Delft University of Technology, Bachelor Seminar of Computer Science and Engineering

# Design approaches to tackle ethical issues for proficiency estimation in AI-enabled recruitment

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**Abstract**

Companies have been looking for automation in their hiring practices and Artificial Intelligence offers a solution. A popular opinion on the topic is that AI-enabled hiring will enhance talent acquisition overall, eliminating bias and bettering results. However, deployed AI hiring tools often do not offer a solution but worsen the problem by violating ethical and moral barriers. Thus, it is crucial to consider the socio-technical perspective of this topic when designing software systems integrated into hiring practices. As part of AI-enabled recruitment, CV screening software is deployed in numerous conglomerates worldwide and is the centre of attention of this paper. The theoretical results delivered via this research originate from a variety of scientific articles of a multi-disciplinary nature. This paper examines how CV screening software can be designed to estimate professional proficiency while taking into consideration the needs and moral values of the stakeholders involved. A literature study has been conducted to derive the results. The research examines three design methodologies (Systemic design, Value Sensitive Design and Human-centered design) that help the design team to address the aforementioned issues and considers their impact on the design process of a CV screening tool regarding proficiency evaluation. The results of the paper conclude that it is crucial to assemble a design team that is multi-disciplinary in nature to elicit and embed the stakeholders' values into the design of a technical system of this nature.

## 1 Introduction

Technological advancements in the field of artificial intelligence (AI) have enabled algorithms to increasingly find applications throughout the corporate world and governments all over the globe. The deployment of such systems aims to aid humans in their tasks and, ultimately, to enhance the execution of such jobs. Social domains such as Human Resources Management (HRM from now on) in businesses could, in particular economically, benefit from AI-enabled recruitment [1], [2]. When used correctly, such an algorithm could be a powerful tool to save hours of surfing through job applications, remove bias from hiring practices and, overall, enhance the talent acquisition process [3]–[5].

The current state of the art indicates the great potential in hiring practices that recruitment algorithms might hold. Moreover, it is considered to be a necessity from an economical

point of view due to the benefits companies will gain after deployment [6]. However, misuse and/or misimplementation of such black-box systems has the potential to increase the bias [7] in the hiring process, disregard fundamental moral values [8] and produce inaccurate and unfair results [9]–[11] - e.g. recommending an unfit candidate and with that, disregarding a competent candidate. Furthermore, there are numerous concerns regarding the evaluation of proficiency of a candidate that need to be taken into account [12]–[14]. Job performance varies on the work setting and environment. Job competencies have different meanings in different work contexts. What is regarded as creativity in one job has a completely unrelated meaning in another. Thus, professional proficiency evaluation should not be regarded as a straightforward process. Numerous perspectives should be taken into account during this step of the hiring process. It is crucial to contemplate such socio-ethical issues during the design process of an AI recruitment algorithm.

The following research will make use of a thorough literature review of scientific journals with the purpose to analyse existing design methodologies. Looking from a socio-technical perspective, design teams behind AI recruitment systems have to contemplate the socio-ethical issues that might arise from the use of a technical system of this essence. The research topic is in nature multi-disciplinary due to the various contexts in which socio-technical design methodologies apply. The scientific articles that are referenced throughout this document are related to AI-enabled recruitment in general, as well as thorough research about the design methodologies, the ethical considerations in AI hiring and the overall impact of socio-technical design on systems. This paper aims to provide more information on ethical violations in AI-enabled recruitment and how to embed fundamental human rights into responsible AI design in recruitment systems. It is a field that is still being in its development process and a small number of organisations have deployed such systems. Therefore, the information on this topic is mostly theoretical. As such, this paper will not be utilizing a practical methodology for AI-enabled recruitment.

While numerous scientific papers focus on the potential benefits of AI-enabled hiring, few consider the ethical barriers between such a system and its implementation [1]. Therefore, this paper aims to provide a detailed description of the ethical considerations in the socio-technical context that need to be taken into account when designing AI recruitment algorithms regarding proficiency estimation. The main research question of the paper is how CV screening software can be designed to estimate professional proficiency while taking into consideration the needs and moral values of the stakeholders involved. Therefore, several subtopics will be considered to obtain a definite answer to the question at hand. Initially, I will examine the current state-of-the-art AI recruitment systems that are used by companies worldwide and reflect on how these systems can provide benefits for the stakeholders involved. Deriving a complete view of AI-enabled recruitment requires reviewing which moral values and norms are disregarded by AI recruitment systems. Then, this paper will outline which professional skills should be regarded as quantifiable and which should not during the talent acquisition process. After providing a distinction between the two types of professional competencies, I will consider how the design methodologies can help designers of AI recruitment systems embed these skills into the system. Assembling all the findings will be essential to the conclusion of this research in regard to design methodologies aiding the design team with the ethical challenges of AI-enabled recruitment.

The paper will adhere to the following structure: Following the introduction, Section 2 provides background on AI-enabled recruitment. Section 3 examines the topic of professional proficiency estimation in AI hiring. Chapter 4 brings forth a discussion regarding the design methodologies to bridge the socio-technical gaps for responsible and inclusive AI design in

hiring practices. Following is chapter 5 which contains a discussion regarding the limitations of this research and the directions for further investigation of this topic. Last but not least, chapter 6 summarizes the research topic as well as the key findings of this paper. Appendix A presents a personal reflection on the reproducibility and integrity of this research.

