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Exploring User Perceptions and the Design of Automated Recruitment Tools to Mitigate Unconscious Bias and Recruitment Challenges

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Mémoire présenté en vue de l'obtention du diplôme de *Maîtrise ès sciences appliquées*
Génie informatique

Août 2023

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Ce mémoire intitulé :

Exploring User Perceptions and the Design of Automated Recruitment Tools to Mitigate Unconscious Bias and Recruitment Challenges

présenté par **Mitra LASHKARI**
en vue de l'obtention du diplôme de *Maîtrise ès sciences appliquées*
a été dûment accepté par le jury d'examen constitué de :

Thomas HURTUT, président
Jinghui CHENG, membre et directeur de recherche
Philippe DOYON-POULIN, membre

DEDICATION

To my father,
I hope I've made you proud...

A mon père,
J'espère vous avoir rendu fiers...

ACKNOWLEDGEMENTS

I am truly grateful to all those who supported me throughout my journey at Polytechnique Montreal. Firstly, my heartfelt appreciation goes to my research director, Prof.Jinghui Cheng. His unwavering support and invaluable guidance were instrumental in the completion of this study. I am grateful for the wonderful experience of researching with him in HCDLab and for his understanding and caring nature during my hardest days.

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Without the collective support of these individuals, this accomplishment would not have been possible. Thank you all from the bottom of my heart.

RÉSUMÉ

Les outils de recrutement automatisés offrent la possibilité d'améliorer l'efficacité du processus d'embauche, mais il faut tenir compte des préoccupations concernant les préjugés et autres risques. Cette thèse vise à fournir une compréhension approfondie des facteurs de risque perçus et des besoins du point de vue des recruteurs et des demandeurs d'emploi.

Dans la première partie de la thèse, nous présentons les résultats d'une étude d'entretiens avec des recruteurs et des demandeurs d'emploi dans l'industrie de la haute technologie. Nous comparons et opposons les préoccupations de ces deux rôles, révélant des thèmes communs tels que l'importance de clarifier les exigences du poste et d'évaluer les candidats en tant qu'"individus à part entière". En outre, les recruteurs se disent conscients des préjugés cognitifs et souhaitent disposer de plus d'outils de soutien pendant les entretiens, tandis que les demandeurs d'emploi soulignent l'importance d'une relation saine entre le candidat et l'entreprise. Les deux rôles ont exprimé des inquiétudes quant à l'incertitude des capacités technologiques et à la réduction du contact humain associée aux outils automatisés. Sur la base de ces résultats, nous proposons des implications en termes de conception pour les outils de recrutement automatisés et les technologies d'aide à la décision.

Dans la deuxième partie de la thèse, nous avons mis à profit les connaissances recueillies lors de l'étude des entretiens pour concevoir et évaluer un tableau de bord de recrutement comprenant divers concepts de fonctionnalités visant à relever les défis des recruteurs et à minimiser les préjugés dans le processus d'embauche. Nous décrivons la création de personas basés sur des études d'entretiens, permettant la conception d'un tableau de bord sur mesure. Le tableau de bord fournit un affichage consolidé et visuellement attrayant des informations essentielles, facilitant la prise de décision et la compréhension des recruteurs, tout en intégrant les besoins des demandeurs d'emploi. Nous détaillons ensuite une étude menée auprès des utilisateurs afin de recueillir leurs commentaires sur la conception du tableau de bord de recrutement. Des entretiens avec des recruteurs ont permis d'obtenir des informations précieuses sur la pertinence et la viabilité des fonctionnalités proposées. Des solutions ont été identifiées pour remédier aux biais cognitifs, notamment des formats alternatifs pour l'éducation aux biais et un système d'anonymisation pour les profils des candidats. L'inclusion de fonctionnalités telles que l'espace de prise de notes dans la salle de réunion de l'entretien en ligne a été bien accueillie, ce qui indique qu'elles peuvent améliorer l'efficacité et l'efficience du processus de recrutement.

Dans l'ensemble, cette étude contribue à une compréhension globale des facteurs de risque

et des besoins en matière d'outils de recrutement automatisés, offrant des implications en matière de conception pour améliorer leur efficacité et répondre aux préoccupations des recruteurs et des demandeurs d'emploi. En tenant compte des perspectives des principales parties prenantes concernées, nous visons à faciliter un processus de recrutement équitable, efficace et transparent.

ABSTRACT

Automated recruitment tools offer the potential to enhance efficiency in the hiring process, but concerns about bias and other risks must be addressed. This thesis aims to provide an in-depth understanding of perceived risk factors and needs from the perspectives of both recruiters and job seekers.

In the first part of the thesis, we report results from an interview study with recruiters and job seekers in the high-tech industry. We compare and contrast the concerns of these two roles, revealing common themes such as the importance of clarifying position requirements and assessing candidates as "whole individuals." Additionally, recruiters expressed awareness of cognitive bias and desired more tool support during interviews, while job seekers emphasized the importance of a healthy candidate-company relationship. Both roles expressed concerns about the uncertainty of technology capabilities and reduced human contact associated with automated tools. Based on these findings, we offer design implications for automated recruitment tools and decision-support technologies.

In the second part of the thesis, we leveraged the knowledge gathered from the interview study to design and evaluate a recruitment dashboard that included various feature concepts to address recruiter challenges and minimize bias in the hiring process. We describe the creation of personas based on interview studies, enabling the design of a tailored dashboard. The dashboard provides a consolidated and visually appealing display of essential information, supporting decision-making and insights for recruiters, while incorporating the needs of job seekers. Then we detail a user study conducted to gather feedback on the recruitment dashboard design. Through interview sessions with recruiters, valuable insights were obtained regarding the relevance and viability of the proposed features. Solutions were identified to address cognitive bias, including alternative formats for bias education and an anonymization system for candidate profiles. The inclusion of features such as note-taking space within the online interview meeting room was well-received, indicating their potential to enhance the efficiency and effectiveness of the recruitment process.

Overall, this study contributes to a comprehensive understanding of risk factors and needs in automated recruitment tools, offering design implications to enhance their effectiveness and address concerns of both recruiters and job seekers. By considering the perspectives of the core stakeholders involved, we aim to facilitate a fair, efficient, and transparent recruitment process.

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LIST OF SYMBOLS AND ACRONYMS

IETF Internet Engineering Task Force

OSI Open Systems Interconnection

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CHAPTER 1 INTRODUCTION

1.1 Context and Motivation

Recruitment of future employees is an essential activity in any organization. At the same time, the recruitment process can be tedious for both the organizations that try to acquire the most competent candidates and job seekers who aim to get a satisfactory position. Many companies and organizations use automated tools to alleviate the efforts required in the recruitment process. Those tools can support the filtering and selection of candidates [1], conducting virtual interviews [2], and providing job recommendations for job seekers [3], to just name a few.

While promising, many risks and challenges are involved in the use of automated recruitment tools. For example, an early adopter of such tools, Amazon, found in 2015 that their machine learning-based tool for matching candidates to job positions was biased toward men [4]. Journalists from MIT Technology Review also questioned the reliability of automated tools for detecting personality traits from voice recordings of answers to open-ended interview questions [5]. Moreover, highly automated interviews are found to have posed challenges in ensuring fairness and allowing job seekers to have social contact with the company [6]. Overall, recruitment bias and misjudgment are widely acknowledged in automated tools that support this complex decision-making process.

1.2 Research Objectives and Approach

In this thesis, our primary objective is to gain a comprehensive understanding of the perspectives of both recruiters and job seekers, who are the core stakeholders in the recruitment decision-making process, regarding the crucial topic of recruitment bias and automation. Building upon their insights and recognizing the challenges they face in dealing with recruitment bias and automation, we investigate design concepts of a recruitment dashboard with tailored features that effectively address these challenges. Through a user-centered design process [7, 8], we incorporate features that specifically target bias and misjudgment, aligning with the unique needs of recruiters, while addressing the concerns of job seekers. We evaluated user perceptions toward these design features, including their potential impact on recruitment bias and misjudgment, by conducting a user study. This study provides valuable insights into the effectiveness of the recruitment dashboard in mitigating bias and improving the overall quality of recruiters' practices.

The specific approach we took to carry out the study included the following phases and steps.

- First, we conducted in-depth semi-structured **interviews** with two distinct groups of participants: recruiters and job seekers to gain valuable insights into their perspectives and experiences regarding biases and misjudgement in the recruitment process, as well as their perceptions of automated recruitment tools. Specifically, we aimed to investigate: (1) the key factors that have the potential to influence recruiters and lead to biases and misjudgments in the recruitment process, (2) the best practices that recruiters can employ to effectively address and mitigate biases and misjudgments, (3) the risk factors associated with using automated job recruitment tools, and (4) the desired features of these tools from the perspectives of both recruiters and job seekers.

- Using our interview study data, we developed two **personas** representing the recruiter's needs and preferences. Utilizing user personas, design implications from our study, and relevant literature, we systematically designed the features and transformed low-fidelity sketches into high-fidelity designs using Figma. The primary objectives of our dashboard design are to assist recruiters in their daily tasks while minimizing potential bias, misjudgment, and the challenges they face in the recruitment process. While the dashboard primarily caters to the needs of recruiters, we also considered job seekers in our design decisions, exploring features that enhance the overall recruitment process.

- Following our initial design, we conducted a **user study** involving a group of five recruiters. The main purpose of this study was to evaluate the effectiveness of the designed feature concepts in addressing bias, misjudgment, and other challenges commonly encountered in recruiters' daily practices. Our primary goal was to gain valuable insights into the specific features that would provide significant value to enhance the recruitment process and determine the essential components that should be integrated into a recruitment dashboard. The outcomes of our user study revealed additional challenges that exist across various aspects of the recruitment process. We also identified potential solutions to address these issues.

Overall, this thesis provided valuable insights into the challenges during job recruitment and offered potential solutions to mitigate bias and enhance the recruitment process. By integrating these features and addressing the identified challenges, our aim is to equip recruiters with tools that improve their decision-making processes, reduce bias, and ultimately enhance the overall efficiency and effectiveness of recruitment endeavors.

1.3 Thesis Outline

The rest of the thesis is organized as follows. Chapter 1 presents the results of an interview study conducted with 10 recruiters and 8 jobseekers, focusing on their challenges in the recruitment process, particularly the issue of bias. The study aims to gain a comprehensive understanding of these challenges and provides guidelines for the development of an automated recruitment tool.

Building upon the insights gained in Chapter 1, Chapter 2 introduces the design of a recruitment dashboard specifically tailored to address bias and other challenges faced by recruiters in their practices. The dashboard is developed based on the findings from the previous chapter, with the goal of mitigating bias and improving the overall effectiveness of the recruitment process.

In Chapter 3, the results of a user study evaluating the recruitment dashboard are presented. The study assesses the usability and effectiveness of the dashboard in real-world scenarios, providing valuable insights into its performance and the user experience it offers.

CHAPTER 2 LITERATURE REVIEW

We build our research on the prior literature related to (1) bias, discrimination, and general challenges in the recruitment process, (2) technology's role in supporting the recruitment process, (3) bias and fairness in recruitment-support tools, as well as (4) dashboard design.

2.1 Bias, discrimination, and general challenges in recruitment

Many previous studies have identified that bias and discrimination are major issues in the recruitment process. For example, Beattie and Johnson [9] identified various sources and impacts of unconscious bias in recruitment and promotion processes. They argued for the importance of raising awareness and promoting equity in recruitment. Whysall [10] conducted a literature review to identify implicit bias in various recruitment steps, such as resume screening, interviewing, and performance evaluation. They found that the discrimination involved in the recruitment process is "subtler, deeper routed" and requires non-conventional approaches to address. Overall, race and gender biases are the most prominent types of recruitment biases that are extensively studied [11, 12].

Some studies have also focused on investigating ways to address unconscious bias in recruitment. In 2007, Collins [13] analyzed the impacts of the "Rooney rule", introduced in 2002 by the National football league (NFL) to increase the diversity among head coaches. The Rooney rule mandates that every NFL team interview at least one minority for head coaching and front office positions or else there would be a fine. The paper argues that since unconscious bias is unintentional and hard to recognize, solutions such as exhortation, education and protesting only modify the conscious beliefs and leave the unconscious core untouched. Therefore, there is a need of addressing the problem with such hard affirmative action. Echoing this point of view, Williamson et al. [14] also questioned the effectiveness of unconscious bias training in addressing equity in work environments. They argued that the popularity of unconscious bias training makes it to be perceived as a "silver bullet" and negatively impacts the implementation of other interventions and actions that may have more sustainable effects.

Previous studies have also focused on identifying various challenges that impact the recruitment process. For example, Rozario et al. [15] conducted a survey study with hiring members as well as successful and unsuccessful applicants to understand the "critical factors" involved in the recruitment process. As a part of this study, the authors found that unsuccessful appli-

cants were more likely to perceive the impact of bias in interviews than successful applicants and that applicants who perceived bias are more likely to urge improvements in the interview process. Focusing on proposing recruitment technology, Koivunen et al. [16] dived into the challenges of recruitment decision-making from a "social matching" perspective. Through interviews with recruitment decision-makers, the authors proposed a framework of recruitment decision-making stages and discussed challenges in each stage of the framework. They identified, for example, unclear matching requirements and narrow views of individuals' qualities make it challenging to *Search for Expert*. They then proposed several ways that technology can help address the identified recruitment challenges.

Our study extends this body of related work to dissect the challenge of bias and discrimination in the recruitment process. We particularly contextualize this investigation in the prominence of automated job recruitment tools.

2.2 Technology supporting the recruitment process

Previous studies have investigated technology support to facilitate many aspects of the recruitment process. Visa et al. [17] demonstrated that improving the recruitment process with new technologies is feasible and resource-saving by combining traditional, manual recruitment with automated systems. Sołek-Borowska and Wilczewska [18] analyzed both advantages and disadvantages of new technologies for the recruitment process. They found that while technologies may help save money and time, strengthen the image of the company, and reach a broader audience of candidates, they may impede relationship building, candidate integration, and personal data privacy. Regarding the last aspect, Nickel and Schaumburg [19] investigated privacy issues and user trust in online recruitment; they found that the perceived privacy of an online recruitment service has a positive impact on user trust.

Moreover, using technology in recruitment can put a disadvantage on certain groups of job seekers. Several previous studies have focused on understanding and addressing this problem. For example, Dillahunt et al. [20, 21] designed and evaluated two tools, for resume feedback and interview practice, respectively, targeting disadvantaged job seekers such as those who are currently unemployed or having health issues. Through this investigation, they provided guidelines and strategies to better support those job seekers. Hendry et al. [22] also targeted homeless young people and provided vision and design insights for a platform where youth can find short-term employment in their neighbourhood. With the popularity of intelligent systems in the recruitment context, Charleer et al. [3] studied how the design of an interactive dashboard can affect explaining and clarifying the suggestion of recommender systems for job

seekers in a mediation session. Their tool design gives job mediators the authority to filter the information on the dashboard when presenting it to job seekers to prevent demotivation; it also provides information through visualization to increase users' trust.

Influenced by this body of literature, we investigate the perception of technology support in the recruitment process from both the recruiters' and the job seekers' perspectives. Through this unique angle, we aim to provide design insights and guidelines to address bias in such technologies that reflect the value and needs of both groups of key stakeholders.

2.3 Bias and fairness in recruitment-support tools

There are several studies in the literature that investigated the problem of bias and fairness in recruitment-support tools, including online recruitment platforms and automated tools. For example, Hannák et al. [23] followed the traces of gender and race bias in online freelance marketplaces. Based on data collected from TaskRabbit and Fiverr online marketplaces, they found that there is a significant correlation between the perceived gender and race of the freelancers and the evaluations they got on these websites. To understand more about whether the internet has any positive impacts on lessening the bias in hiring decisions, Leung et al. [24] conducted a study with 206 Amazon Mechanical Turk participants in a simulated recruiting task. They assigned the task of making hiring decisions for a freelance job to the participants to explore different types of online hiring bias based on gender, race, and attractiveness of the job candidate. Using the discrete choice model to analyze the data, they found that gender, racial, and attractiveness discrimination were all evident in the hiring decision-making process. They also identified that as the number of candidates the participants can choose from increased, the racial bias increased too. Based on these findings, the authors made recommendations for designers to mitigate the bias of online freelance platforms.

Researchers have also explored the bias and fairness issues in automated hiring tools. Peng et al. [25] decoupled and investigated the sources of bias in a human-in-the-loop hiring decision-making context. They found that making the list of job candidates gender balanced would result in the correction of bias in various, but not all, professions. The authors claimed that this professional difference root in human decision-making bias and their "persistent preferences". They also identified that characteristics of decision makers, such as their gender, have an impact on the bias intensity and its direction. Raghavan et al. [26] investigated how the commercially available automated candidate-screening tools claimed to address and mitigate recruitment bias. They found that the practices of these tools varied and may have an intricate relationship with anti-discrimination laws and regulations. Similarly, Sánchez-

Monedero et al. [27] examined three automated hiring tools used in the UK to understand how they address and mitigate bias issues. They found that the tools' ability to expose and mitigate hiring bias is sensitive to the social and legal contexts in which the tools are used. Our study draws from this body of previous work to understand the bias-related perceptions of the key stakeholders of recruitment-support tools.

2.4 Dashboard Design

To facilitate easier data-driven decision-making and improve understanding of data, dashboards that incorporate data synthesis and visualization is commonly used. According to Few's definition, "a dashboard is a visual display of the most important information needed to achieve one or more objectives; consolidated and arranged on a single screen so the information can be monitored at a glance. [28]" Dashboards are widely utilized across various domains such as healthcare [29–31], education and learning [32,33], urban development [34,35], and personal analytics [36]. They play an important role in supporting complex decision-making processes by presenting relevant and visually appealing data from multiple sources in a unified view [37]. Their effective data visualization facilitates pattern recognition and data exploration, thereby allowing decision-makers to gain insights more efficiently [28].

The related work on information dashboard design also highlights the challenges faced by users in terms of interaction and information comprehension. Dashboards' increased adoption has led to issues such as information overload [38] [39] and visual literacy gaps. [40] [41] Alper et al. [39] emphasize the diversity of dashboard solutions, including design, components, indicators, interaction patterns, and goals. To address these challenges and improve the user experience, it is crucial to consider the needs of the final users during the development of information dashboards.

The user-centered design approach [42] is a highly effective strategy for addressing these challenges as it prioritizes the needs and requirements of users at every stage of the development process. By actively involving end-users in the design processes, this approach ensures the creation of systems that are better tailored to their specific needs and ultimately more valuable and usable for them.

For instance, in a study by Dowding et al. [43], a survey was conducted to investigate the impact of numeracy and graph literacy skills on the comprehension of visualized data among home care nurses. Their research revealed that nurses' understanding of visualized information is significantly influenced by their numeracy, graph literacy, and the specific display format of the data. These findings highlight the critical importance of considering individual

differences in these skills when designing dashboard technology. By taking into account these factors, designers can optimize the effectiveness and accessibility of dashboards for users with varying levels of numeracy and graph literacy.

Similarly, Biehl et al. [44] employed a user-centered design approach to develop the FastDash dashboard, which aimed to enhance team activity awareness within software teams. Their comprehensive approach involved conducting surveys, interviews, and in-situ observations to gather insights from users. By leveraging interactive visualizations, FastDash facilitates improved awareness among team members during collaborative programming and problem-solving activities. This work makes a valuable contribution to the understanding of how such visualizations can effectively support teams in acquiring and sustaining heightened awareness, ultimately enhancing their collaborative performance.

Another example is the Qualdash dashboard generation engine presented by Elshehaly [30], which focused on healthcare quality improvement. The design process involved interviews with healthcare professionals, a co-design workshop, and one-on-one meetings with front-line analysts.

In addressing the interaction challenges faced by users with dashboards, Alhamadi [8] underscores the crucial role of developers in understanding the users' perspective. By conducting interviews with seventeen dashboard developers, the study aimed to gain insight into developers' comprehension of user problems and the corresponding adaptations they made. The findings indicate that developers can offer solutions to the majority of users' challenges, although not all. Importantly, the study underscores both the feasibility and desirability of tailoring dashboards to cater to the individual needs of users. This highlights the importance of considering user-centric customization in dashboard design, ensuring that the resulting solutions effectively address users' unique requirements and enhance their overall experience.

In summary, the related work on information dashboard design emphasizes the importance of considering user needs and requirements, as well as individual differences in skills, when developing dashboards. The user-centered design approach, involving end-users throughout the development process, plays a crucial role in creating effective and tailored dashboard solutions that promote knowledge generation and improve the user experience.

