

The Illusion of Routine as an Indicator for Job Automation with Artificial Intelligence

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Abstract. The resurgence of artificial intelligence (AI) has empowered organizations to concentrate their research efforts on enhancing decision-making and automation capabilities. This is being pursued with the goal of increasing productivity, whilst reducing costs. With this, it is perceived that the jobs within these organizations that are considered subject to ‘routine’, or repetitive and mundane tasks, are more likely to be automatable. However, it may be recognised that these jobs are more than a simple set of routine tasks. This study aims to address the concept of routineness from the perspective of the job occupants themselves. The findings reveal that jobs which are considered routine from an organizational perspective, realistically require a degree of human intervention. This suggests that the fear of mass unemployment at the hands of AI may be an unrealistic notion. Rather, the introduction of AI into jobs paves the way for collaborative methods of working which could augment current jobs and create new jobs. Furthermore, this paper accentuates that the acceptance of AI by stakeholders requires an alignment of the technology with their own unique contextual needs.

Keywords: Artificial Intelligence, Employment, Routine Work Activities, Job Automation, Organizational Perspective, Stakeholder Perspective.

1 Introduction

This study was initiated with the purpose of understanding what role AI might play in the future working environment beyond those views conveyed in mainstream media and literature. It was recognised that many of these views are based upon the premise that ‘routine’ jobs are more likely to be subject to automation with AI. This study seeks to question the concept of routine by addressing the hypothesis: *The presence of routine tasks in a stakeholder’s job alone, does not determine the possibility of overall job automation.* To this, a bottom up approach was required. It was recognised that those individuals who are doing a job in practice, labelled here as stakeholders, would be more suitable to consult with when trying to develop an understanding of the level of

acceptance and extent to which AI integration within the working environment might be expected. This paper provides a comparison of the elements which are traditionally considered to constitute a 'routine' task with the perspectives of the stakeholders who are doing such jobs in practice. It also includes an appreciation of the realistic level of cognition required to do a job in practice and draws an understanding of the impact this may have on AI-integrated employment in the future. Furthermore, it provides a description of the precautions that could be taken to navigate some of the arising complexities which may be presented with the introduction of AI in the working environment. Finally, this paper attempts to forecast how AI might be received by employees in the working environment based the primary data that was collected in this study.

2 Background

Multiple areas of industry have and stand to reap the perceived benefits of applied AI in their respective domains. Such applications include automating manufacturing processes [8], ascertaining user sentiment from social media activity [6], assisting clinicians with patient diagnosis [10] and intrusion detection with cyber security systems [12]. The perceived benefits organizations stand to obtain from such applications include increased productivity, higher and more consistent product/service quality and reduced costs. These applications are by no means exhaustive, however, do highlight how AI automation and decision-making is/may be applied within different industries and the potential benefits organizations stand to gain. Rather than defining AI, which is a contentious area due to varying perspectives about how it is expected to behave, this article focuses on the qualities expressed by AI that might be beneficial in a working environment involving a human presence. Therefore, this paper refers to the purpose for which AI and other automated decision-making technologies, such as Virtual Personal Assistants [5], might be adopted in the working environment; that is the automation of human interactions.

The anticipated benefits of automated decision-making come with the looming belief that the need for humans, occupying jobs in the areas elected for AI automation, will be reduced leading to mass unemployment. This view is expressed in the Autor, Levy and Murnane (ALM) model, which attempts to categorise workplace tasks into areas of routineness (see Figure 1).

	Routine tasks	Nonroutine tasks
	Analytic and interactive tasks	
Examples	<ul style="list-style-type: none"> • Record-keeping • Calculation • Repetitive customer service (e.g., bank teller) 	<ul style="list-style-type: none"> • Forming/testing hypotheses • Medical diagnosis • Legal writing • Persuading/selling • Managing others
Computer impact	• Substantial substitution	• Strong complementarities
	Manual tasks	
Examples	<ul style="list-style-type: none"> • Picking or sorting • Repetitive assembly 	<ul style="list-style-type: none"> • Janitorial services • Truck driving
Computer impact	• Substantial substitution	• Limited opportunities for substitution or complementarity

Figure 1- The ALM predictions of task model for the impact of

Fig. 1. computerization on four categories of workplace tasks

(Source: Autor et al., 2003, p.1286)

The model concludes that the rapidly declining price of computer capital will reduce the labour input for routine tasks and increase the demand for nonroutine cognitive tasks [1]. Furthermore, Goos and Manning suggest that such a phenomenon will lead to job polarisation. This entails a rise in the demand for jobs involving nonroutine cognitive tasks (e.g. professional and managerial jobs) and nonroutine manual tasks (e.g. cleaning), with a reduction in jobs involving middle-skilled tasks (e.g. clerical jobs) [4]. Such a disparity could entail income inequality and subsequently necessitate/extend the “sharp divisions between the geographic areas that benefit and those that don’t” [11].

