beyond the Wage-Based Society*, (Polity, 1999). p38

[37] ibid. p45

[38] Author Robert R Hirschfeld, "Work Centrality and Work Alienation: Distinct Aspects of a General Commitment to Work," ed. Author Hubert S Feild, *Journal of Organizational Behavior* 21, no. 7 (2000): 789.

[39] Itzhak Harpaz, "Non-Financial Employment Commitment: a Cross-National Comparison.," *Journal of Occupational Psychology* 62, no. 2 (n.d.): 147.

[40] Raphael Snir, "To Work or Not to Work: Nonfinancial Employment Commitment and the Social Desirability Bias.," ed. Itzhak Harpaz, *Journal of Social Psychology* 142, no. 5 (n.d.): 635.

[41] Robert J Fisher, "Social Desirability Bias and the Validity of Indirect Questioning.," *Journal of Consumer Research* 20, no. 2 (n.d.): 303.

Survey

The survey will be simple and limited to four basic questions:

- Matching the participant's occupation to one listed in the PIACC.
- Describing the composition of the PIACC task categories. This question will require applying a rough percentage to a number of task types.
- Describing the composition of the participant's occupation in terms of task categories determined from the focus group.
- Applying a score to each of the included tasks, indicating to what extent the participant would like to see them automated.

While other data could be collected, it is not felt justified by the scope of this research. As mentioned previously, there is an urgent discussion to be had around how automation disproportionately impacts people based on nationality, race, gender and class. Even so, it is felt that the variation of these impacts is determined by each group's unbalanced representation across different areas of the workforce and so the direct link between say, gender and task preference is not relevant. Indeed, PwC report on these impacts by mapping automatability scores to known workforce composition data, a method which could equally be applied to this research.

The survey will be conducted online, a decision that has been taken for many reasons. Firstly, the nature of the questions lend themselves to an interactive tool. The PIACC lists over 600 occupation types, so a search or filter system to quickly narrow down to the participant's occupation will be vital. Describing task-composition will be greatly facilitated by a visual representation of percentage which can also ensure that they total 100%. Task scoring can be easily filtered by the tasks included in task composition to ensure the responses correlate.

Secondly, electronic surveys - through automation - equate to a near-zero marginal cost. In other words, increased distribution, data collection and processing do not require significantly more resources. In effect, this means a much larger sample size is achievable than by phone, face to face or paper surveys.

Finally, the nature of the research ideally benefits from 'stratified random sampling' which can be approximated in a cost-effective way using Facebook. It is always preferable to use probabilistic sampling

rather than quota sampling [42], but for this research, it is essential to gather data from participants across a broad range of occupation types which requires a sophisticated sampling frame. As Kosinski et al. detail, while Facebook's userbase does not cover the entire population of interest, it is large enough that even underrepresented groups are still of a significant sample size[43]. Furthermore, Facebook's targeted advertising system allows pages to be targeted at specific groups based on many categories, including job title.

The resulting sampling method will be a hybrid. Snowball sampling – sharing amongst existing networks and requesting participants share more widely - will be initially used as it is of no cost and has the potential to reach an appropriately broad audience. If the analysis of collected data shows an insufficient coverage of occupation types then targeted Facebook posts will be used to access groups that are lacking.

Analysis

By having participants detail the composition of their occupations in terms of both the PIACC task categories and the newly developed categories it will be possible to map the survey data to that of previous research and draw conclusions across a larger range of occupations and countries. It is not expected that there will be a general, direct 1:1 mapping between the two sets of categories, but that within any one occupation type there will be a relationship. It is recognised that utilising this relationship adds an extra variable into the conclusions, however, a measure of the correlation between the two will be provided and it is hoped that any discrepancy is offset by the ability to apply findings to a much larger data set. In any case, the stand-alone survey results will remain valid.

Conclusion

The subject of automation is not simple; it has wide-ranging impacts across society and as such should be considered carefully. By building on the methods of existing research but incorporating broader political and sociological concepts, this proposal aims to demonstrate the urgent requirement for public consultation on the direction of automation, that it should not be left to be determined only by market forces.

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[42] Anita S Acharya et al., "Sampling: Why and How of It," *Indian Journal of Medical Specialties* 4, no. 2 (2013): 330–33.

[43] M Kosinski, "Facebook as a Research Tool for the Social Sciences: Opportunities, Challenges, Ethical Considerations, and Practical Guidelines," ed. S c Matz, *American Psychologist* 70, no. 6 (2015): 543.