CHAPTER 3 INTERVIEW STUDY

3.1 Introduction

In order to allow automated recruitment tools to fulfill their promises, an in-depth understanding of the perceived risk factors and needs of the users of these tools is necessary. Recruiters are often considered to be the primary users of recruitment tools since they often drive the decision-making process. However, we argue that the design of recruitment tools should also consider the job seekers' perspectives and needs, because of the following two main reasons. First, job recruitment is a two-way choice activity, in which job seekers actively make decisions based on their experiences with the company or organization, mainly through the recruitment process. Any issues or inconveniences caused by recruitment tools will not only give a bad impression of the company to the candidates but also add to the stress and anxiety that the job seekers already experience during the recruitment process. Second and more importantly, adopting a feminist HCI [45] perspective, considering the experiences and needs of the non-dominant group in the recruitment process (i.e., the job seekers) is not only beneficial, but also crucial, to the design of a truly successful and innovative recruitment support tool. HCI researchers and designers should engage the imbalanced power relationship and advocate for the usually marginalized group (i.e., job seekers). In our opinion, this not only should be done in job seeker-facing technologies (e.g., [3]), but also and perhaps more importantly, needs to be a focus in the traditionally recruiter-facing environment, such as the recruitment tools.

Thus in this study, we conducted semi-structured interviews with two groups of participants (recruiters and job seekers) to understand their opinions and best practices regarding biases in the recruitment process, as well as their perceptions of automated recruitment tools. We particularly asked the following research questions from both the recruiters' and the job seekers' perspectives:

- RQ1: What factors can potentially lead recruiters to have a bias and misjudgment?
- RQ2: What are the best practices for recruiters to address bias or misjudgment?
- RQ3: What are the risk factors in automated job recruitment tools that might lead to bias and misjudgment?
- RQ4: What are the desired features of automated job recruitment tools?

When answering these research questions, we focused on recruitment in the high-tech industry, and thus job seekers who are likely to have received higher education. This decision is made because (1) companies in this industry are (or if not already, likely to be) early adopters of automated job recruitment tools and (2) our familiarity with this industry will allow us better analyze and interpret the data. Thus in this context, we conducted an interview study with ten recruiters who are experienced in recruitment decision-making and eight job seekers who recently underwent a job hunting process.

In the first three research questions, we deliberately focused on issues related to bias and misjudgment. There are various and sometimes conflicting definitions of these terms in the literature [46]. For the purpose of our study, we consider the most common and straightforward definitions. According to the Oxford English Dictionary, **bias** is defined as *inclination or prejudice in favor of or against one thing, person, or group compared with another, usually in a way considered to be unfair*, and **misjudgement** is defined as *the action of forming a wrong opinion or conclusion about someone or something.* In these definitions, both terms carry the connotation of making a mistake in the estimation of someone or something. There are several nuanced differences: (1) the concept of bias often describes the tendency before the estimation (i.e., prejudice) while the concept of misjudgement emphasizes wrong conclusions after the estimation; (2) to have bias, two or more groups are involved while this is not necessary for misjudgement; and (3) bias is connected with the concept of fairness while misjudgement is with correctness (i.e., right or wrong). Considering these definitions, in the context of recruitment, bias describes the recruiters' conscious or non-conscious prejudice for or against a group of candidates, while misjudgement describes the various inaccurate estimations that the recruiters can make when assessing a candidate. We considered both concepts during data analysis to capture a wide scope of aspects related to the potential mistakes made during the recruitment process and with automated tools.

3.2 Participants

Our participants were recruited from our industry connections, advertisements on LinkedIn, and our personal contacts. In total, ten recruiters (five females and five males) and eight job seekers (three females and five males) participated in our interview study. Our recruiter participants included those who have experience taking part in the recruitment decision-making process, such as human resource specialists, talent acquisition specialists, and managers who had experience making hiring decisions. On average, they had 5.7 years of experience involved in the recruitment process, with ages ranging from 30 to 45 years. Table 3.1 summarizes the characteristics of our recruiter participants.

Our job seeker participants included those who had recent experience applying for job positions. All participants had experience in job hunting during the past two years before the interview, with ages ranging from 25 to 35 years. Table 3.2 summarizes the characteristics of those participants. This group's participants were mostly graduates of prominent universities in Montreal, and we found them through our network. We have recruited eight people in this group.

3.3 Data Collection

The interviews were done from May 2021 to May 2022. The first author conducted all the interviews online through Skype, Zoom, or Microsoft Teams based on each participant's preference. Each interview lasted about 60 minutes. The interviews were video recorded and later fully transcribed.

The interviews with recruiters included the following parts:

- *Introduction and warm-up*: We asked the participants to talk about their job titles, responsibilities, and experiences.
- *Recruiting practices*: We asked the participants about their typical recruiting process, positive and negative experiences, and common challenges. We investigated their approaches to examining CVs and managing interviews, as well as their expectations of an ideal process.
- *Bias*: We asked participants about their awareness and opinions of bias in the recruitment process. We also asked questions regarding how they dealt with bias and misjudgement as well as how they think these elements can have an impact on hiring decisions.
- *Automated tools and technologies to support recruiting*: We asked them about the tools they currently use, the effectiveness of these tools, and the challenges they faced while using them. We then asked about their opinion, including the perceived risks and benefits, of some features of recruitment supporting tools. Particularly, we mentioned three features as probes to allow participants to have a concrete perception of automated recruitment tools: (1) an automatic candidate filtering feature, (2) an intelligent dashboard that supports the interview process, and (3) an avatar or a bot that automatically conducts the interview. Finally, we asked about how they think automated tools and technologies can help address unintended bias in the recruitment process.

ID	Company/organization type	Current job title	Years of exp. in recruitment decision-making
R1	HR technology and services	Talent acquisition coordinator	1 year
R2	HR technology and services	V-level management	8 years
R3	Global technology company	Talent acquisition partner	6 years
R4	Power systems solutions	Human resource advisor	4 years
R5	HR technology and services	Technical director	7 years
R6	HR technology and services	Human resource administrator	9 years
R7	Mobility and navigation applications	Product manager	4 years
R8	HR technology and services	Human resource specialist	Less than 1 year
R9	Video game	Creative director	7 years
R10	HR technology and services	Human resource specialist	10 years

Table 3.1 Experience of the recruiter participants of our interview study

Interviews with the job seekers had the following structure:

- *Introduction and warm-up*: We focused on asking about their job title and responsibilities, their target positions in their last job hunting, and their general job hunting experience.
- *Job interview experience*: We probed about their experience in job interviews, the challenges they had, the questions they have been often asked, and their expectation of an ideal job interview.
- *Bias*: We then talked about their observed and perceived bias and misjudgment in their hiring process and the efforts they put into avoiding it.
- *Automated tools and technologies to support recruiting*: We asked them about their experience using automated tools in the job hunting process. We then asked them to discuss the perceived benefits, risks, and challenges of using automated tools in recruitment. We also asked about their opinions, including the perceived risks and benefits, about some features of a recruitment support tool; we used the same three

ID	Company/organization type	Current job title	Duration of the most recent job hunting
S1	Cloud applications and platform	UI/UX designer	5 months
S2	IT outsourcing	Machine learning engineer	5 months
S3	Global technology	Full stack developer	3 months
S4	Online travel shopping	Machine learning scientist	4 months
S5	Mobility sharing service	Software engineer	2 months
S6	E-commerce	Mobile developer	1 months
S7	IT outsourcing	Data scientist	3 months
S8	Internet applications	Data programmer	2 months

Table 3.2 Experience and current position of the job seeker participants of our interview study

features in the recruiter interviews as probes. Finally, we asked them about their opinions on how automated techniques can help address recruitment bias.

3.4 Data analysis

We used a thematic analysis approach [47] to derive themes from the transcribed interview data, with the help of the ATLAS.ti software. We performed the analysis for the recruiters' and the job seekers' interviews separately. For each participant group, we first inductively coded the interviews; each code is under a specific structure based on the subject of the code and the research question they address. We then categorized the codes through an affinity diagram activity. Finally, we found common themes in the participants' comments. Throughout this process, all authors continuously discussed and iteratively refined the codes, categories, and themes.

3.5 Findings

In this section, we present the results of qualitative inductive analysis of our interviews with recruiters and job seekers. The results are organized based on the four research questions, which were answered from the perspective of both groups of participants.

3.5.1 RQ1: What factors can potentially lead recruiters to have a bias and misjudgment?

From the Recruiters' Perspective We identified the following themes in the factors our recruiter participants mentioned that can affect bias and misjudgment during recruitment.

Human nature of recruiters: When discussing the factors that lead to bias, participants frequently mentioned that personal likings and preferences play a role in recruiters' opinions towards the job candidates. For example, some recruiters said that they like to see certain characteristics in CVs, such as being direct, funny, or result-oriented. For example, R3 mentioned: " *I will say I am a stickler for those who don't like spelling mistakes when I see them in a resume. So if I had a clean, direct, concise, funny resume in front of me, that would be my ideal process.*" In certain cases, personal likings of decision-makers can have very strong impacts, as R6 said: "*I might find that this candidate is great, but the hiring manager pushes back on us and says, 'I don't really like this person personally,' or something, or they might bring their own biases towards the recruitment process.*" Episodes of experiences can also affect recruiters' judgement. For example, participants noted that lying or disrespectful candidates can be bad experiences that affect their mindset about certain candidates. The recruiters explained the challenges to change their attitude and approach toward certain candidates after experiencing dishonest behavior in their practices.

Lack of domain expertise for recruiters: Recruiters considered their role as an intermediary between the job seekers and the hiring managers and they frequently described how not having experience in the field they are hiring for can leave room for doubt about whether they chose the right person or not. For example, when asked about their hiring process, R4 said, "*In the beginning, it was more of trial-and-error, I'll bring someone, and I will not be sure if that person will fit with the manager... I have a really broad understanding of the job, but what is it on a day-to-day basis and the challenges, I won't really know.*"

Contents and presentation of CVs do not fully represent candidates: Our findings show that participants believed CVs could not represent all the skills and qualities of a candidate. Participants said that although they usually go through a time-consuming, sometimes even obsessive, process of filtering the CVs to select the best candidates for a role, it is normal that a number of these candidates do not fit for the role or the company after meeting them. For example, R2 mentioned: "*Sometimes you're going to have candidates who really look good on paper and then when you meet with them you see that there's no fit.*" Some participants mentioned that focusing too much on indicators such as GPA can lead to losing good

participants since academic performance does not necessarily bring in all the skills needed for a role. A candidate's CV is how they present themselves to the company. We found that every aspect of it, from the information presented to its style, can affect the recruiter's impression of candidates. Furthermore, time gaps on CVs, having an insufficient amount of details and data, or on the other hand, having too many details, all make the filtering more challenging and bias-prone for the recruiters. As R5 said, "*I appreciate having a high-level technical overview about the technologies a candidate worked within their job description, but if it gets too detailed, it becomes a keyword bomb. It's something that it's a more negative signal for me than a positive one.*"

Time limit: All participants considered the limit of time as a challenge in their job. Due to the high volume of resumes to evaluate and the need to find the most suitable candidate for the position as soon as possible, they can not spend more than a few seconds to minutes on each resume. As R6 said, "*I'll go through the list. I'll take about 12 to 20 seconds per person going through their resumes because it has to be fast. I have so many open positions that I can't spend more than two or three minutes on one candidate.*" Based on what participants declared, the pressure of losing the candidates to competitors is another reason for rushing the process. In some cases, it would actually increase the chance of losing a fit candidate. The limited time spent on each candidate results in an incomplete understanding of the candidates, which in turn leads to bias and misjudgement.

Cultural differences: According to our participants, unfamiliarity with cultural differences brings about room for misjudgments and bias. Our recruiter participants talked about the interaction and communication patterns between people from the same culture or nationality and how failing to learn about these patterns could lead to misjudgments. For instance, when talking about the bias in different stages of the recruiting process, R7 explained, "*I find that Western people would display curiosity in a certain way. It's easy for me to screen out – Like if you give me only Canadian resumes or... French resumes, I kind of see, okay, this is a loner, this is a team player, this is passionate, but if you give me an Indian resume, it's much harder to make that difference.*"

From the Job Seekers' Perspective

Our job seeker participants discussed various factors that can lead to bias and misjudgement in recruitment decision-making. We organized them into the following themes.

Narrow-minded focus on a particular aspect: The participants believed that focusing too much only on a particular aspect can lead to a bias towards some applicants. Participants mostly mentioned "experience" to be the aspect that sometimes recruiters and hiring

managers rely on strictly to filter the candidates. They claimed that using this approach might lead to ignoring the big picture and individual potential. In this regard, S2 said "*A lot of times, someone who may not have that – for example, a number of years of experience. I don't understand why it should matter... It's all about problem-solving, at least in software development. The only metric for hiring someone should be problem-solving.*"

Not considering individual differences: Participants also believed that the company should take individuals' differences into consideration when judging them. They mentioned the personality and ability of people as factors that might affect the outcome of an interview for the applicants. As S2 put, "*... and then soft skills I feel like through the questions they ask in the interview it's kind of easy to detect ... the people who are really good at talking and expressing themselves and things like that. I think they can win over people who are more of an introvert and who can't really express themselves but have really good hard skills. Those are things I feel that the recruiters should have in mind.*" Another reflection of inequality among the candidates is the difference between their familiarity with the automated platforms. As S6 mentioned "*I remember I had struggled with trying to make sense of the input and output [of the tool used for answering the questions], and then also the state of the question... It was very confusing... I definitely stressed out and like halfway on saying, 'Okay, this is going nowhere,' kind of feeling.*"

No clear expectation of the position: The participants pointed out that recruiters not knowing the true requirements and needs for hiring a candidate for a job position can be a hassle in their job search process. For example, S2 said "*... a lot of bigger companies, they generally know what they want. The job descriptions are a lot clearer and they know. Basically, because they've done a lot of interviews, they generally know how to conduct interviews. But, I would say, smaller companies, they just copy-paste, for the most part, the job description from the bigger companies...*" Further, some participants talked about their experience of going through multiple rounds of interviews and challenges and being rejected at the last round. They said what made the experience unpleasant to them is that in the end, they felt that the recruiters did not know what they were looking for. S1 talked about this "*One other bad experience actually been that, I been through all stages of the interviews and a final stage they got back to me and said they realized that they are looking for someone who had more years of experience and they already knew that from the beginning when I was interviewing with them. So, it's just like they had mixed feelings and they didn't know so they dragged me on towards the end.*"

Job descriptions are inaccurate or vague: The participants talked about how they find some job descriptions not clear, inaccurate, or unrealistic. They mentioned that the

inconsistency in some job descriptions would prevent the applicants have a true understanding of the role and its requirements; it would increase the need for further explanations which usually happen during the interview sessions, when more effort was put in. Some of the participants have also experienced dealing with absurd expectations of candidates to fit into the role. For example, S7 said "*I've seen some job posts that are so ridiculous. They're looking for 14 years of experience when this field is barely 14 years old. I remember one in my first job search that was looking for a junior-level data scientist with basically every single qualification that you could possibly have as a data scientist. They need to have reasonable expectations of skill levels and know that no one person's going to have every single quality, probably like the technical skill that they're looking for.*"

3.5.2 RQ2: What are the best practices for recruiters to address bias or misjudgment?

From the Recruiters' Perspective

Our recruiter participants talked about ways to address bias or misjudgment in recruitment decision-making, which we organized into the following themes.

Not relying only on the CV: The recruiter participants believed a true understanding of a candidate takes place when seeking or asking for more information about the elements they put on their resumes. They felt that judging the candidates based on the impression they have of them before interviewing with them can be unfair and incomplete, regardless the shortlisting is done automatically or manually. Some recruiters said even though they would rely on certain criteria and desired keywords derived from job descriptions to filter candidates, they felt that criteria such as education or experience should not be the only thing to rely on. For example, R6 mentioned the need of looking for more information beyond those listed in CVs: "*I also think it's unfair ... if I communicate to somebody like, 'I need five years of experience, and when someone applies, they don't have that many years of experience... So I always seek more information beyond that.*" Our participants also mentioned their experiences about hiring the right matches successfully, when those candidates were not good fits for the position on paper. For example, R3 explained as a part of how they created a shortlist of candidates for the interview "*Sometimes I have individuals who have none of the qualifications the hiring managers first listed and they've hired them because of everything else that became a part of that personal story that they just never thought of including on their resume.*" In other words, there are candidates who are unqualified on paper but address hiring managers' unsaid needs. The problem, though, is how to identify these candidates. R6 described their strategy for addressing this problem: "*I think in order to mitigate those*

biases, it's important to go through external websites like LinkedIn – I will reach out to candidates that might not have that background. That's how I eliminate the bias... I'm assuming many other recruiters do the same."

Consider individual values and differences: Related to the previous theme, the recruiters believed that they should take people's differences into account and should focus more on the values each individual can bring to the company. As R6 said: "*When you're ranking somebody based on their answers, sometimes you just can't put a number to their rankings... It doesn't give you the whole story of the candidate... Because sometimes, even though I have rated somebody 80%, but there's someone who's at 77%, but that 77% person actually has better verbal communication or better style of communicating. I can't necessarily give him a higher number just because of his interviewing skills.*" Adapting the interviews according to job candidates is one approach the participants take to include individual differences in their process of decision-making. As an example, R4 shared: "*Each person is completely different. I mean I've had interviews with people that are so dynamic that they take me off guard – they just come out and they take almost control, be like let me give you my story... And I'll have other individuals that are much more reserved where I have to ask each question – all they do is answer that, that I have to go through that more structured interview process.*"

Specifying hiring criteria and validating them constantly: An essential factor from our participants' perspectives was following the steps of setting needed qualifications for the position and then validating these metrics constantly throughout decision-making. Having a set of specified metrics for evaluating a candidate gives a solid map to all the people in the recruiting process to avoid bias and misjudgement based on personal opinions. As R6 said, "*That's the difficulty when you hire as a team because people have different visions, and then I want to make sure to bring them on the same page... If they could just make sure that we understand what is requested, what will be one part of the skills needed, and can the person do the job. There's really to answer those three basic questions will really help in accelerating the recruiting process.*" Participants mentioned various strategies that fall under this category, such as multiple rounds of review, verifying causes of rejections in groups, and iteratively evaluating the process. For example, R6 again said, "*What we do when we have these HR meetings or certain things, you obviously discuss, 'Why did this position take a certain time to fill?' Or 'What were some of the problems that you faced when you were filling these positions?' For the biases that we do see, we obviously communicate to the director of the HR department, and they, in turn, follow up. They create diversity programs, or they create training modules... So, that works.*"

Asking for hiring team members' opinions: Related to the previous point, the recruiters who participated in our study valued the opinions of diverse members who get involved in the hiring decision-making process. For example, they considered smooth communication with hiring managers to understand the "*magic sauce of the role*" (R3) as a crucial step. In general, having multiple people from the recruiters' team in the interview and the filtering stage as teams to cover each other's bias gaps effectively mitigates the related risks. As R2 said, "*You have two types of biases, you have a positive bias and a negative bias. That's why you have usually several people doing the interview process because you want to mitigate the bias factor.*" Sometimes, seeking the opinions of others can serve as a way to understand their value and needs, and thus streamline collaboration. For example, R3 mentioned: "*Usually what I like to do is that, I will present to the hiring team three completely different candidates. For example, their nationality is the same, but they have completely different personalities. They have different ways of expressing themselves. They have different backgrounds, completely. And they have a different flare to how they do their job. So it's up to the hiring team to figure out which one is best suited for the team... Then as soon as you understand which one they actually want, Well, now you understood your whole hiring team from then on.*"

Easing up the atmosphere of the interview: Based on our study, the participants considered easing the interview's atmosphere as a factor to help them know the candidates better. They claimed that easing the candidate's spirit would let them present themselves as the best without feeling intimidated by the recruiters; this would help the recruitment team make a more accurate judgement. For example, R4 said "*If there are topics to discuss with that person and make them more comfortable, [we will do it]. We can talk about hobbies, for example... Then just to ease the spirit, just to ease the interview down a little bit because it's not easy to be the only person ... when you have like five, six other people in front of you and then it's a little bit intimidating.*"

Asking open-ended, transparent, and honest questions: From our participants' perspective, by asking open-ended questions, the recruiter would be able to get more insights about the candidate based on the way they answer the questions. As R5 said "*I try to keep the questions open-ended. If you are asking questions that I have the right answer and the candidate simply doesn't know the answer I had in mind – I think it doesn't help really to understand the candidate. My goal is to make the candidate talk, because we'll get more insights into the professionality of the candidate and find more effective ways to harvest information.*" They also think that honesty and transparency are important factors. For example, R3 said: "*Things like red flags, like why are you not able or want to have growth in that particular company. Those questions I'll ask and I'll ask them very directly. Because everybody has their style. But I usually at the start of the interviews being like, I work with honesty, transparency*

and clarity. And, as long as we can have it on the call we'll have success together..."

Talking openly about bias: Our participants state that talking about the bias openly and training and educating the recruitment team would pave the way to increase employers' and employees' awareness of the bias and prepare their minds to detect it. For example, R7 said "*[To deal with my bias,] I go to events to learn about how to be inclusive in recruitment. I read about it... You have how to include trans people in your recruitment. Then you have this for people of color, you have this for women in male-dominated industries... I try also internally to talk about it with my colleagues ... so we can learn from each other as well.*". Likewise, they believe the more people know about cultural differences, the better they learn about the norms and differences when gathering a diverse team. For example, R4 said, "*What they told us when we go to school is like, 'Oh you shouldn't spend more than 10 minutes in the resume.' But I don't like doing that because ... for some cultures, they were told to write the most that you can in your resume because that represents you.*"

Proactively cultivating diversity: Our participants said that to mitigate bias, companies should consider creating diversity among employees and reaching out to the whole community as their human resources responsibility. For example, R7 said: "*I try to have some diversity. I've always worked in male-dominated industries. If we have women in the team or if we have people of color in the team, I try to have them interviewing also so the person is not just facing white dudes. Diversity also comes into play before because when I post the job adverts... I make sure I reach out. There is queer groups in tech, there are women groups in tech, and there are some events or networking events, and I know that those candidates won't come to me necessarily, organically, and so I reach out.*" Our participants said that to mitigate bias, companies should emphasize diversity and encourage themselves to utilize quantifiable measures related to diversity while recruiting. They criticized "meritocracy" (R7), the merit-based recruitment strategy that excessively emphasizes the employees' performances over diversity.