# 2 Background on AI-enabled recruitment

Before I introduce the topic of AI-enabled recruitment, a proper background on AI must be provided. Despite AI as a concept being around for decades now, the term Artificial Intelligence is still rather vague. However, a definition by the High-Level Expert Group on AI states that "Artificial intelligence (AI) systems are software (and possibly also hardware) systems designed by humans that, given a complex goal, act in the physical or digital dimension by perceiving their environment through data acquisition, interpreting the collected structured or unstructured data, reasoning on the knowledge, or processing the information, derived from this data and deciding the best action(s) to take to achieve the given goal. AI systems can either use symbolic rules or learn a numeric model, and they can also adapt their behaviour by analysing how the environment is affected by their previous actions" [15, p. 8]. From this description, it can be derived that AI systems find applications in most aspects of our lives. Therefore, AI influences and interact with most members of society on a daily basis. The magnitude of such influence can vary enormously, from a chat-bot in a fast food service that takes your order [16] to a recruitment system that decides whether you get your dream job or not [2], [17]. AI can find applications in almost every situation in our day-to-day. While some have little to no harm potential, the European Commission on Regulations on AI classified some AI systems as "unacceptable risk" that essentially is a ban to developing AI software in certain scenarios due to the colossal socio-ethical hazards it represents such as social scoring systems [18]. AI-enabled recruitment as a system has been labelled as "high-risk" due to the potential of such stand-alone AI systems to harm fundamental human rights, such as freedom and autonomy [8]. AI in hiring should be regulated due to the great ethical hazards that it poses to both stakeholders in the process [19], namely the recruiters and the job candidates. Moral considerations have to be taken into account when designing AI recruitment systems. Therefore, decisions of AI hiring systems are of greater importance and, thus, require a more thorough examination of the possible ethical threats that might arise from the use of such systems.

## 2.1 Current state-of-the-art AI recruitment systems and their benefits

Talent acquisition is a multi-layered process. It starts with a job advertisement listing and ends with the confirmed employment of an applicant. In many phases, during this process, it is possible to apply automation. The following Table 1 presents various AI tools which are used by companies in relation to recruitment processes in organisations worldwide.

As shown in Table 1, there are numerous possible applications for AI automation in the recruitment process. The united goal of all the tools that are listed is to enhance the talent acquisition for the stakeholders involved. The tools present an opportunity for businesses to achieve better results in the recruitment process and facilitate the work of HRM specialists. Moreover, they aim to upgrade the candidate experience during the different phases of a job application. For instance, the job market is full of people who are not actively searching for a job. A multi-database candidate sourcing tool uses numerous databases such as LinkedIn to

| AI-recruitment tool | Problem | Solution |
|---|---|---|
| Job description optimization software | Job descriptions can be off-putting and discriminatory | Optimization of job descriptions for more accessibility to different types of applicants |
| Targeted job advertising optimisation | Job advertising often targets the wrong people | Software targets advertisements for relevant candidates for the correct positions |
| AI-powered psychometric testing | Outdated and irrelevant assessment tests can be off-putting to applicants | Enhances more engaging interviews to improve candidate experience during the assessment of job applicants |
| Video screening software | Pre-screening interviews consume the time of the stakeholders involved unnecessarily | Analysis of video interview estimates whether a candidate is a right fit for a position |
| AI-powered background checking | Background checking can be extensive and tiresome for humans | AI provides recruiters with vital candidate information such as references and criminal record |
| Employer branding monitoring | Brand reputation about the recruitment process is vital for the brand image | AI tool scans public data that identifies weaknesses during talent acquisition |
| Automated scheduling | Scheduling of meetings, interviews and calls can be time-consuming and inefficient when done by a person | Algorithmic optimisation of scheduling makes for efficiency while allowing recruitment to focus on more crucial tasks |
| Candidate engagement chatbot | Recruitment employees dealing with large quantities of candidates is costly and can have negative impact on the recruitment process | NLP algorithms can be used to mimic recruitment responses that improves the candidate experience and allows recruiters to focus on essential tasks |
| Multi-database candidate sourcing | Passive candidates can be more valuable to organisations than active | Scans through numerous databases such as LinkedIn can enhance talent acquisition results |
| CV Screening software | CV screening is tiresome for humans and they become more error-prone with time | Reviews large quantity of CVs to filter the appropriate applicants |

Table 1: AI tools that are used in recruitment processes
*Note*: Adapted from E. T. Albert, *Ai in talent acquisition: A review of ai-applications used in recruitment and selection*, Oct. 2019. [Online]. Available: `https://www.emerald.com/insight/content/doi/10.1108/SHR-04-2019-0024/full/html`.

add passive job candidates to the talent pool for consideration regarding future recruitment [20]. Hence, passive applicants do not miss on potential job opportunities and companies fill their talent pool. Direct stakeholders of the tool, which are the applicant pool, recruiters and their respective companies, have the potential to benefit from automation of the talent hunt. Table 1 reveals that automation can happen on multiple stages of the talent acquisition process. With these AI tools tedium of the tasks is nullified and HR specialist, in particular, can benefit from adopting AI mechanisms in hiring practices.

Taking into account the numerous areas where AI can automate the recruitment process, we need to analyse the benefits it brings to the stakeholders involved, namely the applicants and the organisation. Popular journals highlight the significance of AI in recruitment as it will "revolutionize" hiring practices [2], [3]. First and foremost, going over Table 1, a noticeable common characteristic of the AI tools is that they allow recruiters to focus on more essential tasks. Although not explicitly defined, the most essential task of the talent acquisition process is to assess whether a candidate possesses the right personal and professional qualities for the desired job position. Numerous tedious tasks are part of the talent acquisition process, such as scheduling interviews and background checking. In this area, algorithms have the potential to enhance the results of the HR specialists due to the computational capabilities when being fed large data [6]. Within the microeconomics of a company automation of the talent acquisition process is seen as an unmissable opportunity, not only a "nice to have" feature [4]. The significance of the AI tools listed in Table 1 peaks at CV screening software and will be the focus of this research as part of the existing AI tools - will be regarded as AI systems from now on. CV screening software receives as input numerous CVs and selects only a number of them that are quantified as appropriate candidates for the job. Thus, it can find use in HR departments of big corporations due to the large amount of job applications they receive on a daily basis. CV screening was used in 2019 at some of the largest businesses in today's corporate world such as IBM, LinkedIn and Amazon [20]. The tool is intended to ease the filtering work of an HR specialist. Moreover, it is claimed that it will reduce selection bias and will, ultimately, improve the quality of the talent pool selected [20]. However, such great promise often delivers great moral threats to both parties involved in the recruitment process - the applicants and the organisation.