With the consequences of job polarisation potentially worsening income disparity in society, it is important to question the grounds upon which the argument is based. The argument is underpinned by assertions about job routineness. It is therefore important to question these assertions, particularly those pertaining to what constitutes a routine task; can a job simply be described in terms of the set of tasks which it consists of, or is there more to it? The ALM model considers routine tasks as those which can be accomplished by an explicit set of programmed rules [1]. Contrastingly, Autor et al. describe nonroutine tasks as those of which the “rules are not sufficiently well understood to be specified in computer code and executed by machines” [1]. These descriptions inform the ALM model from which the aforementioned conclusions are drawn. However, the model can be criticised in terms of the task-orientated approach it takes towards defining routine and nonroutine tasks. Such an approach takes a positivistic view of job tasks and overlooks the important humanistic factors required to do a job

to the expected, equivocal standard of a human job occupant. This study recognises that in order to navigate the complexities presented in the real-world, human intervention is needed to conduct tasks in correspondence with human expectations of quality.

Given that this study is focused on the impact of AI implementation in the working environment on stakeholders, it is of a socio-technical nature. As Mumford elaborates, “a sociotechnical approach is one which recognises the interaction of technology and people and produces work systems which are both technically efficient and have social characteristics which lead to high job satisfaction” [9]. This study investigates the perceptions held by stakeholders about their jobs and the influence automation may have on this. Thus, the concern is with human activity systems, that is notional systems which express some purposeful activity. Such systems are notional as they are intellectual constructs used by individuals to “debate about possible changes which might be introduced in a real-world problem situation” [3]. In other words, this study involves the contribution of individuals’ perspectives about the purposeful activities, boundaries, properties and relationships which they believe to constitute their jobs and considers the impact AI may have on this based on their views regarding automation in the working environment.

Towards answering the hypothesis of this study, the following research questions were defined:

- *To what degree do stakeholders consider their job to be subject to routine? How does this impact on job automation?*
- *To what extent might AI affect stakeholders’ jobs?*
- *How might stakeholders react to the introduction of AI in their jobs?*
- *Will AI displace or assist stakeholders?*

3 Methodology

The nature of this study required a detailed description of the modus operandi of an individuals’ job, thus, a stakeholder-centric approach was deemed appropriate. The authors aimed to avoid any positive or negative preconceptions, which participants may hold regarding ‘AI’, therefore the term was not explicitly used. Rather, when posing questions to participants, ‘automation’ was the language used. In this way, participants were able to provide responses in regard to the intended purpose of AI in the context of their own jobs. Using this term also helped convey the purpose of AI to those participants who were not familiar with the concept.

Two methods were employed to gather the necessary quantitative and qualitative data anonymously. Firstly, five 30-minute interviews were carried out with individual participants in order to elicit rich responses about their jobs and views on automation.

These were of a semi-structured nature, taking a conversational approach towards the enquiry, which allowed participants to express their own feelings and opinions [7]. Interviews were conducted face-to-face with participants aged 20 to 40 years old and over, who had two or more years of experience in their respective fields. The participants were selected for interviews based on the authors' initial perceptions of the level of routineness present in their jobs. In ascending degree of perceived job routineness, beginning with highly routine jobs, participant occupations included a retail sales assistant, a pensions administrator, an account strategist and two university professors. The assurance of anonymity aided in the detail respondents were able to provide. Participants were able to provide a critical account of the organizational areas, relational to their job, which they perceived as problematic and how these might be improved by automation. For example, it was discovered that some professors face issues balancing the research aspects of their jobs due to the demanding teaching requirements imposed by the universities' lecture schedule. Thus, it was suggested that teaching could be automated to some degree. Interviews consisted of open-ended questions pertaining to the context of participants' jobs in their respective organization, what tasks they carry out in their jobs, how they use technology to support these activities, how they collaborate and employ creativity to complete tasks and the role they believe automation could play in supporting their job tasks.