From the Job Seekers' Perspective

From our job seeker participants' perspective, there are several things the recruiters can do to address bias or misjudgment in their decision-making. We organized these recommended practices into the following themes.

Recruit as a team: Our job seeker participants mentioned that the recruitment decision-making should be done by a team, instead of controlled by a few people, to avoid personal bias. For example, S2 discussed this point: "*Let's say, ten people are involved in making the decision. If all these ten people are kept in the dark and they only provide that feedback to*

the recruiter and the recruiter makes a decision finally, that's not a good meter. You want to have some sort of shared knowledge." Participants also voiced the importance of having diversity in the recruitment team. Many times, this recruitment team diversity also gives the impression of the diversity of the company. S7 talked about this aspect: "*I really noticed what were the genders and backgrounds of the people who were interviewing me... It was just something I noticed because if this is the team you're going to be working with, I am curious, 'Are you all men? Are you all White men? Who was asking me questions? Who was in the position of power to be giving me the go-ahead or not?'*"

Ease-up the interview atmosphere: Our participants explained how the interview environment and atmosphere can affect their performance, especially when doing a technical challenge. Having other people observing their work whether they are doing the challenge in-person or virtually make participants uncomfortable and divert their focus from the important matter. For example, S7 said "*I had a live coding test in my first job search. I failed miserably at it, and didn't get the job, but anytime I've had a take-home assessment, I've been able to complete it much more solidly, much more confidently... [During the failed coding test] the guy was sitting right next to me. It was too much pressure.*" Interestingly, participants regarded putting comments on their answers or work during the interview as having a destructive impact on their self-consciousness. For example, S5 shared their experience regarding this: "*He [the interviewer] asked me to code the entire class of poker game style, like a poker card. I think I was a little bit slow on the coding side. I know all the concepts. I think I understand the design pretty well. ... But on the coding side, for the past year, I wasn't doing Java coding for a while. ... So I needed a little time to brush up on that. He had comments like, 'You don't know this?' With a surprising sound... Instantly, my heart just – After that, nothing went well.*"

Focus on role-related questions: Our participants' opinion on the questions asked in the interview sessions is that it is better for recruiters to avoid repetitious and generic questions during the "team matching" interviews, but focus on role-related questions about the candidate's experience. Relating to this S2 said: "*[An ideal interview experience for me would be] basically the behavioral parts, the team match, all those parts, be more meaningful. Really try to get to know someone through their experience, and avoid generally those soundbite questions.*" Also in terms of technical questions, they preferred to be asked efficient and less time-consuming questions related to the role they are interviewed for. For example, S2 shared "*It has to be very similar to the problem that you're trying to solve. ... Like it's good to know data structure to do AI, but they don't necessarily match and vice versa. The best thing that you can do is just, if you have a problem of your own and you're trying to solve or debug, and make a similar question out of it and ask that question. If the person can solve*

it, that's it, you don't need to look for anything else in terms of technicalities."

Respecting applicant's time and interests: Based on our interviews, companies' respect for job candidates' time limitations and efforts in gaining information about the candidates can help the candidates to have a better experience in their job interview process. It can help reduce the stress and anxiety of the candidates during the process and maintain a positive view of the company in candidates' minds. For example, S1 said "*Peoples who actually listen to what you're saying and ask good follow-up questions that is the best thing the recruiters can do. Putting time into really reading your resume if they have any questions about that area they could ask us and then we could be more specific and let them know. Because sometimes during interviews you don't have enough time to talk about the stuff you've done. They ask one question and you have to get everything out and let them know you are capable of doing things.*"

Do not rely on the CV as the only source of information: Our job seeker participants expressed the importance of presenting themselves aside from what is said in their CVs. For example, S1 talked about this while mentioning their effort accommodating to the companies' mental model: "*...when explaining my work because I've done the research-based master's. I've basically done two years of research on a project that I focused on. So I tried to put that in focus and let them know that I've worked on a real project.*" Applied to the recruiters' side, the job seeker participants also believed recruiters should put real effort into getting to know their candidates, going beyond what is put in the CVs. For example, job shadowing programs have been mentioned as a way of getting to know the job and environment better as well as being evaluated by different people in the team. As S5 said: "*The first job I had, the interview, the manager had a shadowing program with me for the last round of the interview. ... I was in the company and ... watched over his shoulder. He worked, and then he asked me questions like, 'What does this line do?' Or he randomly throws questions at me more like a conversation style. And he leads me to different team members, also the team he worked with. Basically, I met everyone that I was going to work with. I also see from inside the company, I think that was really good. Even just say hi to the team. I think to have more, I guess, eyes and then make a judgment, so it's not biased based on one person.*"

Provide clear information about the job: Our participants mentioned that generally, job seekers need more information on the role they apply to and that some job descriptions can be too "broad". The job seeker participants expect companies to give them the chance to gain clear information on the daily job of the role, things to expect in the job, and the company's culture. As S8 said: "*If I'm very interested in learning, like someone early in their career, it would be nice in the interview for them to ... give me some information about*

how the company can also help me, rather than just trying to figure out what I can provide to the company. … I don't always get that information. The ideal interview I think would also give me information that I didn't previously have, or leave time for me to ask some questions because I often have questions and usually, we run out of time when the interviewer is asking me questions."

Honest and specific feedback: Participants noted they put a lot of time into preparing for interviews, participating in the interviews themselves, and performing the technical tasks and challenges. These interviews can also sometimes have many stages, especially in big companies. The participants said having feedback on how they did in the interview process after rejection is what companies can do in return for the time they spent in the process. This way, companies are able to convey a sense of importance to all the candidates, as being rejected without any explanation can be confusing, upsetting, and even discouraging for the candidates. For example, S2 said regarding this matter "*If you're not getting accepted, the second best thing that you can get is feedback, good feedback that you know this part I have to work on for the future and that's a really good thing. [A company] was the only place where I got meaningful feedback. The other places, usually they don't care that much which is really a question of ethics of it. I think it's wrong. If people, in general, are spending some time preparing to interview with you, the least you can do in exchange for their time is to give them some feedback.*" Participants also mentioned they prefer to have honest and more specific feedback since auto-responses can be generic and not helpful. As S10 stated "*Overall, in the two job searches that I've had for this career, anytime I didn't make it … and I didn't know why, I always asked for feedback. And sometimes I was given feedback. But I have to say that most of the time I felt it was generic, and I didn't really feel like it was genuine feedback that I could take moving forward.*"

Transparency: Related to the previous point about receiving feedback, participants added that transparency on the criteria of acceptance can lead to clarity of the reason some candidates get rejected. Additionally, participants voiced the importance of having transparency when communicating the stage of the process the candidates are at and informing them of the next steps. Not hearing back from recruiters and the uncertainty of waiting time for an answer only add up to a negative recruitment experience. For example, S10 mentioned the matter: "*I've interviewed with companies that have absolutely horrible communication. They say, 'We will get back to you by X date,' and then you don't hear from them and you have to reach out to them and it's super disrespectful. When companies actually get back to you, when they say that they will get back to you, or they'll at least give you an update, that's an ideal part of an interview process for sure.*"

3.5.3 RQ3: What are the risk factors in automated tools that might lead to bias and misjudgment?

From the Recruiters' Perspective

Our recruiter participants have used various job recruitment tools that have automated components, such as SmartRecruiters[1], LinkedIn Recruiter[2], Oracle PeopleSoft[3], HackerRank[4], ZipRecruiter[5], and Airudi[6]. Collectively, our recruiter participants are concerned about the following factors related to the risk of bias and misjudgement in automated tools.

Current technology capability: When asked about perceived risks of automated tools in the recruitment process, participants voiced various concerns related to the current technology; those include (1) incorrect recommendations and results, (2) the tool's source of data and data accuracy, (3) bias of the machine learning models used in the tool, and (4) missing good candidates and out-of-the-box thinkers. For example, R4 said, "*I think what would be one of the big challenges is the amount of data that you can get and the accuracy of the data.*" R7 also talked about the potential of losing good candidates by using automated tools: "*What is hard is – for example, what I said about focusing on someone who is result-driven. Can it be a tool that checks if the way the resume is phrased is results-oriented? Although if you say to me 'I'm going to screen out everyone that is not framed this way,' I would be scared to lose good candidates.*" Some participants mentioned that they would manually examine the recommendations provided by automated tools to prevent any loss.

Losing human contact: Some of our participants said that an essential factor of having an interview with a candidate in an early stage is to have a personal connection. Recruiters mentioned that they are the representative of the company in the candidate's eyes. By remaining in the interview process and communicating directly with the candidates, they are addressing the candidate's needs of having a way to understand and evaluate the company. As R2 said, "*At the end of the day, recruiting or hiring someone, it's the same process as of selling a platform or buying a car. There's an emotion attached to it. There's a 'customer service.' ... It's all about building that relationship. The downside would be having an avatar do too much and lose that feeling... At the end of the day, a candidate is accepting a position because he liked the interview process. He liked the manager he met, he sees himself working in this position with this team.*" Even worse, some participants raised the possibility that

[1]https://www.smartrecruiters.com
[2]https://business.linkedin.com/talent-solutions/recruiter
[3]https://www.oracle.com/ca-en/applications/peoplesoft/
[4]https://www.hackerrank.com
[5]https://www.ziprecruiter.com
[6]https://airudi.com/en/

candidates might find it an insult if they could not interact directly with people representing the company. For example, R9 said, "*I think some people, especially in more artistic and creative roles, would see it as quite insulting that their potential future in a company could be defined more by a machine than by real humans.*".

Cognitive load required to use the tool: A risk factor pointed out the risk of being distracted by a real-time tool that helps recruiters while interviewing. They wanted to ensure the tool would not interfere with recruiters' other tools and focus during the interview. For example, R3 said, "*So if I've got my WebEx interview going, I would want to have enough space on the screen where I could have it as a user-friendly thing where it's right there, it's not going to interfere with my WebEx space, if you will, and just make it as user friendly as possible and I know that that's easy to say, harder to do.*" Also, some participants mentioned the time and effort required for learning an automated tool as a challenge for the recruiting team.

From the Job Seekers' Perspective

Our job seeker participants mentioned that they have encountered several automated tools during their job hunting processes, such as SmartRecruiter and HackerRank, mainly for filtering candidates; they have also described experiences in which automated techniques were used to conduct assessments (e.g., programming assessment with CoderPad[7]). Overall, our job seeker participants had several concerns about automated recruitment tools that we categorized into the following themes.

Losing human contact: A major concern of the candidates was related to losing human contact in the recruitment process when using automated tools. According to our participants, having a company representative during the interviews provides the benefits of connecting to the company and establishing mutual empathy as human beings. Automating parts of the recruitment process where a company representative and a candidate have a chance to make a personal connection would take this opportunity away from the candidates. For example, S5 said: "*I guess [with automated technologies] there will be less bias but less professional experience from HR as well... Any intermediate person would bring some value into the business as a whole, but if you try to mitigate that, then you may be losing that value from a real person as well.*" Similarly, S6 said "*Something that I think I've experienced personally is that in the recruitment process, a candidate like me or any candidate for that matter wants to have a personal connection. An automated tool doesn't really provide that... For example, if I'm emailing someone, I want the other end to be a human being that really empathizes with*

[7]https://coderpad.io

me." Based on what participants said, utilizing automated job support tools in some parts would also cause lacking of social feedback. The candidates believed when in the interview, facing an automated tool they might never find the chance of having the right impression of how they performed in the interview. For example, S3 shared their thoughts about this matter with us: "*The reason why is that, when you are doing an interview with the person, when you are answering the questions, there is a lot of indicators you can watch to see if you're doing well. For example, the body language of the person, you will see if he's satisfied at the end with yes or not. If you did not answer correctly, you'll see that he's not convinced or trying to elaborate, so having a real person is really important. Having an avatar, I don't know, just doesn't feel the same way.*"

Losing opportunities due to automation: Based on our interviews, a major concern toward automated job recruitment tools is about losing potential candidates. Our participants argued that since the algorithm for candidate filtering in these tools always relies on some predetermined information, there is a chance it misses other quality information. This is a major risk for them. Some participants mentioned a coping approach that they adopted through the process in order to prevent being filtered out by automated tools. For example, S1 said "*In the beginning I was expecting to get more interviews ... but it took maybe around three weeks to get my first... And what I found out, later on, was that I need to change my resume for each job description that I wanted to apply for so it would have matching words that are both in my resume and inside the job description. When I started doing that, I started to get more reactions from the recruiters both on LinkedIn and on the other places that I applied.*" Participants also talked about how the keyword extraction might not work properly with different layouts and styles of resumes (e.g., designers' resumes). Thus, tools relying on such information may not accurate or reliable. Moreover, disadvantaged job seekers can be mistreated by automated tools, as S1 said: "*Not all job seekers are alike. Like there are disabled people out there so if we're going to rely on something just based on talking or based on facial expressions, it's not going to work for everybody... And then there's always different accents and things like that, which really worries me if the technology is strong enough to accept these kinds of things.*"

3.5.4 RQ4: What are the desired features of automated job recruitment tools?

From the Recruiters' Perspective

Our recruiter participants mentioned various features in automated tools that they think would be helpful for them. Those features fall into one of the following categories.

Explainable candidates ranking/shortlisting: The participants talked about a potential candidate ranking and shortlisting feature of automated recruitment tools and voiced their need for explainability and transparency of the decision made in the system. Regarding this, R5 said, "*What is very important is to have explainable recommendations where we don't need only a number or a ranking of candidates. The system should explain why the candidate is recommended over another.*" Even when the explainability of individual decision points cannot be achieved, participants still desire to have a general understanding of the automated components of the tool. For example, R7 said, "*At least, I wouldn't want to see what resumes are filtered out. ... I would like to see how it works. Even if I don't see the algorithm. I would like at least a blog post or something describing how it works.*"

Customizable filters: Our participants talked about their need for a CV filtering feature with the ability to adjust and customize the criteria. They want the tool's flexibility to specify their main requirements, target, and agenda based on the role and then make decisions considering those criteria. For example, when asked about the risks and challenges involved in shortlisting features of the automated tools, R2 said, "*From one company to another, values and culture are different. A good developer for one company is not necessarily a good developer for another... It's important to be able to have that personalization feature where you can calibrate and adjust the weight of each criterion you're looking for. It would be a danger falling to a generic approach.*"

Real-time feedback during interview: The recruiter participants desired tools that have features that can provide feedback about the interview in real-time, helping them evaluate the candidates and streamline the interview process. For example, R2 mentioned: "*It would be nice to have a little assistant on the side that identifies or suggests questions that maybe I did not think of asking and maybe scoring the answers to the questions.*". The participant thought that the tool can provide a second opinion to candidates' answers when "*the answer they gave us is not the answer we're looking for.*" Furthermore, participants think receiving feedback about how they administrated the interviews with the candidates would help recruiters reflect on their performance and make improvements, as R7 said: "*I would also like to have some feedback maybe on my tone, all the words I'm using myself just to improve the interviews for me.*"

Candidate profile summary: The participants said they like to see a summary of candidates' information that is derived from the CVs and/or the interviews gone through. They said they would like to see all the information gathered in the different stages of hiring in one place to facilitate an overview and synthesized analysis, even for the stages done automatically. As R5 said: "*I think it's important that we're not taking the human out of the loop*

there. The most important feature would be, again, to have a summary of the interaction whether it's chatbots that enable the human recruiter to review the process to make a decision." Participants also have various ideas of how tools can support their analysis to ensure diversity. For example, R7 mentioned: "*I wonder if it was used in a sense of maximizing diversity within a team, I would be interested if I had a tool that I would have a sense of who do I already have in the team... If I could have a tool that is looking for people that would complement my team, I would be interested.*"

Anonymity of the candidates: Our recruiter participants highlighted the benefits of having an anonymous review of the candidates' profiles to avoid bias. For example, R7 said, "*For the bias, it would be interesting here to hide maybe names, gender, etc... [These factors] can be brought up at the end to make sure that you have diversity. But it can be hidden from everyone at first.*" R2 also emphasized the importance of focusing on still fits when screening the CVs, by saying: "*Some people at a certain time started to put their pictures on resumes. Personally, I did not like that because it gives you a look at how or who the person is. I really prefer having a CV because you look at the skills. When I'm analyzing the CV, I just really look at if it fits with the job description.*" Generally, participants prefer to have candidate anonymity at the beginning of the profile review. But anonymity itself cannot be considered a silver bullet, as R3 mentioned, "*bias goes much deeper than just having somebody block out a name.*"

Human in control: Participants generally considered that, with automated tools, "*it is important that we are not taking the human out of the loop*" (R5). Part of this desire comes from the lack of confidence in the current capability of the technology, as R9 mentioned, "*My current understanding is that the level of technology needed to deliver a reliable assessment is many years away from us right now. I think it would have to be handled very carefully, and they would need to be done in conjunction with other aspects... Human intervention would be needed.*" However, for many participants, human control is an innate factor in the recruitment decision-making process. They are uncomfortable relying solely on automated technology. For example, R4 mentioned, "*I think you have to have a judgment behind that, some thinking and reflection as a recruiter.*" R3 also said, "*The recruiter or the manager need to have that final say, to be like okay I want to actually speak to this person.*"

(Automated) transcription and note-taking: Related to the previous point, our participants also talked about their interest in having an automated note-taking or transcript feature. Also, some participants mentioned the value of having a space to write down their notes to keep all the information in the same place. For example, R3 said "*So you almost have a... not a spreadsheet but like a questionnaire that you can just fill out quickly as you're*

speaking to the candidate so you don't have to write it down. And if I had a dashboard and I'm speaking to someone, all I need to do is just click off the things that I want to validate. That would be great.".

Process tracking and interview scheduling: The participants voiced the needs to be aware of the status of the candidates and the state of the process. Regarding this, R2 said, "*If that person is not available anymore, I would like to see it in the dashboard. ... If the platform can just remove that person from the data and so I will see how many people withdraw from the position, so I see the urgency of, okay, people are getting really employed in a similar role, so I need to hurry up.*" Participants also expressed the desires to have technological aid for interview scheduling, especially when they handle many candidates at the same time. For example, R4 talked about this: "*We spend a lot of time just managing the hours – what time should I call you, is this time okay with you, or is that time okay with you... In the platform, if we can use it to book directly the candidates instead of sending them validation from my side then [it will be very helpful].*"

From the Job Seekers' Perspective

When it comes to the features to be included in automated recruitment tools, our job seeker participants considered the following themes.

Mutual understanding between the company and the candidates: The participants noted the need for both job seekers and recruiters to gain more information about the other party in an automated recruitment tool. On one hand, they suggested having a space where companies can represent themselves and provide more information about the interview stages where the candidate is in. For example, S1 said: "*I guess on the other side as a job seeker I really wanna know about the company as well. Of course, I wanna apply and get a job sooner, but it really matters to the environment of the company and the culture and all these questions that we job seekers have... So if it's a way it's a tool that would give the company a space to represent themselves and advertise themselves and have employees talk about the company, that would be awesome.*" Participants also voiced that having more information on the day-to-day job of the role that the candidates apply for, and even further simulating it can benefit the candidates. On the other hand, the idea of the tool deriving more information about the candidates from the internet such as LinkedIn was considered useful from job seekers' perspective. As S5 said "*[A useful feature of the tool] I think maybe the people's personal project – GitHub or their blogs or stuff – then also I guess maybe any recommendation they have from LinkedIn or from their previous colleagues... Maybe, if possible, to get a sense of what they're working on right now as well. Sometimes they are confidential within the*

company, so it may be hard, but I think it is just really anything to get a sense of how well or how enthusiastic they are about technology in general or what you are hiring them for."