An increasing number of organisations are adopting AI-enabled recruitment systems of some form in their hiring practices [6]. Such algorithms allow automation of some of the tedious tasks that HRM departments go through every day when looking through job resumes. For example, scanning through thousands of resumes is tiresome for human resources employees. Repeatedly going over what is essentially the same task can be tedious and could have negative implications on the performance of the employee. It would result in an incorrect estimation of whether a candidate is a right fit for a given position in a company. Therefore, from a business perspective, it is an area where organisations could benefit from the automation of the process. Providing profiles of competent candidates to an algorithm, the software filters out the human beings that do not have the corresponding qualifications listed in their CV. Neglecting the purely human perspective, it could enhance the process of talent acquisition [2]. Furthermore, such systems may ensure the best fit for a given position based on extensive background check tools that will go through enormous collections of data, which is not feasible for a talent acquisition specialist with a large number of applicants [20]. Such a system will allow HR to dedicate more detailed attention to the processed candidates and, thus, provide a better hiring experience.

## 2.2 Moral norms and values disregarded by AI recruitment systems

As outlined, the benefits of embedding AI systems into the hiring practices for HR specialists are numerous from an economical perspective. However, automation of talent acquisition tasks incorporates ethical hazards for the stakeholders involved [9]. The aforementioned scenarios were being considered under the assumption that the AI hiring systems are unbiased and take justified and moral decisions. In the case of a fault in the filtering, for instance, the wrong candidates would be selected. That in turn results in inaccurate and faulty decisions and bias and discrimination. It is crucial to take into account that such issues could arise and violate moral norms. Thus, while AI-enabled recruitment aims to enhance talent acquisition - both in terms of process and results - in numerous scenarios it presents plenty of threats and risk to the stakeholders in the recruitment process. From a candidate's perspective, such a scenario results in an unfair discriminatory decision from a faulty piece of software. It could, further, have larger implications for their life - as great as being denied an opportunity of prospering in their dream job position due to faulty systems. Regarding the point of view of the organization that adopts such mechanisms, the consequences relate to the overlooking of a potential right fit for a given position. Furthermore, that means turning detailed attention of talent acquisition specialists to an applicant that is not correctly estimated. Some of those applications of AI seemingly eliminate human bias from the selection process. However, both real-life scenarios and studies have shown that not only AI systems do not guarantee the absence of bias, but often they carry into the hiring practices bias of the training model and/or data with which the algorithm is trained [21], [13], [22]. This research question will analyse what moral values are disregarded by existing AI recruitment systems and if and which design methodologies can eliminate the negative implications of algorithmic hiring.

Predictive algorithms require training data after being implemented into a working solution. Based on the provided data, they generate the decision output. The design of algorithms is solely based on the values embedded by the engineer and/or designer that created them [7]. Therefore, bias in the training data will result in bias in the generated output [9]. Nevertheless, it is only one of the five scenarios presented in the paper which introduces bias and discrimination in the decision-making of such a system. For instance, listing labels such as gender, age and race, should already indicate a warning of potential discrimination. However, Amazon's hiring system was already preferring male candidates over female without the presence of gender labels due to its ability to disregard candidates who attended female colleges. Training their system with mainly resumes from male candidates, the algorithm learned falsely that male employees are preferable to female and promise greater success to the company [21]. Such a concept, undoubtedly, is invalid and incorrect at the very least. To prove that, a study that included 366 companies from the USA, UK, Canada and Latin America shows that diversity grants greater prosperity and potential to a company [23],[24]. Companies that have diversified teams of employees perform better in the market. For one of the stakeholders involved in the recruitment process - the recruiter, efficient results are key, i.e. choosing the right fit. Moreover, bias in the CV screening software means that job applicants who are qualified for a given position are explicitly rejected due to fault in the system.

However, bias in recruitment selection systems comes second to a much larger and significant issue at hand for the stakeholders involved - autonomy over self-representation. Automating competence evaluation during the talent acquisition process has profound implications on the candidate's selves. Designers come up with a technical system that evaluates their proficiency in a sphere via a predetermined model that decreases drastically their

opportunity to express themselves [8]. Different job competencies gain different meanings depending on the context. The applicants are being forced to fit into a model that does not necessarily capture the right image. Such socio-technical system dehumanizes the applicant and alters their characterization into statistical models that are evaluated by AI software. The freedom of the applicants to express their own aspirations is restricted in automation of hiring practices. The applicants lose their autonomy over their own self-representation. Violating fundamental human rights issues a critical warning to the design team of the software. If the candidates are not properly provided with the opportunity to show their competence in a setting, the designers of such a system should question the very foundation of their idea to deliver AI recruitment software. In a sense, this consideration leads the team that designed this socio-technical system to falling down the solutionism trap [10]. The solutionism trap concerns practitioners who develop systems that do not present solutions to the problems at hand, but only create further issues. When a computer scientist can not provide a robust solution to a problem, one should at least ensure to not create further socio-technical issues. In this case, instead of enhancing the talent acquisition process and removing bias, applicants lose their freedom to express their competence by being dehumanized into statistical data. The recruitment process is thus, far less efficient and far from fair to the stakeholders involved. However, that does not correspond to an absolute halt in the development of AI recruitment systems. AI-enabled recruitment should contemplate these socio-ethical issues - violation of fundamental human rights. To prevent such misbehaviour in recruitment, socio-technical design methodologies must be integrated into the design considerations of AI recruitment systems.