The key themes derived from the interviews were used to inform questionnaires which were distributed as part of the subsequent survey. It was understood that the survey could not thoroughly describe the true behaviour of participants. Rather, the questionnaires were used to capture the varying levels of agreement among participants. Thus, the purpose of the survey was to gather information, across a wider population, about how stakeholders view their jobs in the context of the organizational environment and their thoughts about how automation might impact this. Evaluation of the structured data synthesised from the survey responses against the rich detail captured in the interviews allowed the authors to identify the shared/divided views of participants and the understand the potential reasons behind these. Resultantly, 56 respondents from eleven industries in the UK responded. Participants held positions spanning 13 job functions and were aged between 18 and over 60 years old. Furthermore, participants provided responses about the types of skills they mostly employ in their role, which aided further in establishing a profile of their jobs.

4 Main Discussion

Upon analysis of the survey results, it was found that 94% of participants perform tasks outside of their role on a frequent basis. This figure and the interviews conducted both suggest that tasks considered as routine, realistically comprise of complex relationships with other tasks, which can be invoked in certain conditions or at the will of the job occupants themselves. Such relationships became apparent during the interviews with

participants as the majority divulged some additional responsibility that they themselves undertook towards better performing/aiding with their core job responsibilities. For example, an interview was conducted with a Sales Assistant at a retail store, which is considered by the ALM model as routine and subject to 'substantial substitution'. The core job responsibilities of this individual involved processing sales transactions, maintaining the shop floor, providing customer service and managing stock, however, they also expressed that they undertook the non-routine responsibility of carrying out refunds. This allowed the participant to process refund transactions when the supervisor was elsewhere, thus easing queues and increasing customer satisfaction. Relationships like this may be difficult for organizations, who are looking to automate jobs, to perceive for a couple of reasons. Firstly, organizations may be tempted by the potential opportunity to reduce labour costs and increase productivity with the implementation of an autonomous system; this can be referred to as an organizational perspective. This can potentially cloud their understanding of the complexity of the job which they wish to automate as they may easily overlook the intricate relationships shared with other jobs and the contextual environment. Secondly, job occupants have difficulty expressing their tacit knowledge pertaining to the *modus operandi* with their job tasks. As such, they may not be consciously aware of the subtle interrelationships between the tasks within their jobs and those in other jobs, as well as the immediate environment. Therefore, they may be unable to articulate the tacit work practices which may be essential to overall organizational success. Attempts to understand the intricacies within an employees' job can be viewed as taking a stakeholders' perspective.

The difficulty shared from both an organizational and stakeholder perspective, when attempting to holistically understand a job, is a complicated gap to bridge. This is due to the varying conditions which influence job tasks, or exceptions. Where exceptions are presented, environments can be considered complex, requiring the individual to take alternative action to what they might usually; this action can be considered nonroutine. With the previously given example of the Sales Assistant interviewee, such an exception was that the employee took alternative action (i.e. conducting refunds) in order to ease customer queues. The presence of exceptions within work tasks was identified as a common theme across participants in the interviews. It can therefore be suggested that a task which might be considered routine, in practice, involves nonroutine elements. As Frey elaborates, nonroutine occupations involve "complex perception and manipulation tasks, creative intelligence tasks, and social intelligence" [2]. As such, the study confirmed that 87% of participants believe their jobs require them to work creatively and communicate with colleagues on a frequent basis. Such abilities are also used to overcome exceptions presented in practice, even where tasks are narrowly defined and subject to strict control. This was observed in an interview with a Pensions Administrator working within the financial services industry, whose main responsibilities involved dealing with customer queries. The participant acknowledged that his job required him to adhere to strict policies, thus did not allow much room for creative problem solving. However, upon further questioning it was found that when dealing with particularly complex client queries, the participant would proactively reach out to other members of the organization and third-party organizations in order to collaboratively

develop a resolution. These new-founded relationships also allowed the participant to solve similar queries more quickly in the future.