Honest feedback: When talking about the useful features of automated job recruitment tools, our participants discussed the crucial matter of feedback and evaluation for both sides again. They expressed how confusing and hard it can be for them not to know how they performed in the process and where the company stands when it comes to choosing them. The participants emphasized knowing the true reason for their rejection can help them in the future. Further, they need to act based on the chance they have with each company. For example, S3 shared "*I think the bad experiences just you wait and wait. After you pass the interview, and you're not sure if it went well or not, you're not sure if it's better to continue applying or just wait for an offer to come – the uncertainty of it. The time passes and you become a little stressed out because you didn't receive an offer so far. A little bit of fear kicks in and you start to doubt yourself.*" On the other hand, feedback on the interviews, process, and the company itself helps answer the candidates' questions about the company. For example, S1 put their opinion on this matter as follows: "*[I like] having maybe a place that the recruiter can ... after the interview, like put some feedback, a few sentences of feedback, so the job seeker would know... Like, in my idea, I feel like that interview went well, but I never know what the other person is thinking to even improve for the next interview. So having such a place where both the job seeker and recruiter can put a few notes or like a review or something on top of each other's pages, and either private or public – having something like that [would be useful].*"

Anonymity of candidates: The participants believed a way to mitigate bias using automated tools is their ability to keep the candidates' identities and other factors that might lead to bias hidden. Candidates noted keeping hidden pieces of information such as gender, race, physical appearance, etc. can prevent the formation of judgmental thinking and bias in recruiters' minds. It also helps have all the focus stay on the requirements, skills, and needs of the role. For example, regarding this S2 said "*Obviously, the second you see the person you have a judgment, you make a judgment about the person. I usually don't want to have those. The rounds that you don't need to have a visual cue of the person, it's better to do it with a phone or Zoom without video basically to avoid those kinds of visual biases. Generally avoid all the other sort of stream of information that you can get from the person, and only focus on things that you need in that round. Let's say in the round that is talking about salary and all that stuff, it doesn't need to be a Zoom call; it can be on the phone. Or the round that is technical coding, only coding and nothing else. Only focus on the subject that you're interested in.*"

Support thoroughness in decision making: Our job seeker participants thought that having a tool for calibrating various recruitment criteria among all candidates will be beneficial for streamlining the decision-making process and preventing qualified candidates to be accidentally filtered out. Regarding this, S5 said: "*I think it will be helpful to have a platform to put all candidates together, so the recruiter will have an overview of everyone, rather than just not opening a link, not seeing your resume at all. Then to have maybe the top criteria that they're looking for list at the top, and then to be clear, your proficiency in each.*" Similarly, some participants mentioned the importance of supporting knowledge sharing among the members of the recruitment team, in order to ensure a comprehensive view when making recruitment decisions. S2 discussed this aspect by saying: "*There has to be some level of sharing between those people that are making that decision, and what is that level of sharing has to be very clear.*"

3.6 Discussion

In this paper, we explored the essential factors related to recruitment bias and automated recruitment tools from the perspective of two key stakeholders involved in this process, i.e., recruiters and job seekers. This investigation is particularly conducted in the context of the high-tech industry. While gender and race are the main sources of bias and misjudgement in recruitment, our participants also discussed other factors such as the physical appearance of the candidate, the presentation of the CV, and the recruitment culture in this industry that overly focuses on a particular aspect like years of experience. Overall, our findings highlighted the major concerns, best practices, and technology needs of these two groups of users. In the following sections, we first compare and contrast the perspectives of these two groups. Then we discuss the implications of our findings to the design of automated recruitment tools, as well as the limitations of our current study.

3.6.1 Synthesizing the Key Results

On all four research questions, we found that while there are common concerns, suggestions, and desires from the recruiter and job seeker groups, these two groups also provided their unique perspectives on various elements. To better compare and contrast these perspectives, we further organized the themes identified in our findings into five aspects, related to (1) *cognitive bias* in the decision-making process, (2) *position requirements* of the recruiting company, (3) activities conducted for *assessing candidates*, (4) the process of *doing interviews*, and (5) *candidate-company relationship*. We found that along these aspects, our participants discussed issues concerning both bias (i.e., recruiters' systematic prejudice for or against a

job seeker group) and misjudgement (i.e., recruiters' inaccurate estimation when assessing a candidate). Figure 3.1 summarizes the themes we identified from both the recruiters' and the job seekers' perspectives on these five aspects of recruitment decision-making; for the first three categories, we also indicated the themes related to the concept of bias and misjudgement in the figure. In the rest of this section, we discuss the implications of our findings along the five recruitment decision-making aspects.

Cognitive bias: This phenomenon can be defined as "cases in which human cognition reliably produces representations that are systematically distorted compared to some aspect of objective reality" [48]. While our job seeker participants did not focus on this aspect, the recruiters seemed to have been well aware of the risks of cognitive bias, discussing many concerns and providing suggestions to help address them. Particularly, the recruiters have touched on all three types of biases in Haselton et al.'s vocabulary [48]. First, our participants considered the biases related to the limited time they can afford to review each candidate, resulting in reliance on intuitions and "shortcuts" (i.e., the *heuristic bias*). Second, they discussed biases originating from the human nature of recruiters, who may have particular preferences and inappropriate standards (i.e., the *artifact bias*). And finally, the recruiters mentioned cultural differences as a source of bias, emphasizing that they feel more comfortable assessing candidates from a familiar culture (i.e., the *error management bias*). To address these risks of cognitive biases, our participants made three main suggestions. Interestingly, these suggestions touched on both educative approaches (i.e., talking openly about bias) and actionable interventions (i.e., proactively cultivating diversity and incorporating hiring team members' opinions). These perspectives echo the results of previous studies that educative approaches would only be effective when affirmative actions were put in place [13, 14].

Position requirements: Understanding position requirement concerns the activities of specifying the hiring needs, creating a job description to attract candidates, and establishing criteria for matching and selecting candidates. Hiring managers usually list responsibilities and desired skills that meet the role's demands. They can also get help from recruiters to refine them. Our finding shows that regarding this aspect, the recruiters are mainly concerned about their lack of domain expertise, which would leave room for doubt about choosing suitable candidates. What mainly concerns job seekers is the clarity of the expectation of the position and the ambiguity of the job description. These two sides of concern, although from different perspectives, are aligned with each other, since having domain knowledge would help address gaps and vagueness in the job descriptions and clarify expectations. As a way of addressing the problems in this stage, job seekers proposed companies provide clear information about the job. The recruiter's perspective on this matter is to specify solid criteria as job qualifications to evaluate the candidates and at the same time work

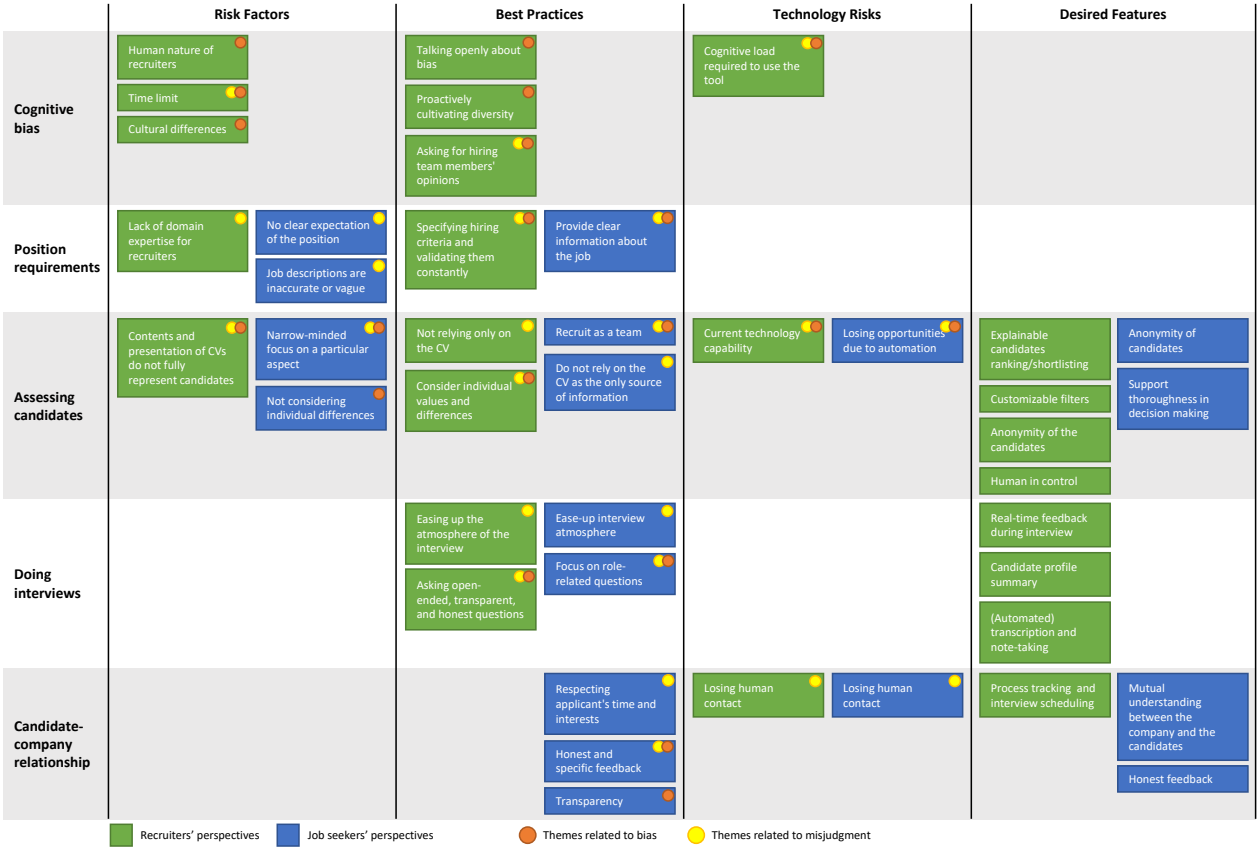


Figure 3.1 Summary of the themes we identified from both the recruiters' and the job seekers' perspectives along five recruitment decision-making aspects. For the first three categories, the orange dots indicate themes related to bias and the yellow dots indicate those related to misjudgment.

with a hiring team to gain domain knowledge and clarify position requirements. Creating concrete criteria and evaluating these requirements and qualifications over time would lessen the chance of wrong match-making. These concerns and suggestions are also aligned with the previous results that clarifying the hiring goal would help make optimal matches and hiring decisions [16].

Assessing candidates: Throughout the recruitment process, it is the recruiters' job to evaluate and compare the candidates based on the position requirements and candidates' qualifications. Previous studies identified that the candidate pools are often heterogeneous and from assessing candidates' points of view, what might prevent the right assessment from happening is being unaware of alternatives and the inability to accurately process all the information [16, 49]. Our findings show that the recruiters are aware of this and believed that resumes often do not fully represent the applicants. As a way to address this issue,

they would consider CV as only a part of the information source. Reaching out to the candidates who might not have the background, looking for more information online, and asking for more information from the applicants are among the practices the recruiters suggested to gain more knowledge about their applicants. It is true that the more information they gain on the candidates, the more parameters will be included in the decision-making. This might make the process more consuming and intricate. Our recruiter participants mentioned another best practice to address this intricacy; that is to focus on the individuals' values, considering their differences, and knowing their stories. For the aspect of candidate assessment, the job seeker's concerns aligned with those of the recruiters. Particularly, the junior applicants believed that their background is not the only factor that matters, and they feel the need to present themselves more. Reflecting back to the previous aspect related to position requirements, specifying hiring criteria and their importance can be useful to prevent the possible further complexity of the decision-making process for the recruiters. For job seekers, on the other hand, having more information about the job requirements can help them provide more relevant information about themselves during the application process. Moreover, regarding the risks of using technology for assessing candidates, the recruiters and job seekers both voiced concerns about the capability of the current technology in incorporating all the complexity and providing a correct and fair assessment of the candidates.

Doing interviews: Interview is an important aspect in any recruitment decision-making, for both the companies and the candidates to have a better assessment of the other party. Typically, based on the information given by our participants, recruiters conduct a preliminary interview with each applicant (which can take place over the phone). Following that, there are several rounds of interviews with a greater technical focus. These interviews are conducted by the hiring manager or members of the team that is recruiting. In our study, both recruiters and job seekers have expressed the need for an interview environment that is less stressful for candidates. The recruiters stated that they prefer their interviews to resemble a conversation in which both parties can feel at ease and express their points of view. Concerning this issue, job-seekers reported that the atmosphere and environment of the interview affect their performance, especially in technical interviews. With an interview atmosphere that puts each candidate at ease, allowing them to individually achieve their best performance, a fair and equitable assessment can be achieved. Regarding the questions to be asked during the interviews, the recruiters emphasized the importance of including open-ended questions in the interview to allow acquiring more spontaneous and honest information from the candidates. On the other hand, however, the candidates wished for a greater number of role-specific questions as opposed to general and standard questions. This difference in the preferred interview style poses an interesting challenge for automated technologies

(e.g., chatbots or avatars) to support the interview process. Additionally, both recruiters and job seekers have expressed their concern about losing human contact when such kind of technology is used. They considered that the connection and the interaction with the other party are important ways to establish mutual understanding and trust, leading to a better assessment and decision-making.

Candidate-company relationship: The recruitment process is often the first step in building the relationship between a company and a future employee. Fostering a constructive candidate-company relationship is also important for building the "word of mouth" of the company among potential candidates. Interestingly, based on our results, the job seekers seemed to have more opinions concerning this aspect than the recruiters. While keeping human contact is still an important factor mentioned by both job seeker and recruiter participants, our job seeker participants voiced various very specific suggestions and needs that they wish the companies could satisfy. In the recruitment process, the recruiters are often perceived to be in a position that has more power [50]. Our job candidates suggested ways that challenge this perception. Particularly, they wished that mutual respect between candidates and the company can be established, that honest and specific feedback can be provided to the candidates for them to understand the decision-making rationale, and that the decision-making process is made transparent to the candidates. Previous work has shown that experiencing power is associated with over-confidence, thus bias and misjudgement, in decision-making [51]. Focusing on a more constructive and healthy candidate-company relationship by challenging and balancing the existing power dynamic between the two parties can be a viable way to address recruitment bias and misjudgement.

3.6.2 Design Implications

Based on our results and the main aspects of recruitment decision-making that our participants discussed during the interview, the design of recruitment technologies and automated recruitment tools should consider the following elements.

Addressing cognitive bias. Our results revealed that the recruiters are aware of and actively addressing different types of cognitive bias in their work. However, they did not seem to have ideas about how tools can support this consideration. The HCI community has long been investigating the phenomenon of cognitive bias and technology and techniques for addressing it (e.g., [52, 53]). This knowledge can be leveraged to support recruiters ameliorate their process. However, the current design literature seems to focus on actionable interventions but overlooks educative factors. Our results suggest that both approaches need to be considered for more holistic support.

Supporting team decision-making. Recruitment decision-making relies on teamwork. Our results indicated that involving the expertise and opinions of the recruitment team members can help clarify position requirements and alleviate personal biases; both recruiters and job seekers valued this aspect as a best practice. As a result, recruitment decision-making tools should support this type of collaboration, allowing multiple roles to contribute to the process. Moreover, such tools need to address the intricate issue of "in-group bias" that may appear in group decision-making [54]. This is an element that our recruiters discussed when they talk about cognitive biases in general and diversity in particular.

Facilitating rather than performing decision-making. When discussing desired features of automated recruitment-support tools, our participants discussed many themes related to human control in the candidate assessment and interview activities. Not surprisingly, explainability, customizability, and general human control are frequently discussed by our participants when considering tools that automate these activities. Interestingly, our participants have also emphasized ideas for automated technologies used to facilitate, rather than perform, decision-making, such as providing real-time feedback to recruiters, summarizing candidate profiles, and synthesizing candidate information from various sources. Moreover, our participants are generally worried that automation would take away human contact, an important factor that fosters the candidate-company relationship and strengthens decision-making. Thus the concept of automated recruitment tools needs to be broadened and emphasize more facilitating technologies, rather than technologies that directly perform decision-making.

Empowering job seekers. Our job seeker participants often voiced concerns that they feel outpowered in the recruitment process. They desired to have a more equal position with the company, discussing as best practices to obtain more detailed information about the job they apply for and to receive honest and constructive feedback about their performance and qualification. Thus automated recruitment tools should incorporate this perspective and provide features that not only support recruiters but also empower job seekers during the recruitment process. For example, technologies can be developed for job seekers to query information about a specific position. Also, personalized feedback can be generated with the help of automated techniques to allow job seekers better understand the decision-making process.

3.7 Conclusion

This study aimed to gain an in-depth understanding of the perspectives and needs of users of automated recruitment tools through an interview study. While recruiters are typically

considered the primary users of these tools, we argued for the inclusion of job seekers' perspectives in the design process. Through thematic analysis of the interview data, common perspectives emerged among recruiters and job seekers. These included the importance of clear position requirements, assessing candidates as "whole individuals," and fostering an equal and constructive relationship between job seekers and companies. Recruiters reflected on cognitive bias and expressed technological needs for conducting interviews, while job seekers emphasized the desire for a more equitable recruitment process. The findings highlight the need to address cognitive bias, support team decision-making, facilitate rather than automate decision-making, and empower job seekers while assisting recruiters in the design of automated recruitment support tools. Overall, this study contributes insights for the development of guidelines to inform the interface design of recruitment systems, emphasizing the importance of considering the perspectives of both recruiters and job seekers to create more effective and inclusive tools.

CHAPTER 4 DASHBOARD DESIGN

4.1 Introduction

Based on our research findings and the design implications presented in the previous chapter, we investigate the design of a dashboard that aims to mitigate bias and address recruiters' challenges. Taking a user-centered approach to dashboard design [7], we placed the user at the core of the design process to create a highly usable dashboard tailored to their needs [8].

During our interview study, we gained valuable insights into the mindset, motivations, and behaviors of recruiters. Using this knowledge, we segmented our audience into groups with common patterns, which helped us to create two recruiter personas. By identifying these personas, we were able to better understand their unique needs and challenges. Based on our understanding of each persona, we designed the dashboard with a focus on addressing their specific needs and challenges. This approach allows us to create feature concepts of a usable interface that meets the needs of all personas, ensuring that the recruitment process is efficient and effective for both recruiters and job seekers.

4.1.1 What is a Persona?

Based on the definition provided by the Interaction Design Foundation (IDF) website, user personas are "*fictional characters created based on research to represent different types of users who might interact with your service, product, site, or brand in a similar manner.*" [55] Personas are a valuable tool to understand users' needs, goals, frustrations, experiences, behaviors, and motivations.

To create user personas, researchers often collect information from real users through interviews, surveys, and observations. Their objective is to gain insights into the users' identities, aspirations, preferences, and requirements. The goal is to go beyond basic demographic data and gain a more personal understanding of users. This allows for the creation of personas that closely resemble real individuals with unique characteristics and experiences.

User personas play a crucial role by allowing researchers and designers to empathize with their users. By putting themselves in the shoes of these personas, they can better comprehend the users' motivations and frustrations. This understanding guides the design process and ensures that the final product or service effectively addresses the needs of the target users.

4.2 User Personas

4.2.1 Personas Creation Process

To create personas, we started by segmenting our recruiters based on the interview data gathered previously (see Chapter 3). By considering the recruiters' behaviors, goals, needs, and especially challenges, we established five criteria of attributes that characterize the recruiters as they strive to achieve their goals and address their problems. These criteria are as follows: (1) recruiters' goals, needs, and expectations in the recruitment process, (2) their use of technology, (3) their daily tasks in their recruiting practices and how they approach them, (4) their perception toward bias in their recruiting process, and (5) their demographic information. Each of these criteria includes multiple attributes that aid in segmenting our recruiters' participants. We discuss these criteria in more detail below.

- **Goals, Needs, and Expectations:** In this category of attributes, we synthesized information about recruiters' preferences and expectations regarding CV screening and job interview phases. We sought to understand their primary needs in these steps.
- **Recruitment Technologies:** This set of attributes revolves around the technologies and tools commonly utilized by recruiters, as well as the advantages and challenges associated with their usage.
- **Tasks:** These attributes encompass the various approaches recruiters adopt in their recruiting practices. For instance, we examined how they filtered CVs during the CV screening stage and the frequency of technology use throughout the process.
- **Unconscious Bias:** This category addresses attributes related to unconscious bias in the recruitment process, specifically from the perspective of recruiters. We sought to understand their awareness of bias and how they manage it within their practices.
- **Demographics:** This set of attributes includes demographic data about the recruiters, such as their level of experience and the size of the companies they work for.

By taking into account these characteristics, we were able to segment our recruiters and create personas that accurately reflect their behaviors, goals, needs, and obstacles in the recruitment process. We investigated a total of 21 characteristics (see Figure 4.1). Based on the participant recruiter interviews, we categorized each attribute on a scale. Then, by placing all recruiters on these scales, we compared participants, identified those who frequently appeared at similar places, and identified the patterns. We selected the two most prevalent patterns and used them as the basis for our two personas.

Figure 4.1 The 21 characteristics used to segment our recruiters' participants

4.2.2 Personas

The two personas are shown in Figure 4.2. Below we describe each persona in detail.