# 3 Professional proficiency estimation and AI-enabled recruitment

Having established the great significance of AI recruitment systems, this paper will consider professional proficiency as an area where ethical considerations on existing design approaches could enhance talent acquisition for the multiple stakeholders involved in the process. Estimation of professional proficiency during the hiring process is an essential part of the recruitment process. Ultimately, it is key to evaluating whether a candidate would be a suitable fit for a given position. The term "proficiency" from a personal perspective is an accumulation of multiple skills. They can be quantifiable such as, for instance, having 5 years of job experience in a given area or being able to complete a software project in several months less than what is initially agreed with a client. Another example in this school of thought would consider that graduating from a certain university with a GPA higher than 7.5 can be quantified on a scale. However, there are numerous personal skills in which proficiency is not so easily quantified. For example, when it comes to soft skills, teamwork and communication is not a skill that is measured with ease. Having completed a successful group project in an academic or a professional environment does not necessarily guarantee excellence in teamwork. Yet, teamwork is one of the key soft skills that is being sought by talent acquisition specialists. Moreover, abstract skills such as creativity and out-of-the-box thinking are aspects of the job application that are not easily estimated. Both quantifiable and unquantifiable skills should be considered in the design of an AI-enabled recruitment system to enhance the talent acquisition process and results.

### 3.1 Quantifiable and unquantifiable job competencies in proficiency estimation

Professional proficiency estimation lays the foundations of hiring. It is the basis that reflects whether a candidate is the right fit for a job position. Therefore, properly assessing a candidate in the first place lays the foundation of ethical AI recruitment. Assessment of candidates without any assistance from AI tools is a multi-layered process. Companies look for a nuanced set of skills in their employees' resumes. Depending on the position applicants seek, job prerequisites vary. The sought prerequisites might be having several years experience in a given position or having graduated from an elite university or college, as well as having quality personality traits, such as communication, teamwork and so forth. Determining whether an applicant is competent and would perform well in the work setting of the company is one of the numerous tasks of HR specialists, but arguably their most important one. They need to estimate whether their potential future colleagues would be of benefit to the company. A suitable way of coming to such conclusions is the evaluation of the professional proficiency of a candidate.

Professional proficiency is a combination of both academic and/or professional skills and personality traits. Embedding estimation of quantifiable skills into the design of CV screening software should be relatively straightforward. For instance, scanning tens of thousands of CVs of developers to filter only the ones that include applicants having more than five years of experience in a relevant IT position can be easily embedded in the design of such a tool. Moreover, having a GPA above a certain rating could also be considered easily when developing AI systems. Skills and traits that could be rated on a scale should not be a problem for designers when deriving a formula for the assessment of professional proficiency.

In recent times, numerous psychometric tests have emerged to derive the competence of applicants regarding their personality traits. These tests estimate the soft skills, such as teamwork, communication skills, abstract or out-of-the-box thinking, as well as creativity. However, a range of scientific studies have outlined that work competencies differ between various job positions [12], [14], [25], [26]. Depending on the work context, various work terms or skills might gain an unrelated the meaning. For instance, what is creativity in the context of software development would have a completely different meaning when applied to a business administration. Another example would examine cultural differences when it comes to work ethic between diverse types of people. Therefore, when choosing to evaluate a certain professional skill, designers bind the meaning of the competence to the context in which it is assessed. Measuring communication skills in a work environment full of software engineers should be treated equivalently as assessing the communication skills of a political figure or a lawyer, for instance. In essence, the challenge to evaluate personal traits or soft skills represents the challenge to consider the real-life scenarios in which they are applied. Real-life challenges in the work environment often differ vastly from the assignments during psychometric tests. Therefore, psychometric testing in various scenarios is bound to produce an unrealistic evaluation [14].

Regarding AI hiring, failing to assess a candidate's job competence leads to wrong hiring decision - either rejecting or accepting based on false assumptions. Either way, the candidate is restricted in their attempt to show the recruiter the talent they possess and their work goals. Failing to consider such values to the respective stakeholders in the talent acquisition processes would result in discrimination of the output and loss of autonomy over the applicants' self-representation. Violation of fundamental human rights has to motivate a meaningful discussion among designers of such a socio-technical system. If the AI

recruitment system they designed is not doing any good but is rather problematic from a socio-ethical perspective, they should not have produced it in the first place. That calls for careful considerations into which skills should be quantified and in what way. Therefore, the biggest challenge is to embed such skills when designing AI hiring systems in such a way that the outcome is fair for all the stakeholders involved.

## 3.2 Embedding professional skills evaluation into AI recruitment systems for responsible AI design

Using quantification to estimate certain professional skills has profound implications for the meaning of the skill itself. For the sake of correct assessment of professional proficiency, skills are to be divided into sections of quantifiable and unquantifiable. During the design of CV screening software, developers should consider these two aspects of the evaluation of job candidates. Failing to do so has a negative impact on the software. After all, the stakeholders will have no interest in using AI that inconsistently produces the right results and at times does harm to both direct stakeholders involved - both the applicant pool and the recruiters. The AI system should evaluate the quantifiable skills of job candidates, such as years of professional experience, during the evaluation process. However, the tough task in front of developers remains. Multiple questions have to be brought to the table regarding how to make an assembly of those competencies, both quantifiable and unquantifiable, in AI recruitment systems to properly assess the candidate. That includes bringing up a thorough discussion on the socio-technical context of AI-enabled recruitment. The design team initially have to identify the stakeholders. That includes sketching who the direct and indirect stakeholders are - are there more direct stakeholders than the human applicants and the recruiters? Having identified who the stakeholders are in this process, software developers need to incorporate the needs of the users. The design team and the stakeholders have to contemplate the impact of quantification of certain skills on the context in which assessment is applied. If, for instance, designing a system for AI-enabled recruitment that evaluates software engineers, leadership skills will gain an unrelated meaning when applied in a business administration context. Applicants and recruiters have to provide their position on which skills should be quantifiable. Furthermore, having a distinction between the two sets of skills, the next question is regarding how are unquantifiable skills brought into the assessment process. In that way, the AI system will provide its users with an algorithm that correctly evaluates their professional proficiency based on CVs.