One might question why the ability to conduct nonroutine tasks is important within a job. Given that an outcome of AI implementation is to reduce human labour input whilst increasing productivity, it can be observed that AI is expected to complete a task equivalently or to a higher standard than that of a human job occupant. Thus, the extent to which exceptions can be handled in a job is directly related to the level of quality observed in the output. To this, it might be suggested that organizations considering automating supposedly routine jobs, need to think carefully about the level of cognition realistically required to do such jobs in practice in relation to the output quality they desire/expect. Organizations might better understand the complexity present in tasks by considering them in terms of nonroutine requiring high cognition and nonroutine requiring low cognition from the stakeholders' perspective, rather than from an organizational perspective in terms of routine and nonroutine. With this, tasks are considered in terms of the extent to which they involve handling exceptions. For example, a non-routine, high cognition task conducted by an Account Strategist, who was one of the interview participants in the study, would be that of understanding a client business problem as it involves a high degree of communication and reflection. Within the same profession, a nonroutine task requiring low cognition could include updating logs of conversations with a client onto a CRM system. Adopting the stakeholders' perspective may allow organizations to more accurately determine which job tasks are better left to a human workforce and to what degree some jobs could be automated without heavily sacrificing quality. In this way, an organization can work with stakeholders towards understanding which tasks might be automatable for the benefit of enhancing the worker's competency to do the job to an exceptional standard.

Having established an understanding of the difference between the perspectives taken when considering routineness in jobs, one can begin to think about the impact of AI implementation on employment within an organization. Specifically, the extent to which automation might impact on peoples' jobs and how they may welcome such change.

Towards developing an awareness of how stakeholders might react to the introduction of AI in their jobs, participants were asked how often they use technology in their jobs each day. This helped the investigation by developing an awareness of the importance of technology within stakeholders' jobs. Resultantly, 89% of survey respondents confirmed that they use technology within their jobs on a frequent basis. From this, it can be deduced that technology largely facilitates stakeholders in task completion, therefore people are already accustomed to using technology in their jobs. This suggests that the introduction of AI, as an entity which can beneficially aid stakeholders with task completion in some way, will be welcomed. Furthermore, participants were questioned as to how they would feel about a technology that could automate some of the repetitive tasks in their jobs. To this, 89% of survey participants agreed that they would find it useful. Exploring this further, the themes identified in the interviews with participants,

who were posed the same question, illuminated the desire for automation with particular job tasks which are thought to impede progression with higher priority tasks. For example, an interview with a University Lecturer highlighted that automating the detection of minor errors (e.g. spelling, grammar, punctuation etc.) and the conducting of extensive plagiarism checks when marking student assignments, would allow them to focus more on assessing the meaning of the work. Similarly, the Pensions Administrator believed that a system which could automatically generate a document with the correct information, at the appropriate time for a client could save time and allow them to focus more on resolving queries. Such perceptions held by stakeholders about what could be automated in their jobs indicate the preference of automation with smaller tasks. It is perceived that such incremental automation would necessitate an overall augmentation of the stakeholders' competency to do their job. This also suggests that stakeholders may react positively to the introduction of AI as long as they can see the benefit of it to their jobs. As Mumford proposes, "people will actively welcome change if they believe that it brings with it personal benefits" [9].

Previous conclusions drawn about the nature of exceptions, which are present in any job task practically conducted, entails with it an appreciation of the relationships that exist between jobs in an organizational environment. Job tasks are not always conducted in isolation and often, in practice, involve some human interaction with other tasks. Thus, participants were asked how reliant they believe others (i.e. clients and colleagues) are on their job, to which 75% stated that others are highly reliant. This was also a common theme identified amongst interview participants, thus inferring that some change to the existing technology in an organization which supports stakeholders in their jobs, can affect multiple other jobs. Therefore, a technological change such as the introduction of AI, could necessitate either a positive or negative rippling affect throughout an organization pertaining to the ability of stakeholders to carry out jobs tasks effectively using technology. For AI to be considered a displacing phenomenon of human workers, it should be developed with a comprehensive understanding of the complex and subtle interrelationships between jobs in an organizational environment. As previously mentioned, this is a difficult task due to the mutual difficulty faced when attempting to conceive/express a holistic understanding of a job from both organizational and stakeholder perspectives.