Persona 1 : Tyler - Technology Enthusiast Inclusive Recruitment Advocate

- **Job Title:** Talent Acquisition Specialist
- **Years of Experience:** 5-6 years
- **Industry**: Tech Industry

Tyler is a seasoned Talent Acquisition Specialist based in Canada. With over 5 to 6 years of experience in the field, he possesses a deep understanding of inclusive recruitment prac-

tices and a passion for fostering diversity in the tech industry. Tyler is highly skilled in sourcing, screening, and assessing candidates for various roles, and he actively advocates for the importance of diversity and inclusiveness throughout the talent acquisition process. His adaptability to the dynamic nature of the industry allows him to stay up-to-date with emerging technologies and trends. Tyler's goals and needs revolve around ensuring a **clear understanding of company requirements, drafting inclusive job advertisements, and implementing a comprehensive assessment process tailored to the tech industry.** He seeks time-efficient screening tools that automate candidate selection based on specific criteria while maintaining transparency and control in the process. Tyler actively addresses bias in recruitment and strives to promote diversity through educational resources and best practices. However, Tyler also faces challenges in his work. Overcoming unconscious bias in talent acquisition is a constant effort, as is navigating the homogeneity often found in tech teams. He must balance time constraints and limited resources while addressing underrepresentation and adapting to evolving industry trends. Nonetheless, his skills in sourcing, screening, and assessing candidates, along with his strong communication and collaboration abilities, make him an effective Talent Acquisition Specialist in the tech industry.

Persona 2 : Initia - Intuitive Recruiter

- **Job Title:** Senior Recruiter
- **Years of Experience:** 10 years
- **Industry:** Tech sector (but also familiar with other industries)

With nine years of experience finding talent, Initia Thompson is an expert recruiter. Initia is a Senior Recruiter for a mid-sized technology company where she brings a wealth of knowledge and experience to her position. Initia's expertise in finding and evaluating candidates, conducting interviews, and matching talent with organizational needs has been honed through her completion of a Bachelor's or Master's degree in human resources or a related field. She is known for her **strong intuitio** and **personal judgment** in selecting candidates, preferring to present three diverse individuals to the hiring team, each with a unique personality and background. Initia's primary goal is to find **qualified candidates who possess the necessary skills, experience, and technical knowledge for the job**. Initia values clear and concise resumes without spelling mistakes, as she finds lengthy resumes overwhelming. However, she understands the challenges of evaluating soft skills solely through resume evaluation. To address this, Initia formulates interview questions based on job requirements and conducts effective interviews to assess candidates thoroughly. One of Initia's main challenges is the scarcity of skilled candidates, especially those who meet all requirements and salary expectations. She also encounters frustration when candidates disappear or accept other

job offers during the recruitment process, leading to delays and inefficiencies. Nevertheless, Initia's skills in analyzing job descriptions, identifying relevant keywords, and evaluating resumes allow her to navigate these challenges effectively. Her adaptability to changing recruitment practices and tools, along with her awareness of biases in the recruitment process, further enhance her abilities as a recruiter.

4.3 Ideation and Design

To address the design implications from our previous chapter and meet the needs and expectations of our personas, we started a design process that began with a low-fidelity sketch of five pages of a dashboard aimed at assisting recruiters in their recruitment practices. Using an iterative process, we generated multiple sketches in the ideation stage and refined them along the way, ultimately leading to the creation of a final dashboard design. The final design incorporates a number of features that are specifically tailored to address the challenges that recruiters face, such as the issue of bias in the recruitment process. To make our idea come to life, we used Figma to turn the refined sketch into a high-fidelity design.

4.3.1 Ideation

During the ideation phase, we began by sketching ideas for the recruitment dashboard. Our approach was driven by the specific challenges faced by the personas we created, taking into consideration their unique recruiting processes. We focused on how the dashboard could effectively address each problem, and at the same time, we considered the design to cater to the needs and expectations of job seekers. Figure 4.3 shows a selection of the sketches that emerged from this brainstorming process.

4.3.2 Dashboard Design

The final design is created after various iterations based on discussions with two researchers and informal user feedback. In this section, we provide an overview of each page of the recruitment dashboard design, along with the features embedded in them.

Home Page

The home page serves as the primary interface of the dashboard, welcoming users upon accessing it. On our designed home page, recruiters are presented with a comprehensive overview of the company's numbers and visualized information (see Figure 4.4). Addition-

Tyler

Technology Enthusiast Inclusive Recruitment Advocate

"Creating a diverse and inclusive tech workforce is not just a goal; it's a commitment that requires constant self-reflection, addressing biases, and embracing change."

Toronto

Bachelors in Human Resource Management

Background

Tyler started their career as a Recruiter and HR Administrative professional, gaining extensive experience in the recruitment process. Recognizing the need for inclusivity and diversity in hiring, Ryan transitioned into a role where he could focus on advocating for inclusive recruitment practices within the tech industry.

Inclusivity Advocate | Tech-Savvy | Collaboration and Communication | Analytical Thinker

Goals and Needs

- Clear Understanding of company requirements and expectations.
- Draft inclusive Job Adverts
- Comprehensive Assessment Process
- Time-efficient CV screening process
- Automated tools with transparency and control.
- Actively addresses bias in their work by utilizing a variety of strategies.

Frustrations

- Overcoming Bias in Recruitment
- Navigating Homogeneity in Tech Team
- Ensuring Transparency and Control in A Tools
- Time Constraints and Limited Resourc
- Addressing Underrepresentation
- Adapting to Evolving Industry Trends

Skills

Initia

Intuitive Senior Recruiter

"I believe that relying solely on keywords in the job description or using software filters may not be effective in finding the right candidates. Intuition and judgements based on your experience play a crucial role in the selection process."

Montreal

Bachelor's in Business Administration

Background

Initia is a seasoned Senior Recruiter in the tech sector with ten years of experience. Her intuitive and diverse candidate selection approach, along with adept interview skills, sets her apart. She navigates challenges with adaptability and is dedicated to finding top talent for her organization.

Intuitive and insightful | Experienced and mature | Skilled in identifying talents

Goals and Needs

- Identify and recruit qualified candidates who possess the necessary technical skills, experience, and knowledge required for the job.
- Presenting a variety of candidates to the hiring team to promote company's diversity
- Conducts effective interviews to thoroughly assess candidates, especially for evaluating soft skills that cannot be fully assessed through resume evaluation.
- Prefers clear and error-free resumes without spelling mistakes, as lengthy resumes can be overwhelming to review.

Frustrations

- Dealing with resumes containing spelling mistakes and lengthy unnecessary details
- Identifying candidates with rare and hard-to-find technical skills
- Ensuring candidates stay engaged throughout the recruitment process and avoiding candidate dropouts
- Striving for diversity in tech teams and overcoming any resistance to change
- Handling High Volume of Applications

Skills

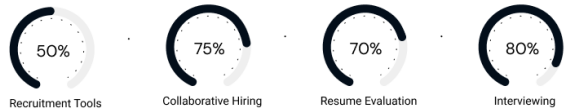
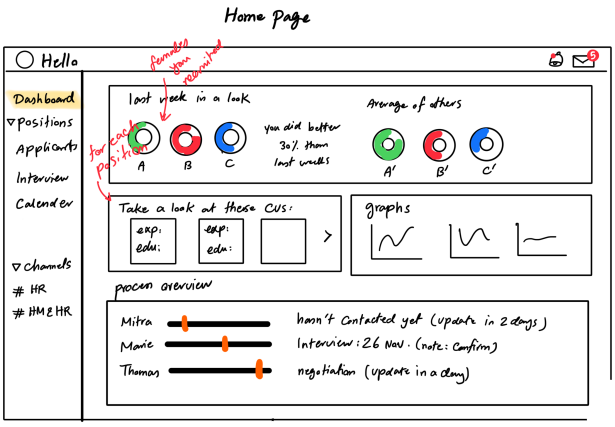
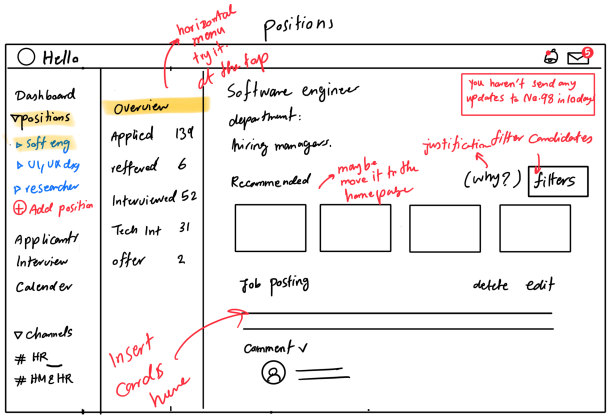


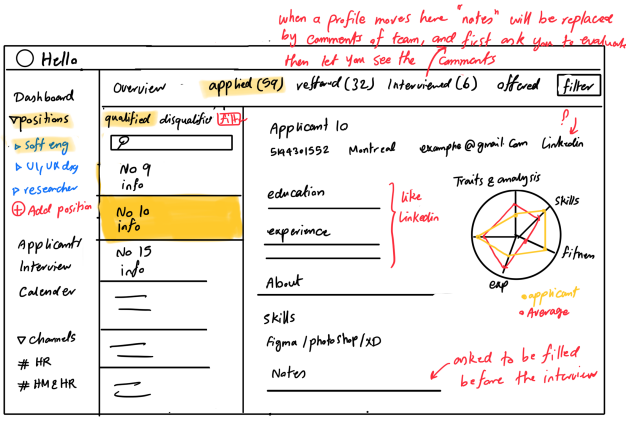
Figure 4.2 The two personas



(a) Sketch 1



(b) Sketch 2



(c) Sketch 3

Figure 4.3 Some of the ideation phase sketches

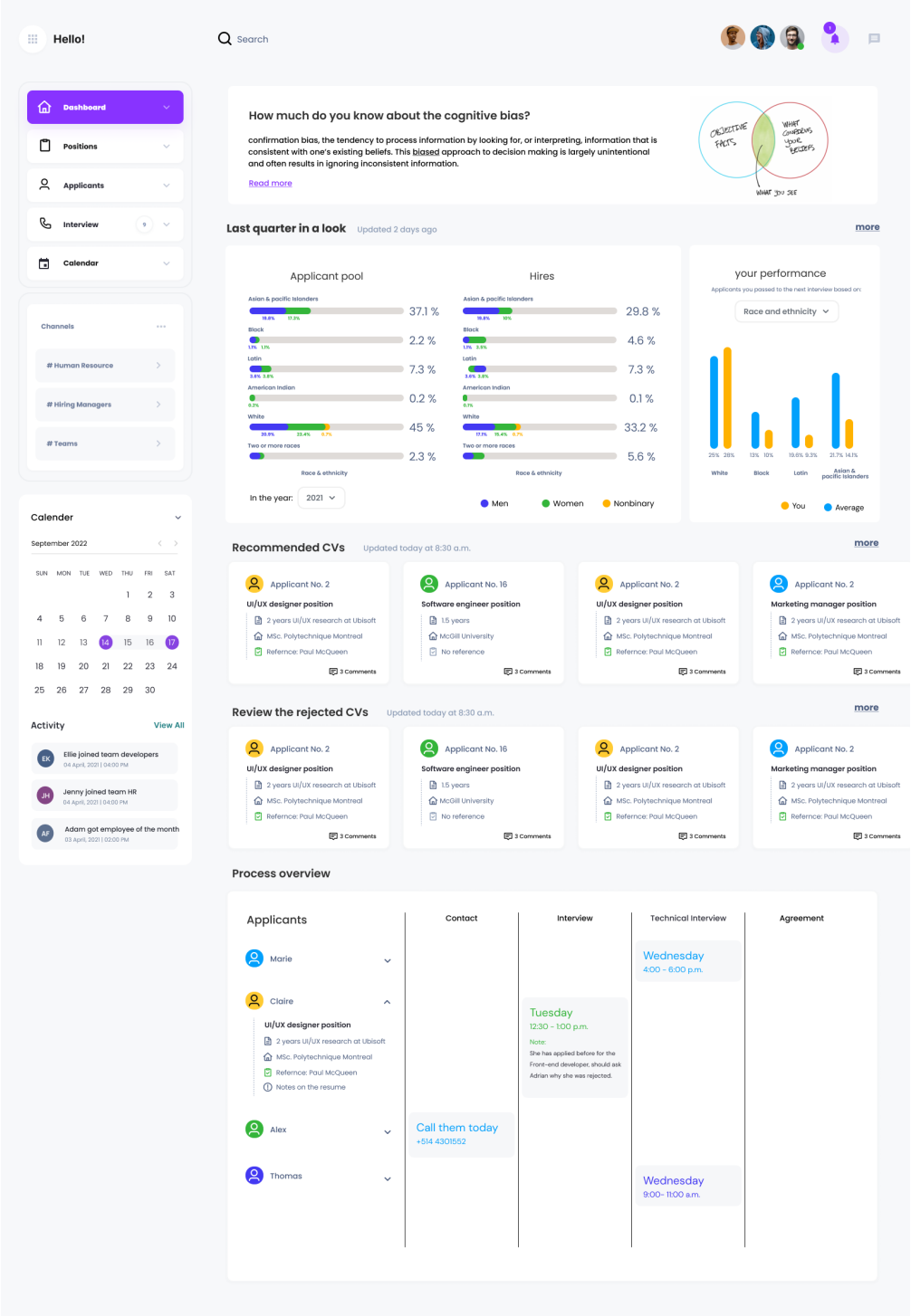


Figure 4.4 The Home Page Design

ally, the home page offers resume recommendations to assist recruiters in their candidate evaluation process. Furthermore, a process overview is provided to facilitate efficient applicant tracking, enabling recruiters to stay organized and easily monitor the progress of each

candidate.

- *Banner feature:* We conceived the idea of incorporating a prominent banner at the top of the home page, strategically positioned as one of the first elements the recruiter encounters upon accessing the platform(see Figure 4.5). This banner serves as a valuable resource by providing information about unconscious bias, including its occurrence, impact, and ways to address it. It has the capability to dynamically update with each visit, ensuring that the content remains fresh and relevant. By clicking on the banner, users can delve into comprehensive details on the subject. Our design of the banner feature adopts an educational approach, aiming to foster a reduction in cognitive bias among recruiters. It serves as a valuable learning point and a timely reminder of the biases that can influence the recruiter's decision-making process, such as the halo effect or confirmation bias. This feature empowers Initia to make more objective and fair decisions, fosters diversity and inclusion, and ensures a more equitable recruitment experience for all candidates.

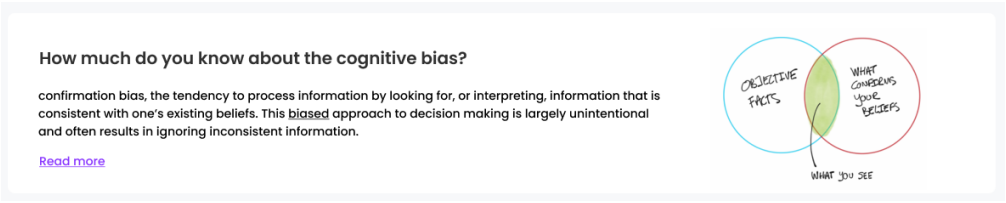


Figure 4.5 The Banner

- *Data visualization and analysis feature:* In our design, we have incorporated a data visualization and analysis feature aimed at presenting key data points related to company hires, applicants, and recruiter performance (see Figure 4.6). The inclusion of this feature is motivated by the recognition of data visualization as a valuable tool for reflection, learning, and increasing awareness. By leveraging these visualizations, users can gain meaningful insights and be influenced positively.

  The visualization in our design draws inspiration from the DEIB (Diversity, Equity, Inclusion, and Belonging) metrics and indicators [56, 57]. For example, charts are created to illustrate the demographics of hired employees compared to the applicant pool across different years. Recruiters' performance can also be evaluated based on the diversity they have contributed to or reduced within the organization. These features enable recruiters to compare their performance against the company average and their own past records, facilitating a deeper understanding of how their decisions and actions

impact bias reduction. By incorporating such metrics and visualizations, the recruitment dashboard empowers recruiters to monitor and improve their decision-making processes, fostering greater inclusiveness and minimizing bias throughout the hiring journey.

Figure 4.6 Data Analytic Feature

- *CV Recommendation:* We envisioned a dedicated section on the home page for CV recommendations, where a selection of applicant CVs would appear on a regular basis, along with the date they were last updated (see Figure 4.7). This feature was created to address the issue faced by recruiters like Tyler who value inclusiveness. Such a tool can assist Tyler in expanding the candidate pool by recommending individuals with relevant skills and experiences, even if they lack traditional or expected qualifications. This approach aligns with Tyler's goal of fostering diversity and inclusiveness by considering a broader range of candidates who can contribute unique perspectives and talents to the team.

  To mitigate unconscious bias during the screening stage, we envisioned that the recommended CV thumbnail would display only specific qualifications, allowing for a concise summary of candidates' profiles. These qualifications can be customized by the user, and in this case, we selected experience and education as they were the most frequently mentioned qualifications by our interview study participants. Additionally, candidate names, pictures, demographics, and any identifiable information will be concealed, with each candidate assigned an anonymous ID number.

  Additionally, users will be able to see if a candidate was referred by an employee within the company. To ensure optimal functionality, it is essential for the machine learn-

ing algorithms that drive this feature to minimize bias and provide fair and objective recommendations.

- *Rejected CVs:* Just like the above feature, rejected CVs is also showing a list of CVs that were rejected in the process and the reasons why they were rejected as a part of recruiters' comments on each profile (see Figure 4.7). As a user of this platform, Tyler could benefit from this feature, because as an inclusive recruitment advocate, he understands the importance of transparency and control in the candidate selection process. Having access to rejected resumes can provide valuable insights and opportunities for reflection, ensuring fairness and minimizing the potential for unconscious bias in decision-making. By being able to review rejected resumes, Tyler can assess if any qualified candidates were inadvertently overlooked or if there were biases present in the initial screening process. This feature enables Tyler to address any potential biases, learn from past experiences, and make improvements to the recruitment process moving forward.

  Moreover, seeing rejected resumes again allows Tyler to maintain a candidate database for future reference. This can be beneficial when new positions become available or when specific skills or qualifications are needed. By revisiting rejected resumes, Tyler may discover potential candidates who were not initially the right fit for a particular role but could be suitable for future opportunities within the company. A recruitment tool with the capability to view rejected resumes again empowers Tyler to foster transparency, enhance fairness, and maintain a diverse talent pool by ensuring that qualified candidates are not unintentionally overlooked and that the recruitment process continually evolves and improves. Also, this capability allows Initia to reevaluate candidates who didn't initially meet the requirements, giving her the opportunity to reassess their qualifications and potential. By revisiting rejected CVs, Initia can identify any biases or shortcomings in her initial evaluation process and make adjustments for future recruitments. This feature enhances her decision-making, helps uncover hidden talent, and contributes to a more comprehensive and unbiased recruitment process.

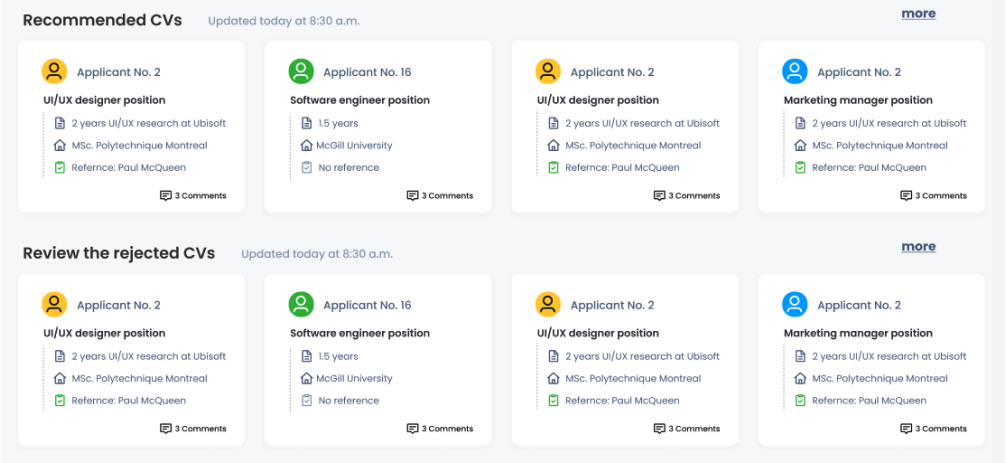


Figure 4.7 CV Recommendation and the Rejected CVs feature

- *Process overview:* Although our primary focus was on addressing bias-related challenges, we recognized the importance of considering the holistic recruitment process. During the interview sessions, valuable insights were shared by participants regarding the difficulties associated with interview scheduling, which we incorporate into this feature. In the process overview section, users are provided with a clear visualization of each applicant's progress through the recruitment funnel. This includes important details such as interview schedules, contact information, applicant profiles, and any notes the recruiters have recorded for each individual. To enhance convenience and streamline the process, the platform can be seamlessly integrated with popular scheduling platforms like Google Calendar to facilitate interview scheduling. Once a candidate is selected for an interview, recruiters can utilize the platform to choose from available time slots. The platform then automates the scheduling process by automatically reaching out to the candidates through calls or emails, facilitating the setting of an interview time.

Job description page

On this page, recruiters are provided with the ability to view and modify the job descriptions for the positions they are responsible for recruiting. It serves as a central hub where recruiters can access and edit all the pertinent information associated with each job posting (see Figure 4.8).