However, there is more room for improvement during the screening process. The final state of a CV screening algorithm has to be more of a decision-support instead of a decision-making system. By doing so, more of the responsibility for the evaluation of the candidate will return to the HR specialists who are using the tool. Furthermore, it presents more of a solution to one of the violated principles of Ethical AI - transparency [27]. Developers should design CV screening software in such a way that all the evidence for rejecting or accepting candidates be present. In that way, faulty software will be easier to catch and will be eliminating some of the black-box parts of algorithms. Both of these ethical considerations need to be made when designing CV screening software to increase trust in the AI-recruitment system.

# 4 Design methodologies for AI recruitment systems

Software design teams should consider applying design methodologies to tackle these critical issues in AI recruitment systems. Three main design methodologies are considered that are intended to aid the estimation of professional proficiency - Systemic Design, Value-Sensitive Design and Human-Centered Design. These approaches have distinguished strategies to embed value into design systems. Priority during the design process should be to incorporate the needs and moral values of the stakeholders, namely the applicants and the recruiters. Correct estimation of the applicants' professional proficiency is also to be considered in a way to have both parties satisfied with the end product.

While the potential that AI-enabled hiring has is undoubted, the ethical considerations so far eliminate the possibility to adopt such a system on an organisational level. There are risks for all stakeholders involved during the recruitment process relying on the use of decision-making AI systems. Initially, let us consider applying Systemic Design during the design process of such software.

Systemic Design (SD) is the first design methodology this paper will consider. It examines the problem from the largest perspective possible. The design methodology focuses on the larger whole rather than on the separate parts of a system [28]. The emphasis in the design process lies in the impact of the whole system. In the context of AI-enabled recruitment, the concern does not prioritize how assessment software evaluates different candidates. The accent of systemic design is how CV screening evaluation influences the stakeholders involved in the recruitment process as a whole. Moreover, specific for SD is the separation of design and intervention processes in systems which allows designers to intervene and redesign the system. Thus, it can be useful and will be included during the ethical considerations process of the design of AI recruitment systems. The first consideration would be to adopt systemic thinking [28] in the design process of the CV screening software. Designers of AI recruitment systems need to take a broader look at the whole picture and consider the innovation product from a societal perspective. That includes identifying the stakeholders of such a system and computing the impact CV screening might have. Thus, it might mean that social innovation practitioners might be involved in the design process. They are able to deliver higher expertise in that aspect in this multi-disciplinary problem. Being able to consider more perspectives during the design process means that more ethical hazards will be covered and taken care of. The study argues that socio-technical systems that involve social innovation practitioners are distinguished by their high complexity and therefore, "cannot be sufficiently described or controlled through a pre-determined solution" [28]. Therefore, that leaves designers of such systems with the only opportunity - to design for intervention. Being able to intervene in such a socio-technical domain will allow HR practitioners that use CV screening software to stay in charge of the decision-making. Ultimately, that will have a positive impact on the direct stakeholders involved - the applicant pool and the organisation deploying CV screening software.

After considering the broader impact of adopting CV screening could have, developers also have to focus on designing the software itself for the end-users as well. This paper considers two main design methodologies to aid to that end.

Value-sensitive design (VSD from now on) is a software development methodology [29], [30]. It is centred around comprehensively embedding human values into the design of the final technical system . The study shows that some of the values often associated with the software design in which VSD is applied are human welfare, freedom from bias, traceability and, last but not least, autonomy. Value-sensitive design consists of principles to ensure

that the autonomy of the end-users is preserved. In the current scenario, that refers to the candidates' ability to represent themselves instead of being coerced to fit into a predetermined model. Using the methodology might be key to rightful competence estimation in AI hiring systems. Integrating VSD in the design process will enable designers to contemplate this concerning issue and reflect on it. That, in turn, constructs a better AI system not only in terms of yielding results, but also eliminates bias as much as possible. Considering human values in the design process is an essential part of VSD and is possibly beneficial when designing AI hiring systems. However, VSD is stakeholder-oriented and therefore, considers the values of the stakeholder involved in the process, not genuine moral values [31]. In a sense, using VSD limits the ethical considerations during design to the values of the identified stakeholders. Considering all possible stakeholders is, thus, key to embedding the correct values into the system design.

VSD is related to numerous methods used by practitioners to identify the necessary values to be embodied in the software [30]. First and foremost, identification of both direct and indirect stakeholders of the tool takes place. The team that designs such a software system, could include experts from various disciplines. The designers have to consider which are the parties that directly interact with the tool during the recruitment process. The following task of the design team is to analyse the stakeholders indirectly influenced by CV screening. After the successful completion of this task, the values of this assembled group of stakeholders are to be considered. VSD methods include Value-oriented semi-structured interview for eliciting values as design requirements. Stakeholders are invited to an interview during which the design team engage in values eliciting. Regarding CV screening and proficiency estimation, this process would include a multi-disciplinary team to ask what are the main values that a software system of this nature is expected to be sensitive about and consider thoroughly. Furthermore, the separate stakeholders have to be interviewed about which are the skills that they feel should be evaluated in the process. The design team need to take into consideration the gained responses from the stakeholders in such a process while also contemplating the notion that different works require different types of evaluation. After gaining a concept of the main requirements that HR specialists should look for in candidates, they can embed the acquired professional skills in the design of software to be produced.