The study also sought to determine how different age groups might react to AI. Initially, it was expected that those who are more acquainted with technology and use it often (i.e. younger generations) would be more welcoming of automation into their jobs. Contrastingly, it was thought that those in older generations, who were thought to be less familiar with technology, would be opposed to automation in their jobs. However, the results yielded suggest otherwise. All age groups questioned (classified into generations X, Y and Z), occupying a number of different jobs which entailed varying levels of technology use, agreed that they would find automation useful in their jobs. This, in combination with the previously drawn understanding that people desire automation with smaller tasks, could indicate that the adoption of AI by stakeholders, who wish to complete job tasks, cannot be reduced to a particular set of factors expressed in a given

demographic. Rather, it may be considered that AI will be useful to a wide variety of stakeholders depending on their own unique needs. Such needs are influenced by the unique contextual situation associated with each stakeholder respectively. As an example of this, one of the interviewees, who can be classified into generation X, said they enjoy using technology on a frequent basis in both their personal time and in their working environment. In addition to this, they agreed that an automated entity could be useful in their jobs as long as it was not too intrusive.

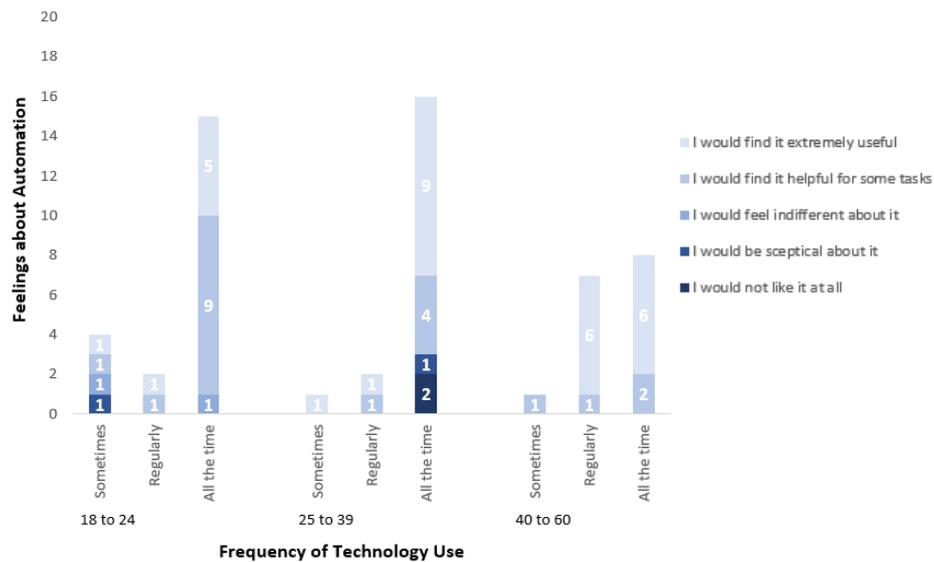


Fig. 2. - Technology Usage and Age Comparison Chart

5 Conclusion

When considering the likelihood of job automation at the hands of AI, two perspectives emerge. Those who take a task-based view of AI implementation, primarily with the aim of reducing costs and increasing productivity, tend to classify job tasks in terms of routine and nonroutine. This organizational perspective neglects to fully appreciate the exceptions present in a task which make an organizational environment complex and is conducive to the overall output quality desired or expected. Contrastingly, the stakeholder perspective can be adopted, whereby tasks are appreciated in terms of the unique complexity that they present. Such an outlook values the humanistic abilities employed to navigate complex environments, thus categorising jobs in terms of nonroutine tasks, requiring low cognition, and nonroutine tasks requiring high cognition. This will entail a shift in the focus of organizations considering AI implementation towards pursuing the augmentation of employee competencies with their jobs, so that they might perform to a higher standard. Organizations who take this perspective may benefit from increased productivity and quality of output through AI-augmented workers. This paper has also established that stakeholder acceptance of AI in the working environment may

not be reduced to a number of particular factors. Rather it might be considered that AI should be developed to augment stakeholders in their jobs based on their own needs as influenced by their unique contextual situations. This would encourage the development of an AI system which stakeholders see the benefit of using.

It can be considered that those stakeholders who occupy positions in less complex environments may be displaced by AI. Such environments may exist where enough exceptions are known about a job to produce an output of a consistent and expected level quality. This could entail progressive change whereby these job occupants targeted for automation are displaced into consultative positions responsible for guiding the development of the system. It may also involve the elimination of some of these jobs, or marginal displacement, as productivity increases through AI-augmented workers thereby reducing the need for as many human workers. For these, advancements in AI-enabled education may be beneficial in effectively upskilling workers.

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