- *Job description overview and comments:* Within this section, recruiters are provided with the ability to view and modify the job descriptions they have created for specific

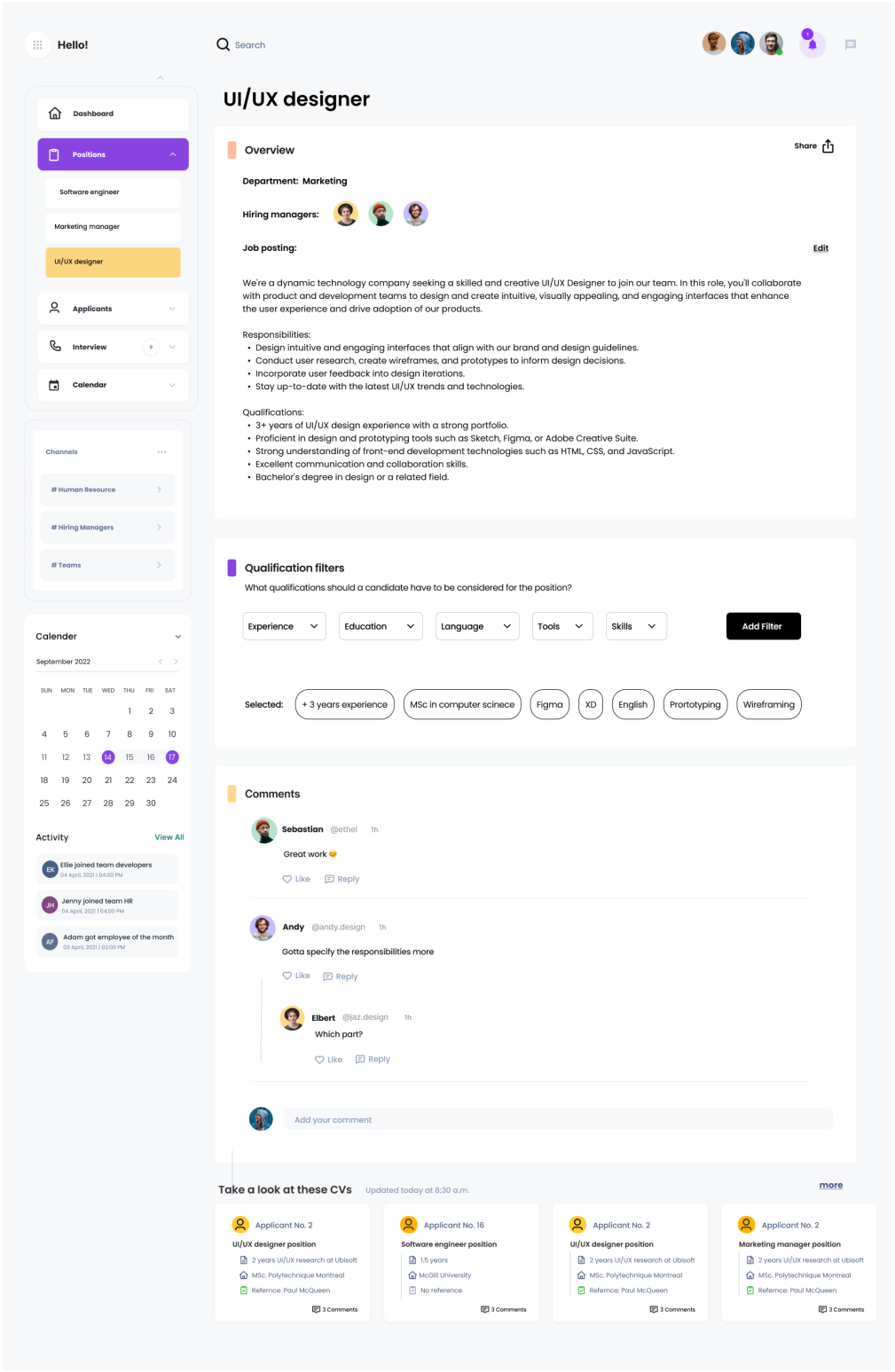


Figure 4.8 Job Description Page

positions. In the edit mode, recruiters can inspect the length of the job description and the tone used. Our interview study findings highlighted that recruiters often express concerns about their lack of domain expertise, which can lead to doubts when selecting suitable candidates. Conversely, job seekers primarily seek clarity in understanding the expectations and requirements of a position, often facing ambiguity within job descriptions. To address these concerns and provide clear information about the position in the job description, it is important to consider not only domain expertise but also the best practices for writing effective job descriptions. Based on a LinkedIn study conducted in 2016 and 2017 [58], we incorporated some of the recommended tips within this feature. Our envisioned design includes suggestions for elements to be included in the job description, drawing from these tips.

Furthermore, in the comments section, users have the opportunity to engage with other individuals involved in the recruitment of similar job positions. They can read the opinions of hiring managers, recruiters, and other relevant team members regarding the job description. Additionally, users can share their own thoughts and opinions. This fosters collaboration and allows for the close involvement of hiring managers with domain expertise. Every edit made to the job description can be monitored and checked by recruiters and hiring managers, enabling more effective collaboration.

The sharing feature also facilitates the dissemination of the job posting to individuals who possess expertise but may not be directly involved in the hiring process. Furthermore, it allows for the inclusion of people who have previously held or currently hold the position, providing valuable insights on what makes a job description more appealing to candidates. This sharing and collaboration feature not only encourages input from multiple perspectives but also addresses the potential issue of "in-group bias" that can emerge during group decision-making. By leveraging this collaborative and inclusive approach, recruiters can gain clarity on position requirements, alleviate personal biases, and create more appealing and informative job descriptions, ultimately enhancing the recruitment process.

Both Initia and Tyler would value such a feature. For Initia, this feature allows her to align job descriptions accurately, receive feedback, and continuously improve the recruitment process. For Tylor, it ensures coordination and consistency among team members, streamlined communication, and knowledge sharing, all of which contribute to more efficient decision-making and improved overall recruitment performance.

- *Filtering the qualifications:* Using this feature, recruiters can filter the candidates in the CV screening based on their own desired qualifications. They can also create filters

and tags to filter the CVs (see Figure 4.9).

Both our personas, Initia and Tyler, greatly benefit from a job recruitment tool that includes a resume-filtering feature based on the filters they have set. This feature allows them to specify criteria such as skills, experience, education, and other qualifications that are important for the job position. They can refine and adjust the filters based on her evolving requirements, ensuring she is consistently presented with resumes that align with Their current needs. By having the ability to filter resumes, They can efficiently review and prioritize candidates who meet the specific requirements, saving time and effort in the screening process. This ensures that Tyler and Initia focus on the most relevant applicants and increases the chances of finding the right talent for the job and it satisfies their need for customization and flexibility in the recruitment technologies.

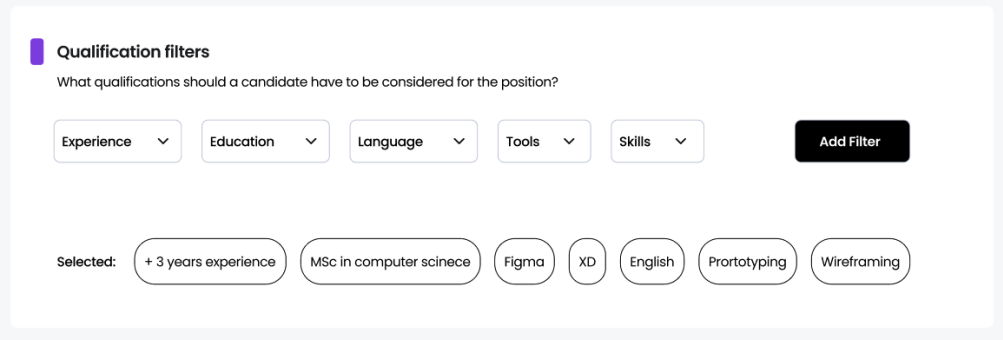


Figure 4.9 Qualification Filters

Applicants page

On the applicants page, recruiters have access to the list of all applicants along with the respective stages they have reached in the recruitment process. By clicking on each applicant's profile, recruiters can gain insights into the qualifications of the anonymous applicants. Within the profile view, recruiters can benefit from an auto-generated summary of the applicant's CV, which provides a concise overview of their qualifications and relevant information. Additionally, an auto-generated analysis of the applicant's traits is also available, providing recruiters with valuable insights into the candidate's characteristics. This combination of features streamlines the recruitment process by offering recruiters a quick and efficient way to review applicant profiles.

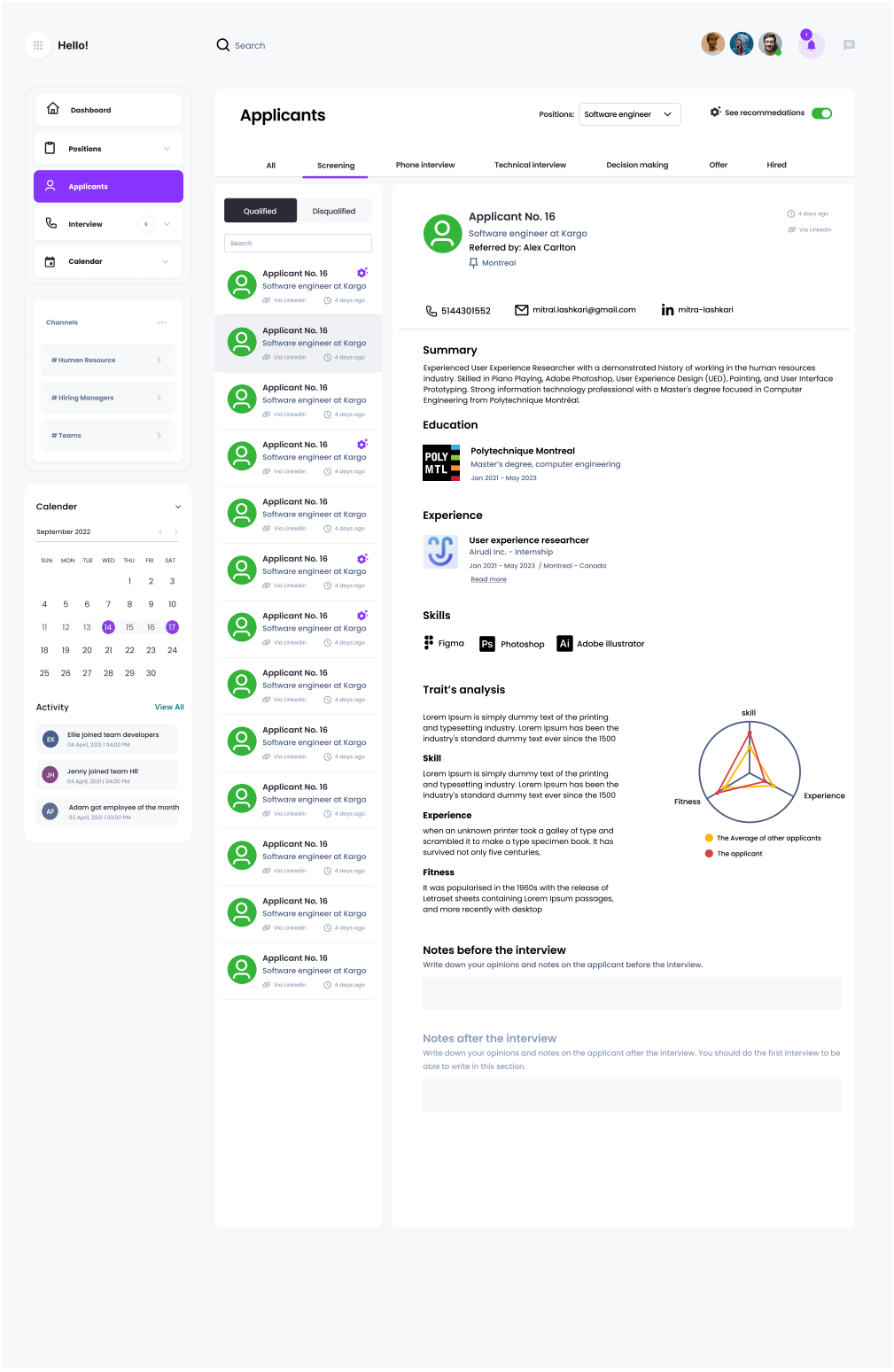


Figure 4.10 Applicants page

- *Recommendations and the profiles list:* Recruiters have the ability to enable the "see recommendations" toggle button located at the top of the page, which allows them to view recommended CVs derived from the system's machine learning algorithm within the list of applicants. It is important to note that this feature does not prioritize the recommended CVs on the list but rather places a recommended icon on the top left corner of the profile. The rationale behind this design decision is to offer recruiters a more comprehensive view of candidate profiles, rather than restricting their focus solely to recommended ones. By adopting this approach, we ensure that all CVs have an equal opportunity to be displayed on the list, promoting fairness and preventing potential bias.

  The applicant list is divided into two groups: qualified and disqualified, based on the same filters created on the job description page. Retaining the filtered-out applicants proves beneficial for recruiters like Initia, who face challenges with recruitment technology. Initia recognizes the potential risks associated with excessive reliance on automated processes and filters, as it may result in the exclusion of qualified candidates and the introduction of biases. Additionally, she encounters difficulties in assessing candidates' soft skills, as recruitment technology often emphasizes hard skills and technical qualifications. Striking a balance between leveraging technology for efficiency while incorporating human judgment and holistic assessment is essential for Initia. This ensures that exceptional talent and diverse perspectives are not overlooked. Providing Initia with access to the filtered-out resumes allows her to thoroughly review and revise any missed applicants if necessary. Overall, this feature empowers recruiters to combine the benefits of technology-driven recommendations with their own expertise and judgment, ensuring a comprehensive and fair evaluation of candidates.

- *Trait's analysis:* We envisioned a powerful feature designed to support recruiters in evaluating applicants more effectively by providing valuable data for their decision-making process (see Figure 4.11). This decision was motivated by our overarching goal to address the challenges present in the current dashboard, aiming to aid recruiters in making better, less biased decisions while reducing the chances of misjudgment in candidate evaluations. One concept we considered was a diagram that illustrates the applicant's data point on a radius alongside the average data point of all applicants. Each radius on the diagram represents a specific criterion, which can either be inputted by the recruiter or generated automatically. However, we acknowledge that certain criteria are not naturally quantitative and cannot be easily mapped using numbers. To address this, we proposed a solution where the system initially generates the diagram

based on quantitative data. As the recruitment process progresses and recruiters (both technical and non-technical) provide their opinions, the system employs a method similar to a graphic rating scale used in job appraisals to convert qualitative traits into quantitative values. This ensures a more comprehensive and standardized evaluation process. The average data point on the diagram represents either the expectations for the newly hired person in the position or an average derived from individuals currently working in the same position. The primary objective of this feature is to serve as an asset for recruiters during their decision-making process, facilitating a more informed and efficient evaluation of applicants.

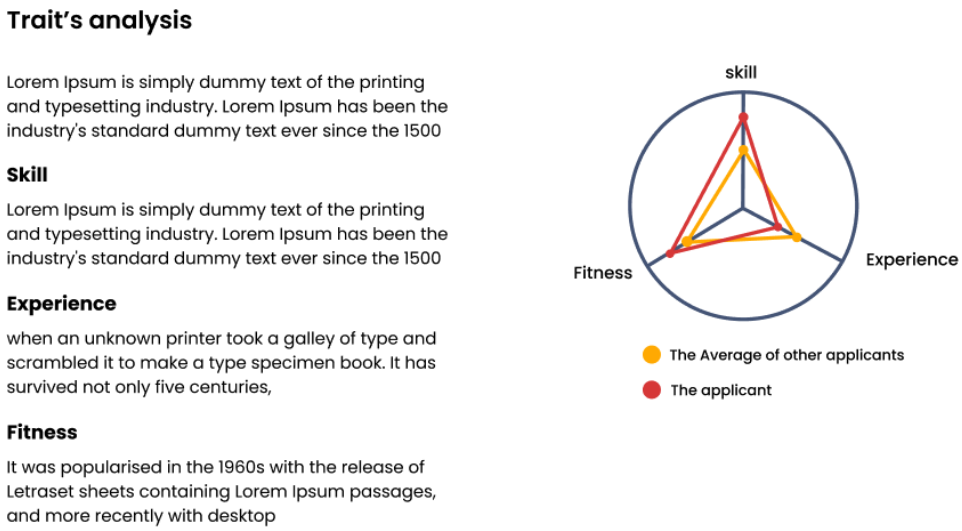


Figure 4.11 Trait's Analysis Feature

- *Recruiters' note space:* We have incorporated a dedicated space for recruiters and individuals involved in the recruitment process to write down their opinions and notes. Within each applicant's profile, there are two separate note sections provided. The first note space is designed for users to record their opinions and thoughts prior to meeting the applicants in person during the interview stage. This allows recruiters to capture their initial impressions and expectations without being influenced by direct interactions. The second note space becomes active after the interview has taken place. Users can then document their opinions and observations based on their interaction with the candidate. By providing this post-interview note space, we enable users to compare their pre-interview and post-interview opinions, facilitating a self-reflection process. This feature serves as a valuable tool for both personas, allowing them to

detect any biased opinions or information that may have influenced their assessment. By comparing their initial expectations with the actual interview experience, users can identify any discrepancies or biases that may have impacted their judgment.

The inspiration for this feature came from a personal experience shared by a recruiter who admitted to having a positive bias towards a candidate simply because they resembled the recruiter's friend. Recognizing the potential impact of such biases on the hiring process, we believed that implementing this feature could effectively address such situations and help mitigate bias.

Furthermore, users can share their opinions and notes with others involved in the recruitment process, fostering collaboration and preventing bias and distortions from taking hold. This sharing capability enhances transparency and accountability, as different perspectives can be considered and evaluated collectively. Overall, this feature promotes self-awareness, encourages critical evaluation of biases, and supports a collaborative approach to mitigating biases in the recruitment process.

Interview meeting space

We have allocated a dedicated space within the dashboard for conducting online interview meetings, similar to popular platforms like Zoom or Microsoft Teams (see Figure 4.12). This interview meeting space encompasses various features designed to enhance the interviewing process.

- *Transcript auto-generation and taking note space:* Many participants in our interview study highlighted the importance of having a solution to capture and document the conversation accurately. In addition to the automated transcript generation feature that is commonly seen in remove meeting platforms, we have included a dedicated note-taking space within the interview meeting platform. Participants emphasized the value of having a central location to store their notes and maintain all relevant information in one place. This note-taking feature allows users to jot down their observations, impressions, and key points during the interview. By having a designated space for note-taking, recruiters and interviewers can easily refer back to their notes, recall important details, and keep their thoughts organized throughout the hiring process. By incorporating these features, we aim to streamline the interview process and enhance productivity for recruiters and interviewers. While the transcript auto-generation alleviates the need for manual note-taking, the dedicated note-taking space provides a convenient and organized repository for capturing essential information. As in our personas the automated transcirpt generation saves time by providing accurate interview

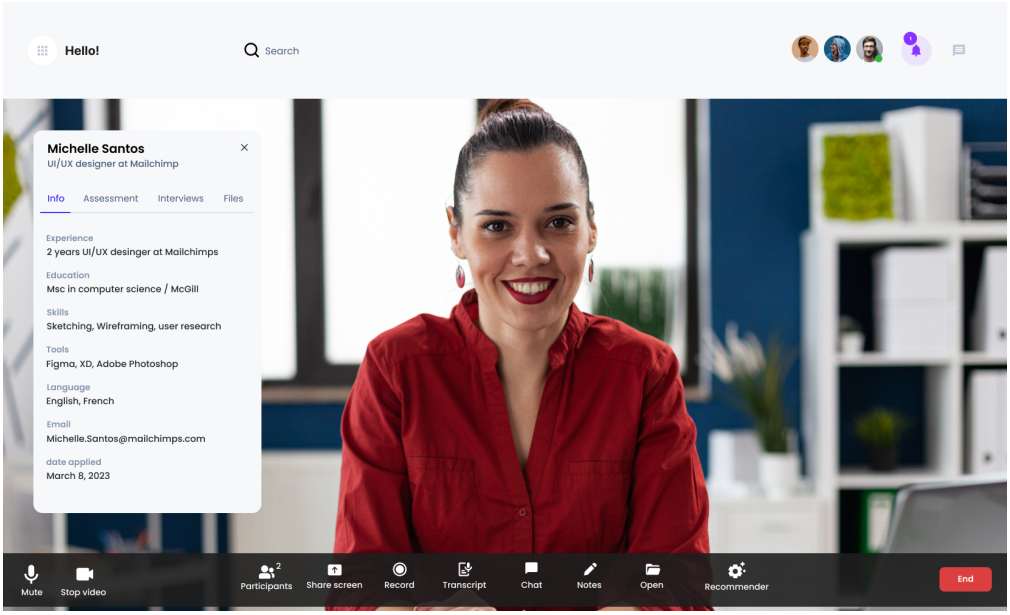


Figure 4.12 Meeting Room with the access to the applicant's resume

records and allows Initia to focus on candidate engagement. The note-taking feature aids both Ryan and Initia in efficient collaboration and informed decision-making for the recruitment team, improving hiring outcomes.