Human-centered design (HCD from now on) consists of a group of methodologies and principles that carry the main purpose of designing systems in a way that they meet human needs and wishes. The focus revolves around the usefulness and usability of a system for the stakeholders involved [32]. The foundation of this design methodology lies in identifying the correct stakeholders of the design system. Applying HCD to AI hiring systems will allow designers and developers to contemplate the necessities of both job applicants and HR specialists. However, it carries similar risks to VSD, concerning the stakeholders. Designing for a group of people might result in neglecting another group that is influenced by the system in design [33]. The study further investigates how focusing on humans over activities could be harmful to the overall usefulness of the system. Nevertheless, in the context of AI hiring systems HCD would be beneficial to support HR specialists in their work as well as taking into account the needs of job applicants.

HCD is an amalgam of numerous different design practices [34]. Among those is Interaction Design or Designing for Interaction. Interaction Design is a design methodology that focuses on the interaction between human and computer [35]. During the iterative process of interaction, designers can review the behaviour and actions taken by the user. This methodology allows the development team to evaluate the usability of a system. It

captures all aspects of the user experience. Interaction Design is used to apprehend potential harmful interactions with the users [34]. As part of the HCD practices, this methodology has the potential to be instrumental in delivering ethical and transparent AI systems [36]. Analysing human behaviour during a continuous interaction with an AI system will reveal the strengths of the system as well as the parts that influence the user in a bad manner which includes the ethical hazards to the person. Outlining the negative impact a technical system has on its user and/or stakeholders inspires a discussion between the stakeholders. In turn, that leads to altering the initially embedded requirements and ultimately, delivering a useful and concise AI recruitment system. ID can be key to identifying the aspects that bother the user to optimize the user experience.

After the completion of the required values list, designers need to guarantee the validity of the gathered results. The method to validate the values of the stakeholders are taken into consideration is prototyping. CV screening software can show the effect of the design considerations only after being deployed and fed data. However, the design team could deploy the Wizard of Oz (WoZ) method with another group of stakeholders [37]. This method of both VSD and ID practices is used in the current context to ensure the values to the end-users. With WoZ the designer of the AI system will be able to conclude whether the user can be in control of the system and use it with the intended purpose. The user should control the system and use it only as a decision-support algorithm instead of letting the algorithm come to a decision autonomously. After the interaction between the users and the recruitment system, the design team can be certain of the soundness and robustness of the system. The current process will allow the designers to reevaluate their ethical considerations if something goes wrong. In case the system is faulty and does not serve the stakeholders involved fairly, it is vital that the changes happen during the design process and not after deploying the system.

These design methodologies can be applied during the design process of CV screening software to tackle the socio-ethical issues in the automation process of recruitment. Their inclusion is a must to properly mitigate these ethical issues.

# 5 Discussion, limitations and future work

Competence assessment is a crucial part of the talent acquisition process and lays the foundation of AI-enabled recruitment. A conceptual representation of what the professional proficiency estimation should be like is the first step towards proper AI-inspired candidate assessment. Embedding a candidate assessment into such a socio-technical system is the key to the development of this sphere. Having eliminated the loss of autonomy over candidates' own self-representation would turn the attention of further research into other ethical issues, such as bias and transparency. Choosing what should be quantified and how certain professional skills should be quantified is enough to inspire a thorough consideration concerning the training data that is used on the AI model. Bias issues regarding the training of AI models can be found in released AI-enabled recruitment systems [21], [22]. Moreover, transparency is an aspect of AI hiring that requires exhaustive contemplation. Candidates have to see how their quantifiable skills are assessed and what is the logic behind the final output of the recruitment system. These are points of direction into which the research could be further investigated.

The timespan of this project limited the amount of research into possible design methodologies that was carried out. There are other design methodologies with the purpose of tackling ethical issues of software design. For instance, another newly emerging methodology is

Human-Centered Artificial Intelligence (HCAI) [34], [36], [38]. It branches out from HCD which essentially resembles the main goal of the methodology. However, it targets software categorized under Artificial Intelligence, which in turn has the potential to have more impact when designing AI tools. Another point of improvement would consider the fact that this research is entirely theoretical. Therefore, researchers could look for improvement in this perspective. Empirical studies in this socio-technical context might validate and solidify the theoretical notions outlined in this paper.

# 6 Conclusion

Talent acquisition around the world has already started the process of automation. While, undoubtedly, deploying AI in hiring practices is economically beneficial for companies, bias and discrimination during recruitment are serious threats to the moral values of people involved in the process. Automation can happen at many levels during the recruitment process. Therefore, when designing a tool that is a systematic component of AI-enabled recruitment, it is important for developers to take into consideration the impact that the software will have. That includes seeing the big picture which concerns the social infrastructure in which the automation takes place.

This paper takes into consideration three socio-technical design methodologies that have the potential to mitigate the loss of autonomy of applicants over their own self-representation in the output of CV screening tools during the selection process. Initially, software developers need to apply systemic thinking when designing such a tool. Hence, the design team need to consider the system CV screening software will be a part of. The paper concludes that since this process is out of the scope for software developers, it is likely that if put into practice, social innovation practitioners need to be involved. That will help to mould the tool and to elicit the requirements that embody the values of the stakeholders involved. Moreover, designing a technical system for AI-enabled recruitment requires that software design methodologies are included in the process. Introducing Value-sensitive design and Interaction design practices in the design considerations aids the development team to prioritize the values and needs of the stakeholders involved in the process.

# A Responsible Computer Science

The research laid its foundation on a literature review from scientific journals in multiple disciplines. It included articles found via Google Scholar [39], as well as media articles that introduced general knowledge on the topic of AI-enabled recruitment. The literature research that was carried out was to my best of efforts objective and with the intention to lay out the scientific knowledge from multiple perspectives. Reproducing the objective information from the scientific sources should be straightforward if the reader dives into the articles listed in the References section. However, combining theoretical ideas and notions about the design methodologies and AI tools deployed in talent acquisition required me to express my point of view. The concepts that I have examined in this paper are a product of my understanding of the subject which is where the reproducibility of the paper might vary. The research includes some opinions from me that are necessary to produce the final deliverable of the paper. It included analysing the design methodologies with their flaws and strengths to showcase how they could be applied in this socio-technical context

involving multiple stakeholders. However, another researcher combining several scientific sources might come to different conclusions than the ones defined in this paper.

# References


[1] M. Cubric, "Drivers, barriers and social considerations for ai adoption in business and management: A tertiary study", *Technology in Society*, vol. 62, p. 101 257, 2020, ISSN: 0160-791X. DOI: https://doi.org/10.1016/j.techsoc.2020.101257. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0160791X19307171.

[2] C. D. Costa, *How ai can revolutionize recruitment?*, Aug. 2019. [Online]. Available: https://medium.com/@harish_6956/how-ai-can-revolutionize-recruitment-dd32948d4378.

[3] R. Heilweil, *Artificial intelligence will help determine if you get your next job*, Dec. 2019. [Online]. Available: https://www.vox.com/recode/2019/12/12/20993665/artificial-intelligence-ai-job-screen.

[4] J. S. Black and P. van Esch, "Ai-enabled recruiting in the war for talent", *Business Horizons*, 2021, ISSN: 0007-6813. DOI: https://doi.org/10.1016/j.bushor.2021.02.015. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0007681321000173.

[5] P. van Esch, J. S. Black, and J. Ferolie, "Marketing ai recruitment: The next phase in job application and selection", *Computers in Human Behavior*, vol. 90, pp. 215–222, 2019, ISSN: 0747-5632. DOI: https://doi.org/10.1016/j.chb.2018.09.009. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0747563218304497.

[6] J. S. Black and P. van Esch, "Ai-enabled recruiting: What is it and how should a manager use it?", *Business Horizons*, vol. 63, no. 2, pp. 215–226, 2020, ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING, ISSN: 0007-6813. DOI: https://doi.org/10.1016/j.bushor.2019.12.001. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0007681319301612.

[7] B. D. Mittelstadt, P. Allo, M. Taddeo, S. Wachter, and L. Floridi, "The ethics of algorithms: Mapping the debate", *Big Data & Society*, vol. 3, no. 2, p. 205 395 171 667 967, Dec. 2016. DOI: 10.1177/2053951716679679. [Online]. Available: https://doi.org/10.1177%2F2053951716679679.

[8] E. Aizenberg and J. van den Hoven, "Designing for human rights in ai", *Big Data & Society*, vol. 7, no. 2, p. 2 053 951 720 949 566, 2020. DOI: 10.1177/2053951720949566. eprint: https://doi.org/10.1177/2053951720949566. [Online]. Available: https://doi.org/10.1177/2053951720949566.

[9] D. F. Mujtaba and N. R. Mahapatra, *Ethical considerations in ai-based recruitment*, 2019. DOI: 10.1109/ISTAS48451.2019.8937920.

[10] A. D. Selbst, D. Boyd, S. A. Friedler, S. Venkatasubramanian, and J. Vertesi, "Fairness and abstraction in sociotechnical systems", FAT* '19, 59â68, 2019. DOI: 10.1145/3287560.3287598. [Online]. Available: https://doi.org/10.1145/3287560.3287598.

[11] M. Vasconcelos, C. Cardonha, and B. Goncalves, "Modeling epistemological principles for bias mitigation in ai systems", *Proceedings of the 2018 AAAI/ACM Conference on AI, Ethics, and Society*, Dec. 2018. DOI: 10.1145/3278721.3278751. [Online]. Available: http://dx.doi.org/10.1145/3278721.3278751.

[12] J. P. Lantolf and W. Frawley, "Proficiency: Understanding the construct", *Studies in Second Language Acquisition*, vol. 10, no. 2, pp. 181–195, 1988, ISSN: 02722631, 14701545. [Online]. Available: http://www.jstor.org/stable/44488172.

[13] B. Dattner, T. Chamorro-Premuzic, R. Buchband, and L. Schettler, *The legal and ethical implications of using ai in hiring*, Aug. 2019. [Online]. Available: https://hbr.org/2019/04/the-legal-and-ethical-implications-of-using-ai-in-hiring.

[14] M. Govaerts and C. P. van der Vleuten, "Validity in work-based assessment: Expanding our horizons", *Medical Education*, vol. 47, no. 12, pp. 1164–1174, 2013. DOI: https://doi.org/10.1111/medu.12289. eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1111/medu.12289. [Online]. Available: https://onlinelibrary.wiley.com/doi/abs/10.1111/medu.12289.

[15] "A definition of ai: Main capabilities and scientific disciplines", 2019.

[16] J. Walker, *Fast food robots, kiosks, and ai use cases from 6 restaurant chain giants*, Nov. 2019. [Online]. Available: https://emerj.com/ai-sector-overviews/fast-food-robots-kiosks-and-ai-use-cases/.

[17] *Hirevue: Video interview software recruitment platform.* [Online]. Available: https://www.hirevue.com/.

[18] *Lex access to european union law.* [Online]. Available: https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1623335154975&uri=CELEX%5C%3A52021PC0206.

[19] *What do you need to know about the ai act?* [Online]. Available: https://www.timelex.eu/en/blog/what-do-you-need-know-about-ai-act.

[20] E. T. Albert, *Ai in talent acquisition: A review of ai-applications used in recruitment and selection*, Oct. 2019. [Online]. Available: https://www.emerald.com/insight/content/doi/10.1108/SHR-04-2019-0024/full/html.