- *Real-time recommendation and feedback tool:* While the technical implementation is to be explored, we have envisioned a real-time recommender that suggests interview questions and provides feedback during the interview process in order to satisfy the needs of our personas. Firstly, having a system that recommends interview questions can greatly support Initia and Tyler in maintaining consistency and thoroughness in their interviews. With a pool of relevant and well-structured questions tailored to the specific job requirements, they can ensure that they cover all necessary aspects during the interview process. Secondly, the ability to receive real-time feedback from the system during the online interview is invaluable for Initia and Tyler. The tool's sophisticated analysis capabilities allow it to assess various aspects of the candidate's performance, including their responses, communication skills, and non-verbal cues. By receiving objective feedback in real-time, Initia and Tyler gain valuable insights that can assist them in evaluating the candidate's suitability for the role. This feedback serves as a reliable resource for making informed hiring decisions and providing constructive feedback to candidates. By incorporating this feature, we aim to enhance the overall interview experience for recruiters. The system's intelligent recommendations and real-time feedback empower them to conduct more efficient and insightful interviews, leading

to more informed hiring decisions and improved candidate evaluation.

- *Access to the applicant's resume and predetermined interview questions:* With this feature, recruiters can seamlessly access applicants' resumes and predetermined interview questions directly from within the interview meeting interface. This eliminates the need for recruiters to have multiple tabs open or switch between different applications, allowing them to maintain a focused and undistracted interviewing environment. By having all the necessary information readily available within the interview meeting interface, recruiters can quickly refer to the applicant's resume to refresh their memory about the candidate's qualifications, experiences, and achievements. This ensures that recruiters have accurate and up-to-date information at their fingertips, enabling them to ask relevant and insightful questions during the interview.

  Moreover, recruiters can easily access their predetermined interview questions without the hassle of navigating through different documents or applications. This streamlined access eliminates any potential confusion or disruption that may arise from searching for or transitioning between different resources. It enables recruiters to maintain a smooth flow of conversation and ensures that they cover all the essential topics they had planned to discuss with the candidate. By integrating resume access and interview questions directly into the interview meeting interface, our feature empowers recruiters to focus their attention on the interview itself, rather than being burdened by administrative tasks or external distractions. This enhanced focus allows for better judgment and more effective evaluation of candidates, ultimately leading to more informed hiring decisions.

4.4 Conclusion

In this chapter, we describe our persona creation and dashboard design processes. Dashboards provide a consolidated and visually appealing display of essential information, enabling decision-makers to gain insights efficiently. Our recruitment dashboard is specifically designed to address the challenges faced by recruiters and minimize bias in the recruitment process. Particularly, we first created personas based on interview studies, segmenting recruiters according to their behaviors, goals, needs, and challenges. By understanding each persona's unique characteristics, we were able to design a dashboard that meets their specific requirements. The ideation and design process involved generating multiple low-fidelity sketches, refining them iteratively, and ultimately transforming them into a high-fidelity design using Figma. The resulting dashboard features were carefully tailored to assist recruiters in their daily tasks, minimize potential bias, and enhance the overall recruitment process. Overall, it serves as a valuable tool to support decision-making, provide insights, and improve

the efficiency and effectiveness of the recruitment process for both recruiters and job seekers. In the next chapter, we describe the user study to gather feedback on our recruitment dashboard design.

CHAPTER 5 USER STUDY

In this chapter, we report the user study aimed to gather feedback on the recruitment dashboard features designed in the previous chapter. To achieve this, we conducted studies with five participants who are experienced recruiters. In the following sections, we present the methods and the results of the user study, highlighting the feedback received from the recruiters. By analyzing these findings, we aim to further examine the user needs, gather insights into the potential effectiveness of the proposed features, and refine the recruitment dashboard design.

5.1 Methods

5.1.1 Participants

We recruited our participants through a combination of industry connections, targeted advertisements on LinkedIn, and personal contacts. A total of five recruiters, comprising one male and four female professionals, participated in our study. Our selection criteria sought recruiters with extensive experience in the recruitment decision-making process. On average, our recruiter participants had approximately three years of experience in various aspects of the recruitment process, and their ages ranged from 25 to 35 years. Table 5.1 summarizes the characteristics of our recruiter participants. It is important to note that all of our participants are currently working for high-tech businesses.

5.1.2 Data Collection

The studies were conducted in March and April 2023. All user studies were held online via platforms like Skype and Zoom. Each study session lasted approximately 90 minutes and was recorded in video, which was then later transcribed in its entirety. The user studies included two key components:

During the first component, we briefly gathered information on the participants recruiting practices and their challenges. In this stage, our primary objective was to gather responses to the same four research questions addressed in Chapter 3. By doing so, we aimed to gather contexts related to the practices and challenges encountered by our participants. We asked the same questions as described in Section 3.3.

Following the interview component, we moved on to focus on the dashboard design features in

	Company/organization type	Current job title	Duration of the most recent job hunting
1	Digital solution company	Talent Acquisition Specialist	2.5 years
2	Global technology company	World wide senior business technology leader	4 years
3	Global technology	HR advisor and office	2 years
4	Technology company	Developer	2.5 years
5	Multinational software company	Talent acquisition expert	+20 years

Table 5.1 Experience and current position of the recruiter participants of our user study

order to gather comprehensive information on each of them. It's important to note that this part of the study is focused on gathering feedback on the design concepts rather than usability assessment. As such, at the onset of the test, we reminded participants that the prototype was semi-interactive, emphasizing that it was not a finalized product. We specifically highlighted that the included features were intended for research and evaluation purposes, with the aim of reducing bias and error in judgment. This reminder served to ensure that participants understood the context of the testing and to prevent any confusion with regard to the nature of the prototype. Then, we provided participants with a link to access the prototype version of the designed pages through Figma. In order to gain deeper insights, we requested participants to share their computer screens with us, allowing us to observe their interactions. One by one, we carefully examined the designed features, seeking feedback from participants regarding their perceptions and the extent to which each feature could address the challenges they encountered, including bias-related issues. We encouraged participants to express any questions they had about the functionality of the features, and we provided explanations on how we envisioned these features would work.

5.1.3 Data Analysis

To analyze the transcribed interview and the test data, we adopted a thematic analysis approach, employing the ATLAS.ti software to facilitate the process. Initially, we conducted inductive coding, organizing each code under specific structures aligned with the subjects they addressed. To further enhance the analysis, we performed an affinity diagram activity

to categorize the codes. This step allowed us to identify patterns and connections among the codes, contributing to a clearer understanding of the data. Following that, we carefully identified common themes that emerged from the participants' comments. Through continuous discussion and iterative refinement, we ensured the codes, categories, and themes accurately captured the essence of the data. This process enabled us to gain comprehensive insights into the participants' perspectives and experiences, enriching the findings of our study.

5.2 Findings

In this section, we provide the results of our qualitative inductive analysis. While our primary focus is on presenting the dashboard user testing findings, we also leverage insights from the first interview component to enhance the understanding of recruiters' perspectives on the effectiveness of the features. Particularly, we provide a feature-by-feature analysis, offering a comprehensive overview of participants' opinions and suggestions.

5.2.1 Home Page Features

- *Banner Feature:* The participants expressed a generally neutral impression of the banner feature, which aimed to remind users about bias and approaches to address it. They acknowledged that having a reminder on the platform could be useful in general. However, they raised concerns that its influence may diminish over time, as recruiters may become less inclined to continuously engage with it. For example, R2 said, "*I usually skip these because ... there's a lot of times when I go into an app, there's like a trial or a banner or something, say how much do you know about the cognitive device?... So this seems like to be an extra thing...*" In another instance, two participants actively sought a collapse button to dismiss the banner. Interestingly, R4 mentioned that the reminder could potentially contribute to bias. They shared, "*Because I think seeing it every time would be like another bias to me because when you're just thinking about not to do something is equivalent to do that, ...*

  Another feedback regarding this feature was to position the reminder at a different stage, such as the final selection stage. R5 suggested, "*It would be nice to have another reminder when you are selecting a candidate, when you would say, the selected candidate is this person and we wanna move forward with an offer. Then it would be good to have a reminder saying you have chosen the best candidate including diversity for this position, and you click a yes or a no, it's a reminder.*"

- *Data Analytic Feature:* All participants unanimously expressed agreement regarding

the usefulness of a data analytic feature that incorporates data visualization to represent information related to organizational diversity. Their positive response indicated that such a feature would greatly assist them in easily comprehending and comparing diversity-related data, ultimately contributing to improved diversity management. For instance, R3 emphasized the significance of a snapshot view, stating, "*Especially the snapshot, you know, of seeing ... in the last quarter, like you hired a percentage of black individuals, indigenous individuals, white. I think it's very, like, it's nice to see it in this context because it makes you, again, it's right in your face, so it's difficult to see this and then to not have it in mind, like as you move on to whatever you're doing next.*"

However, it is worth noting that one participant raised concerns regarding privacy issues associated with employees sharing personal information with the company. They questioned whether employees would be willing to provide such information. Additionally, there were feedback and suggestions related to its usability, such as the desire for a clearer representation of the meaning of colors or improved categorization of the data. Taking into account both the positive reception and constructive feedback, these insights will help guide the development and refinement of the data analytics feature within the recruitment dashboard.

- *CV Recommendation Feature:* Participants held varying opinions regarding this feature. Two participants expressed that the feature would be partially useful to them, specifically highlighting the aspect of anonymizing CVs. Another participant (R2) believed that the feature would be more beneficial if the machine learning algorithms could analyze CVs at a higher level, providing a summary that explains why a particular profile could be a potential fit for a role. They further elaborated on this by stating, "*If you were using a generative AI, like ChatGPT, and reading that text from the resume and summarizing it here, saying this is for a UX/UI designer, like this applicant number two could be a good fit for the UI/UX designer. Because, you know, a few bullets like they have been doing user research and they have related education from a good school without the name of the school, and they have good references... If it gave me that, then I would be like, wow, that's really good. Someone is doing my job, upgrading that resume and summarizing it. That would be a good AI thingy.*" However, participants also identified challenges associated with this feature. Three participants raised concerns regarding the potential for unconscious bias when displaying certain information on resumes, such as school names, even though we had already removed the applicants' names. They believed that mentioning an applicant's school of graduation could

trigger biases based on the recruiter's impression of the school. Similarly, revealing the name of the person who referred the profile could introduce similar biases. These insights from the participants shed light on the potential benefits and challenges of implementing such a feature within the recruitment dashboard. They provide valuable considerations for addressing unconscious biases and improving the AI-driven analysis and presentation of CVs.

- *Rejected CVs Feature:* Three participants expressed their appreciation for the feature, highlighting its usefulness in their recruitment practices. R1 believed that having access to rejected resumes would be beneficial as it would create a valuable resume bank for their organization. The other two participants saw the advantage of utilizing the rejected CVs for comparison with the current ones in their possession. They emphasized that analyzing the rejected CVs might reveal patterns that could contribute to enhancing diversity in their recruitment process. These participants also stressed the importance of having access to comments and reasons for CV rejections, which could further inform their decision-making. Moreover, two participants recognized the potential of this feature to improve the system's performance by using the rejected CVs for learning and better filtering of candidate recommendations. As R2 put it, "*If I'm a recruiter, the ones that I have brought up and then they have gone further to the interview and were rejected with the feedback that this was not a good profile... If I could mark them somehow and then if my system is recommending, these are the good ones, a note that says, by the way, this was similar to this one that was rejected...*" R1 also shared their experience of encountering potential profiles that did not fully meet the role qualifications, leading to their rejection. They proposed the idea of saving such potentially promising resumes with a tag, which could open doors for future opportunities. Overall, the participants' positive feedback underscores the value of this feature in enabling recruiters to learn from past rejections, make informed decisions, and enhance the efficiency and inclusiveness of the recruitment process.

- *Process Overview Feature:* Participants found it beneficial to have all candidate information in one place, along with a convenient "click to action" button for joining the meeting room with a specific applicant. Nevertheless, one recruiter, R1, raised concerns about the system's ability to effectively track a large number of applicants and the potential for confusion or overlooked details.

5.2.2 Job Description Page Features

- *CV Filtering Qualification Feature:* All participants found this feature helpful. However, one participant (R2) expressed a preference for the filter to first recommend tags or keywords based on the pool of CVs, allowing the recruiter the option to choose. They explained, "*I think if you are giving me too much freedom, I'm limited too much... I wish it was a little bit more pre-filled based on recommendations on the data of what is out there or something.*"

  Participants also emphasized the need for a powerful algorithm within the feature that could recognize different terms with the same meaning. They highlighted the importance of a robust semantic analysis algorithm to ensure that no important information is missed from a profile. When discussing the risks and challenges associated with using such a feature, participants mentioned the potential for bias when filtering profiles based on criteria such as education or skills. One participant (R3) expressed concerns about potentially overlooking a good candidate when using this filter. They proposed a solution, stating, "*The only thing that comes to mind immediately is... in the job descriptions for qualifications, they have 'must have' or 'nice to have.' So then it gives the opportunity with a 'nice to have,' it's okay because there are things that are non-negotiable.*" These insights highlight the participants' appreciation for the feature while also raising important considerations regarding the initial recommendations, the need for robust AI, the risk of bias, and the flexibility in qualification filters. Incorporating these perspectives can contribute to the refinement and improvement of the feature within the recruitment dashboard.

- *Job Description's Edit and Share Feature:* A participant who works for a large, international company (R2) shared their personal observation that the hiring managers, not the HR team, are typically in charge of writing the job descriptions. As a result, they expressed a preference for restricting the ability to change the job description within recruiting tools such as our dashboard. They emphasized that any modifications made should be reflected at the source, ensuring consistency. On the other hand, another participant (R4) expressed the desire for the tool to provide feedback and advice on the job description they had created, indicating the need for assistance in crafting effective and inclusive descriptions.

  As for the sharing feature, participants did not see it as directly addressing challenges or bias in their recruitment process. By understanding the differing perspectives of participants on the edit and sharing features, we can better tailor these functionalities to meet the specific needs and preferences of recruiters, while also considering potential

implications on job description consistency and feedback mechanisms.

- *Commenting Feature:* Regarding the chat/commenting space for recruiters and hiring managers to communicate below the job description, the majority of participants (4 out of 5) found it not only useful but also necessary for effective communication in the recruitment process. They expressed the need to have a dedicated space where they could directly interact with hiring managers without having to switch to another chat platform like Slack. They believed that having this feature would streamline communication and facilitate better decision-making. Additionally, one participant mentioned the desire for the ability to attach files in this chat space, further enhancing collaboration.

  While participants recognized the benefits of this feature, they also identified potential risks and challenges. They highlighted the possibility of nitpicking and bias emerging within the chat discussions, particularly due to in-group bias based on the company's culture. To address this concern, one participant (R4) suggested incorporating a linked guideline within the chat space, outlining best practices for expressing ideas and comments, especially when discussing candidates. This guideline could serve as a reminder to maintain objectivity and mitigate potential biases. By acknowledging both the positive aspects and potential challenges associated with the chat space feature, it is crucial to design the functionality in a way that promotes effective and inclusive communication while mitigating the risks of bias and fostering a respectful and unbiased discussion environment

5.2.3 Applicant's Page Features

- *Traits' Analysis Feature:* For this feature, our focus was primarily on gathering information about the criteria that participants use to evaluate and compare candidates. We also explored the participants' opinions on whether these criteria could be visually represented on a diagram to enhance the understanding of an applicant's profile. Apart from skills and experience, which were already represented on the diagram, participants suggested additional criteria to include. These criteria encompassed the percentage of similarity between the candidate's CV and the job description, participation in specific workshops, community involvement, and completion of tests provided by the company at the beginning of the hiring process (such as psychological and problem-solving tests). The aim of embedding this feature in the dashboard was to gather more information about the candidate's attitude and enthusiasm, extending beyond their skills and experience, and ultimately aiding in identifying the best fit for the role.

Three participants expressed a positive attitude towards this feature, highlighting its potential usefulness. One participant remained neutral in their opinion towards utilizing this feature, while another participant displayed less enthusiasm. We will now delve into the reasons behind their differing levels of interest.

Some participants expressed discomfort with quantifying each criterion, as they believed it could introduce bias. For example, (R4) shared their perspective: "*I would say skill and experience would be good... experience is the most important one because it's actually a numeric value for us. But skill could be a little bit more descriptive. But if we want to turn it into numbers, yeah, it's a bit tricky but helpful again.*" They also emphasized the importance of focusing on result-based rather than number-based evaluations. They suggested that candidates should provide examples of their expertise and accomplishments, highlighting specific changes or improvements made in previous roles. While the recruiter could potentially assign numerical values to skills, it was not advised for candidates to quantify their own skills. By considering participants' opinions on visualizing criteria on a diagram, it is essential to strike a balance between providing meaningful insights and avoiding potential biases. The feature should aim to present relevant information in a clear and informative manner, allowing recruiters to make informed decisions while ensuring fair and unbiased evaluations.

- *Recommended Applicants Feature:* In terms of the recommendation feature, participants emphasized the importance of the algorithm's reliability, as it plays a crucial role in the usefulness of the feature. One participant (R3) further added that they found the feature particularly valuable if the algorithm also took diversity into consideration when providing recommendations. This participant also appreciated the ability to view all profiles even after enabling the "seeing the recommendations" button. They expressed their preference for being able to see disqualified CVs as well, stating, "*I love that you would be able to see... maybe there's somebody who doesn't quite have every single thing that you're asking for, but they have most of it... being able to see everything I think could actually help you to make a better decision.*" Participants also appreciated the fact that the feature did not solely filter to recommended profiles, as they preferred to review all profiles regardless. However, two participants expressed a desire to have a dedicated list of recommended profiles and suggested the inclusion of a filter for this purpose. One identified that the risk associated with this feature was the potential for recruiters to solely focus on the recommended profiles, overlooking other qualified candidates.

- *Notes Feature:* The majority of participants (4 out of 5) expressed their liking for this

feature. They appreciated the ability to write their opinions and notes on each profile, both before and after meeting the candidates in an interview. This allowed them to refer back to their notes, make comparisons, and share their thoughts with other team members. One participant (R2) specifically mentioned their enthusiasm for this aspect, stating, "*I love this part because then that way I get a chance to write them down and then after the interview I could have changed my mind... So I like all of the other aspects of it.*" Additionally, one participant mentioned their desire to have the ability to chat with their manager about each profile within this feature, further emphasizing the importance of communication and collaboration during the recruitment process.

5.2.4 Online Meeting Room Features

- *Real-time Recommendation Feature:* Three participants highlighted the usefulness of this feature, particularly for junior recruiters or those who have recently joined the team. They mentioned that having a recommender system in the meeting room that suggests questions to ask would be beneficial in the initial stages of interviews. One participant (R4) expressed this sentiment by saying, "*It might be helpful sometimes for the new interviewers... They're new to this kind of interview because if you just change the job position, the agenda would be different.*" Participants also discussed their expectations for a recommender system in an online recruitment meeting. One participant (R2) mentioned their desire to have recommendations based on real-time speech with the candidate. R4 also mentioned the need to see content related to meeting agenda in the recommender, rather than just general questions to ask the candidate. These insights highlight the need for tailored recommendations and contextual guidance to support recruiters during interviews.

- *Note, Transcript and Resume, and Interview Questions Features:* These features generally received positive feedback from our participants, who appreciated the ability to write down their notes in the meeting room. They found this feature useful for saving time and reducing distractions during interviews. Additionally, participants expressed a favorable view of being able to access the candidate's resume or a summary of it within the meeting room. They mentioned that having the candidate's information readily available while engaging in conversation helped mitigate misjudgment and facilitated a smoother interview flow. Furthermore, the participants highlighted the benefits of obtaining a transcript at the end of the interview. They mentioned that this feature enabled the hiring team to double-check details if there were disagreements or if anything was missed during the interview, ensuring a comprehensive evaluation process.

5.3 Discussion

In this chapter, we conducted a user study to gather the opinions and feedback of recruiters on the recruitment dashboard features that we designed based on the findings from our initial interview study. We carefully analyzed and considered the participants' feedback, expectations, needs, and desires. The features we incorporated into our design were intended to address the challenges and risks faced by recruiters, while considering the job seekers' needs, particularly bias and other significant challenges identified during the initial interview study. In the following sections, we discuss the implications of our dashboard design and the user study results around the five aspects of recruitment discussed in Section 3.6.1, namely: (1) Cognitive Bias in the Decision-Making Process, (2) Position Requirements of the Recruiting Company, (3) Activities Conducted for Assessing Candidates, (4) The Process of Conducting Interviews, and (5) Candidate-Company Relationship..

5.3.1 Cognitive Bias

In order to address the issue of bias in the recruitment process, we designed several features aimed at mitigating bias stemming from recruiters' inherent human nature. One such feature was the inclusion of an information banner on the first page of the dashboard, which aimed to reduce bias by educating recruiters about its existence and importance. However, our study revealed that a simple form of bias education, such as reading about it, was not effective in capturing the recruiters' attention. They tended to overlook this feature, considering it as an additional task they were unwilling to undertake. To make the bias education more engaging and impactful, alternative formats could be explored. For instance, incorporating small games or interactive activities that demonstrate how biased their selection process can be might prove more effective. [59] [60] Additionally, a feedback system could be implemented, providing recruiters with information on how their hiring decisions influenced the company in terms of diversity or other relevant aspects. This would serve as a tangible demonstration of the consequences of bias and help recruiters understand the importance of mitigating it.