[21] J. Dastin, *Amazon scraps secret ai recruiting tool that showed bias against women*, Oct. 2018. [Online]. Available: https://www.reuters.com/article/us-amazon-com-jobs-automation-insight/amazon-scraps-secret-ai-recruiting-tool-that-showed-bias-against-women-idUSKCN1MK08G.

[22] R. Maurer, *Hirevue discontinues facial analysis screening*, 2021. [Online]. Available: https://www.shrm.org/resourcesandtools/hr-topics/talent-acquisition/pages/hirevue-discontinues-facial-analysis-screening.aspx.

[23] V. Hunt, D. Layton, and S. Prince, *Why diversity matters*, Mar. 2021. [Online]. Available: https://www.mckinsey.com/business-functions/organization/our-insights/why-diversity-matters#.

[24] A. Saxena, "Workforce diversity: A key to improve productivity", *Procedia Economics and Finance*, vol. 11, pp. 76–85, 2014, Shaping the Future of Business and Society, ISSN: 2212-5671. DOI: https://doi.org/10.1016/S2212-5671(14)00178-6. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S2212567114001786.

[25] L. Li, T. Lassiter, J. Oh, and M. K. Lee, "Algorithmic hiring in practice: Recruiter and hr professionalâs perspectives on ai use in hiring", May 2021. DOI: https://doi.org/10.1145/3461702.3462531.

[26] G. Delandshere and A. R. Petrosky, "Assessment of complex performances: Limitations of key measurement assumptions", *Educational Researcher*, vol. 27, no. 2, pp. 14–24, 1998, ISSN: 0013189X, 1935102X. [Online]. Available: http://www.jstor.org/stable/1176194.

[27] *Ethics guidelines for trustworthy ai*. [Online]. Available: https://digital-strategy.ec.europa.eu/en/library/ethics-guidelines-trustworthy-ai.

[28] M. van der Bijl-Brouwer and B. Malcolm, "Systemic design principles in social innovation: A study of expert practices and design rationales", *She Ji: The Journal of Design, Economics, and Innovation*, vol. 6, no. 3, pp. 386–407, 2020, ISSN: 2405-8726. DOI: https://doi.org/10.1016/j.sheji.2020.06.001. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S2405872620300447.

[29] B. Friedman, P. H. Kahn, A. Borning, and A. Huldtgren, "Value sensitive design and information systems", in *Early engagement and new technologies: Opening up the laboratory*, N. Doorn, D. Schuurbiers, I. van de Poel, and M. E. Gorman, Eds. Dordrecht: Springer Netherlands, 2013, pp. 55–95, ISBN: 978-94-007-7844-3. DOI: 10.1007/978-94-007-7844-3_4. [Online]. Available: https://doi.org/10.1007/978-94-007-7844-3_4.

[30] B. Friedman, D. G. Hendry, and A. Borning, "A survey of value sensitive design methods", *Foundations and TrendsÂ® in HumanâComputer Interaction*, vol. 11, no. 2, pp. 63–125, 2017, ISSN: 1551-3955. DOI: 10.1561/1100000015. [Online]. Available: http://dx.doi.org/10.1561/1100000015.

[31] N. Jacobs and A. Huldtgren, "Why value sensitive design needs ethical commitments", *Ethics and Information Technology*, Jul. 2018, ISSN: 1572-8439. DOI: 10.1007/s10676-018-9467-3. [Online]. Available: https://doi.org/10.1007/s10676-018-9467-3.

[32] M. van der Bijl-Brouwer, "Designing for social infrastructures in complex service systems: A human-centered and social systems perspective on service design", *She Ji: The Journal of Design, Economics, and Innovation*, vol. 3, no. 3, pp. 183–197, 2017, ISSN: 2405-8726. DOI: https://doi.org/10.1016/j.sheji.2017.11.002. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S2405872617300692.

[33] D. A. Norman, "Human-centered design considered harmful", *Interactions*, vol. 12, no. 4, 14â19, Jul. 2005, ISSN: 1072-5520. DOI: 10.1145/1070960.1070976. [Online]. Available: https://doi-org.tudelft.idm.oclc.org/10.1145/1070960.1070976.

[34] J. Auernhammer, "Human-centered ai: The role of human-centered design research in the development of ai", *DRS2020: Synergy*, Aug. 2020. DOI: 10.21606/drs.2020.282.

[35] C. C. Gomes and S. Preto, "Artificial intelligence and interaction design for a positive emotional user experience", W. Karwowski and T. Ahram, Eds., pp. 62–68, 2018.

[36] W. Xu, "Toward human-centered ai: A perspective from human-computer interaction", *Interactions*, vol. 26, no. 4, 42â46, Jun. 2019, ISSN: 1072-5520. DOI: 10.1145/3328485. [Online]. Available: https://doi-org.tudelft.idm.oclc.org/10.1145/3328485.

[37] J. T. Browne, "Wizard of oz prototyping for machine learning experiences", in *Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems*, ser. CHI EA '19, Glasgow, Scotland Uk: Association for Computing Machinery, 2019, 1â6, ISBN: 9781450359719. DOI: 10.1145/3290607.3312877. [Online]. Available: https://doi-org.tudelft.idm.oclc.org/10.1145/3290607.3312877.

[38] B. Shneiderman, "Bridging the gap between ethics and practice: Guidelines for reliable, safe, and trustworthy human-centered ai systems", *ACM Trans. Interact. Intell. Syst.*, vol. 10, no. 4, Oct. 2020, ISSN: 2160-6455. DOI: 10.1145/3419764. [Online]. Available: https://doi-org.tudelft.idm.oclc.org/10.1145/3419764.

[39] [Online]. Available: http://scholar.google.com/.