While keeping candidate profiles anonymous and hiding names appeared to be a successful attempt at reducing bias, it became evident that any kind of identifiable information, such as the person who referred a candidate or the name of a company or school, could still trigger bias in recruiters. It was clear that even with anonymous profiles, biases could be formed based on such information. To address this challenge, a system should be devised to hide this information from recruiters without depriving them of important details needed to make informed decisions.

Another useful feature we identified was the ability for recruiters to write down their opinions on candidates before and after conducting interviews. This feature would provide them with an opportunity to compare their initial impressions with their final assessment, enabling them to identify if bias influenced their decision-making process. Our study highlighted the significance of documentation for recruiters, as it helps facilitate better decision-making and offers an avenue for self-reflection and bias detection. By incorporating these additional measures and features, we aim to create a recruitment dashboard that actively supports recruiters in combating bias, making informed decisions, and ensuring a fair and effective hiring process.

5.3.2 Position Requirements

The aspect of position requirements encompasses activities such as specifying hiring needs, creating compelling job descriptions to attract candidates, and establishing criteria for candidate matching and selection. Hiring managers typically outline the responsibilities and desired skills that align with the demands of the role. They may also seek assistance from recruiters to refine these requirements. Based on our interview study, we identified two primary challenges within the position requirements aspect. Firstly, recruiters often face a lack of domain expertise in the specific field they are recruiting for. This can hinder their ability to accurately assess the suitability of candidates. Secondly, job seekers expressed frustration with inaccurate and vague job descriptions, which can lead to a mismatch between their expectations and the actual role requirements.

To address these challenges, we incorporated features in the job description page of the dashboard. One such feature is a chat space that facilitates communication between recruiters and hiring managers, allowing them to discuss any questions or concerns related to the job description or different candidates. While this feature was found to be interesting and useful, recruiters were mindful of the potential influence of in-group bias that could occur within these conversations. To mitigate bias within the chat feature, we propose adding guidelines to the system on how to express opinions without bias. For instance, recruiters could be encouraged to provide additional context about their decision-making process when discussing candidates in the chat. This transparency can help minimize the impact of biases and promote more objective evaluations. Additionally, our findings indicate that AI interventions can be implemented to provide feedback on the job description itself. This can help ensure clarity and thoroughness in the job descriptions, reducing the likelihood of ambiguity and mismatched expectations for job seekers. By incorporating these guidelines and AI interventions, we aim to enhance the effectiveness of the job description page in addressing the challenges related

to position requirements. This will enable recruiters to make more informed decisions and improve the overall alignment between job requirements and candidate expectations.

5.3.3 Assessing Candidates

One of the crucial tasks for recruiters throughout the recruitment process is to evaluate and compare candidates based on the position requirements and their qualifications in order to find the best fit. Building upon the challenges identified in the previous chapter, one of the most daunting aspects for recruiters in this process is how to effectively evaluate candidates' resumes and profiles, ensuring fair assessment and avoiding overlooking potential top candidates.

To identify the best-fit candidate, our findings suggest that while experience and skills are primary criteria, there are other measurable factors that can contribute to the evaluation process. These can include standardized psychological or problem-solving tests, community involvement, participation in relevant programs or workshops, and other dynamic criteria specific to each role. While giving recruiters the flexibility to choose qualifications and keywords for CV filtering is a desirable feature, our system should also suggest keywords based on the applicant pool. This necessitates the implementation of a powerful semantic analysis algorithm.

Additionally, summarizing resumes can be a helpful feature, as it enables recruiters to quickly extract key information. During our study, one participant emphasized the importance of having access to disqualified or rejected CVs, highlighting that "information is power." Our findings indicate that granting recruiters access to such CVs allows for decision correction, learning opportunities, and potential future opportunities. This way, recruiters remain in control of the data, and the disqualified CVs can be utilized for further learning and improvement of the algorithm. Based on our findings and to increase the trust of recruiters toward automation, we propose the idea of employing Explainable AI and Transparent AI for CV filtering.

Data analytics emerged as the most favored feature in our study. Based on our findings, incorporating data analytics in a recruitment dashboard, particularly to provide information on inclusiveness and diversity, can significantly enhance recruiters' understanding and help mitigate bias and misjudgment. When designed properly, data analytics has the potential to empower recruiters by providing valuable insights and supporting the maintenance of inclusiveness. By incorporating these features and considerations, we aim to create a recruitment dashboard that facilitates effective candidate assessment, empowers recruiters with relevant information, and fosters a fair and inclusive recruitment process.

5.3.4 Doing Interviews

In our efforts to meet the desired features of recruitment technology tools expressed by recruiters, we focused on addressing their needs during the interview process. Our findings highlighted several features that were highly desired by recruiters, including interview recommendations, note-taking capabilities, automated transcript generation, and the ability to view the candidate's resume or a summary of it.

Based on our research, a significant number of recruiters expressed a preference for having an agenda and real-time question generation during interviews. This feature would assist in maintaining structure and consistency throughout the interview process. Recruiters also emphasized the importance of having ample note-taking space within online meeting rooms, as this facilitated efficient documentation and record-keeping. They greatly appreciated having this feature integrated into the recruitment dashboard, as it eliminated the need to switch between external tools, streamlining the overall process. Overall, recruiters expressed satisfaction with the inclusion of these features within the online interview meeting room as embedded functionalities. These additions addressed their specific needs and significantly reduced the effort required for toggling between different tools. By incorporating these features, we aimed to provide recruiters with a comprehensive and efficient interview experience. These features enhance the overall functionality of the recruitment dashboard, enabling recruiters to conduct interviews seamlessly, take notes effectively, and access relevant candidate information without unnecessary disruptions.

5.3.5 Candidate-Company relationship

We have implemented several features on the job description page with the aim of providing candidates with clear and comprehensive information about the job they are applying for. Our research indicates that incorporating an AI-empowered feedback system for writing job descriptions can be highly beneficial. While recruiters may not be the ones directly writing the descriptions, this feature can assist hiring managers in ensuring all essential details about the role are covered, benefiting the applicants.

Additionally, our findings suggest that including features such as note-taking, generating transcripts, and viewing resumes within the platform can eliminate the need for recruiters to rely on external tools for these partially necessary tasks. This approach helps minimize distractions and enables recruiters to stay fully engaged during meetings, ultimately creating a more favorable impression on candidates. As recruiters serve as the initial representatives of the company for applicants, maintaining a focused and attentive presence is crucial.

Furthermore, Based on our findings, incorporating a process overview feature into the dashboard is desirable for recruiters as it streamlines the scheduling and tracking of applicants. This feature simplifies the organization of schedules and facilitates easier communication with applicants. However, it is important to address the potential trust issues associated with using this feature. Building trust by ensuring data security, privacy, and maintaining transparent communication channels will be crucial in overcoming any apprehensions that recruiters may have.

One aspect that is omitted in the current design but can be addressed in future work is a feedback feature for candidates on their side of the platform. Such a feature will allow job seekers to evaluate themselves after interviews. This will provide candidates with valuable insights and facilitate self-assessment following the interview process.

5.4 Conclusion

In conclusion, we conducted a user study to gather valuable feedback on the design concepts of the recruitment dashboard features described in the previous chapter. Through five user study sessions with experienced recruiters, we gained insights into how end users may perceive each feature that we conceptualized to address bias and recruitment challenges in various pages of the recruitment dashboard. By involving these experienced professionals and gathering their feedback, we aimed to gain valuable insights into the relevance and viability of the proposed feature concepts.

Our study identified specific challenges and potential solutions in various aspects of tools that can support the recruitment process. To address cognitive bias, we proposed alternative formats for bias education, incorporating interactive activities and a feedback system to increase recruiters' awareness and minimize bias. We recognized the importance of anonymity in candidate profiles and proposed a system to hide any identifiable information that could trigger bias. The inclusion of note-taking space and other features within the online interview meeting room was well-received by recruiters, indicating their potential to significantly enhance the efficiency and effectiveness of the interview process.

CHAPTER 6 CONCLUSION

Automated recruitment tools have become increasingly prevalent, yet they face numerous challenges and risks that hinder their ability to fulfill their promises. To create tools that genuinely support and improve the recruitment process, it is crucial to have an in-depth understanding of the perspectives of the main stakeholders: recruiters and job seekers. We aim at addressing this gap in this thesis.

In Chapter 3, we conducted an interview study with recruiters and job seekers, uncovering their perceived risk factors related to bias and misjudgment in recruitment decision-making. We also explored their suggestions for best practices, concerns about automated tools, and desired features. The findings indicated the need to focus on addressing cognitive bias, supporting team decision-making, facilitating decision-making rather than replacing it, and empowering job seekers while assisting recruiters.

In Chapter 4, we explored difference design concepts through a recruitment dashboard as a powerful tool for data-driven decision-making. We created a prototype of a user-centered recruitment dashboard that specifically addressed challenges faced by recruiters and aimed to minimize bias in the recruitment process. Through a meticulous design process, which included creating personas based on interview studies, refining low-fidelity sketches, and producing a high-fidelity design, we tailored the dashboard's features to meet the unique requirements recruiters, while considering the perspectives of job seekers. The resulting dashboard design involved different features to provide valuable support for decision-making, insights-gathering, and enhanced efficiency in the recruitment process.

In Chapter 5, we conducted a user study to gather feedback on the recruitment dashboard feature concepts. Through interviews with recruiters, we gained insights into their experiences, challenges, and feedback on the dashboard. The study identified specific challenges and proposed solutions, such as alternative bias education formats, anonymity in candidate profiles, and improved interview features. The feedback from recruiters pointed directions for us to refine and enhance the dashboard.

In conclusion,This thesis explores user-centered automated recruitment tools, aiming to enhance efficiency and effectiveness by addressing cognitive bias, supporting collaboration, and empowering recruiters and job seekers. The findings provided in this thesis offer valuable guidance to researchers and practitioners involved in the design of automated recruitment tools and related decision support systems. Ultimately, this work contributes to advancing the field of recruitment by bridging the gap between technology and the needs of recruiters

and job seekers.

6.1 Limitations and Future Work

There are several limitations of our current study. First, we were only able to interview ten recruiters and eight job seekers for the interview study and only five recruiters for the user study. Thus, the generalizability of our findings needs to be examined by future studies with larger samples. However, since our recruitment was terminated by data saturation, we believe that our results represent the major concerns of our target users. Second, most of our recruiter and job seeker participants are from North America. Also, all our job seeker participants have received higher education and most of our recruiter participants are from high-tech companies. Thus, our findings are contextualized in the highly educated population in the North American culture and the job market. This limitation is introduced by the physical location and social connection of the authors. Additionally, this culture and job market are most familiar to us so that we can better analyze the data and interpret the results. However, the issues investigated in this study need to be expanded by future work with a global, more inclusive, view.

Moreover, we adopted the interview research method to explore participants' experiences and perceptions regarding recruitment bias and automated tools. This approach, however, focuses on reflection, which may not be the real practice; it also does not reflect the frequency or nature of bias or misjudgement in actual recruitment processes. While we believe this reflection by the participants provided important information to answer our research questions, future studies using observational methods and analysis of recruitment data, including data generated through automated systems, are needed to further explore the related topics, especially those concerning unintended or unconscious bias.

Furthermore, our design of the recruitment dashboard currently represents a conceptual stage rather than a functional prototype. During the user study, our main focus was on capturing participants' reactions to the design concepts rather than evaluating the usability of the system. To address this limitation, future studies can be conducted using a fully functional prototype to assess both the design concepts and the usability of the system.

Finally, it is worth noting that our user study did not include job seekers as participants. This decision was made because the primary users of the dashboard are recruiters, and job seekers would not have direct experience using it. However, we recognize the importance of considering the job seekers' perspective as well. Therefore, we propose that future research focuses on evaluating and incorporating the feedback of job seekers to gain a comprehensive understanding of the tool's effectiveness and usability from their point of view.

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APPENDIX A PERSONAS

Tyler

Technology Enthusiast Inclusive Recruitment Advocate

"Creating a diverse and inclusive tech workforce is not just a goal; it's a commitment that requires constant self-reflection, addressing biases, and embracing change."

Toronto

Bachelors in Human Resource Management

Background

Tyler started their career as a Recruiter and HR Administrative professional, gaining extensive experience in the recruitment process. Recognizing the need for inclusivity and diversity in hiring, Ryan transitioned into a role where he could focus on advocating for inclusive recruitment practices within the tech industry.

Inclusivity Advocate | Tech-Savvy | Collaboration and Communication | Analytical Thinker

Goals and Needs

- Clear Understanding of company requirements and expectations.
- Draft inclusive Job Adverts
- Comprehensive Assessment Process
- Time-efficient CV screening process
- Automated tools with transparency and control.
- Actively addresses bias in their work by utilizing a variety of strategies.

Frustrations

- Overcoming Bias in Recruitment
- Navigating Homogeneity in Tech Team
- Ensuring Transparency and Control in A Tools
- Time Constraints and Limited Resource
- Addressing Underrepresentation
- Adapting to Evolving Industry Trends

Skills

Figure A.1 Persona 1: Tyler

Figure A.2 Persona 1: Initia

Initia

Intuitive Senior Recruiter

"I believe that relying solely on keywords in the job description or using software filters may not be effective in finding the right candidates. Intuition and judgements based on your experience play a crucial role in the selection process."

Montreal

Bachelor's in Business Administration

Background

Initia is a seasoned Senior Recruiter in the tech sector with ten years of experience. Her intuitive and diverse candidate selection approach, along with adept interview skills, sets her apart. She navigates challenges with adaptability and is dedicated to finding top talent for her organization.

Intuitive and insightful | Experienced and mature | Skilled in identifying talents

Goals and Needs

- Identify and recruit qualified candidates who possess the necessary technical skills, experience, and knowledge required for the job.
- Presenting a variety of candidates to the hiring team to promote company's diversity
- Conducts effective interviews to thoroughly assess candidates, especially for evaluating soft skills that cannot be fully assessed through resume evaluation.
- Prefers clear and error-free resumes without spelling mistakes, as lengthy resumes can be overwhelming to review.

Frustrations

- Dealing with resumes containing spelling mistakes and lengthy unnecessary details
- Identifying candidates with rare and hard-to-find technical skills
- Ensuring candidates stay engaged throughout the recruitment process and avoiding candidate dropouts
- Striving for diversity in tech teams and overcoming any resistance to change
- Handling High Volume of Applications

Skills

APPENDIX B INTERVIEW STUDY QUESTIONS - RECRUITERS AND JOB SEEKERS

B.1 Recruiters' Interviews:

These questions were asked in the semi-structured interview with the recruiter participants of the interview study in chapter 1:

B.1.1 *Experience and Roles*

- Please briefly tell us about your process of recruiting. (or in your current job)
- Please briefly describe your job responsibility.
- How many years have you been working as a recruiter?

B.1.2 *Recruiting practices*

- Please briefly tell us about your process of recruiting. (or in your current job)
- Please tell us a particular experience that you have had during your recruiting practices.
  - *[Why do you think this is a particularly memorable experience?]*
- How do you typically examine the CVs to shortlist candidates for a job interview?
  - *[How do you match CVs to job descriptions?]*
  - What types of information do you often focus on or skip?
  - What are the challenges you have had when examining the CVs? [how do you overcome]
- From your perspective as a recruiter, what would be an ideal experience of examining the CVs to shortlist candidates?
- How do you typically formulate job interview questions? *(predetermined questions? mismatch/match between CV and job descriptions)*
- How do you identify opportunities to ask follow-up questions?
- From your perspective as a recruiter, what would be an ideal job interview experience?

B.1.3 *Bias in the recruitment process*

- What are your experiences dealing with bias in the recruitment process?
- Where in the recruitment process do the biases often take place?
- How do you get the awareness of the biases in the process?
- What efforts have you made to avoid unintended biases?
- How do you think automated techniques can affect bias in the recruitment process?
  - *[Please talk about both benefits and risks]*

B.1.4 *Digital tools and technologies to support recruiting*

- What digital tools and technologies have you used to support recruiting? *[If there is any please explain how it works]*
  - *[What are the **benefits, risks, and challenges**?]*
- As you may know, we are envisioning automated techniques and tools that can support recruiting in three different aspects. **(Reminder: Talk about the overall platform and the possible options for the dashboards.)** The first aspect is (1) automated candidate shortlisting (by matching CVs and job descriptions). In your opinion:
  - What would be the most useful feature to include in a tool that supports candidates shortlisting?
  - What would be the risks or challenges involved in using such a tool?

  The second aspect is (2) a dashboard providing support to online recruitment. (Reminder: This is just a plain idea and we want to know their opinions.) In your opinion:
  - What would be the most useful feature to include in such a dashboard?
  - *[What about a real-time dashboard?]*
  - What would be the risks or challenges involved in using such a tool?

  And the last aspect is (3) an automated interview avatar. In your opinion:
  - What would be the most useful feature to include in an automated interview avatar?
  - What would be the risks or challenges involved in using such a tool?

- What are the other aspects of recruitment do you think can benefit from automated techniques and tools?
- In your opinion, how would the biases involved in these recruitment aspects be affected by these automated techniques and tools?
- Do you have anything else to add? Do you have any questions for us?

B.2 Job Seekers' Interviews

These questions were asked in the semi-structured interview with the Job Seeker participants of the interview study in chapter 1:

B.2.1 *Experience and Roles*

- What is your current job title?
- What were your target positions in your most recent job hunting?
- How long did your most recent job-hunting process last?

B.2.2 *Overall job-hunting experience*

- In the context of your most recent job hunting, please tell us about your process (hiring stages).
- What is the overall experience you had during that job hunting process?
  - *[Challenges, good or bad experiences]*

B.2.3 *Job interview experience*

- Please tell us a good experience that you have had during a job interview.
  - *[In your opinion, what are the key elements that made it a good experience?]*
- Please tell us a bad experience that you have had during a job interview.
  - *[In your opinion, what are the key elements that made it a bad experience?]*
- What types of questions have you been often asked during job interviews?
  - *[For each type: What were your experiences answering this type of questions?]*

- From your perspective as a job seeker, what would be an ideal job interview experience?
  - *[In your opinion, what factors can contribute to creating such an experience?]*
- What are the challenges you have had during your overall job-hunting experience? *[We will prompt for areas such as looking for matching opportunities, understanding job descriptions, interacting with the recruiter before, during, and after the job interview, etc.]*
  - *For each challenge, how did you overcome it?*

B.2.4 Bias/Uncertainty

- From your perspective, ideally, what factors should be considered for an applicant to be accepted for a job?
- In reality, what other factors would influence the decision making process?
- Have you experienced any situations in which those factors influenced your job hunting?
  - *[What are your experiences dealing with bias in the recruitment process?]*
- What efforts have you made to avoid unintended bias?

B.2.5 Digital tools and technologies to support recruiting

- In your job hunting experience, have you noticed that a digital tool or technology is used, if any?
- What digital tools and technologies have been used, if any? *[For each tool or technology mentioned:]*
  - Please tell us how you think it works.
  - What were your experiences about it? *[We will prompt for perceived benefits, risks, challenges.]*
- How do you think these tools and technologies would help recruiters address bias and unintended bias?
- If there were any technologies used, what do you think they are used for or how do they are used?

- *As you may know, we are designing a tool for recruiters that supports recruiting by providing some new functions. The first function is (1) automated candidate shortlisting (need more explanation) . In your opinion:*
  - What would be the most useful feature to include in a tool that supports candidates shortlisting?
  - What would be the risks or challenges involved in using such a tool?

  The second function of this tool is (2) a dashboard providing (real-time) support to online job interview sessions. In your opinion:
  - What would be the most useful feature to include in a tool that provides real-time supports to interview sessions?
  - What would be the risks or challenges involved in using such a tool?

  And the last function is an automated interview avatar. In your opinion:
  - What would be the most useful feature to include in an automated interview avatar?
  - What would be the risks or challenges involved in using such a tool?
- What benefits and risks do you think automated techniques can bring for recruiters to address bias and unintended bias?

APPENDIX C USER STUDY QUESTIONS

These questions were asked in the semi-structured interview with the 5 recruiter participants of the user study in chapter 4:

C.1 Experience and roles

- What is your current job title?
- Please briefly describe your job responsibilities.
- How many years have you been working as a recruiter?

C.2 Recruiting practices

- Please briefly tell us about your recruiting process.
- Please tell us about your challenges in the process.

C.3 Digital tools and technologies to support recruiting

- What digital tools and technologies have you used to support recruiting? *[If there is any please explain how it works]*
  - *[What are the benefits, risks, and challenges?]*

C.4 Bias in the recruitment process

In our previous research on bias and misjudgment in the recruitment process, to avoid conflict, we used the most common definition when talking about them. Considering the Oxford English Dictionary's definition of these terms in the context of recruitment, "bias" describes the recruiters' conscious or non-conscious prejudice for or against a group of candidates, while "misjudgment" describes the various inaccurate estimations that recruiters can make when assessing a candidate.

- What are your experiences dealing with bias and misjudgment in the recruitment process?

- What efforts have you made to avoid unintended biases?
- What do they think is needed to mitigate bias and misjudgment in your work? (in the recruitment process)
  - What do you think is needed to identify bias?
- How do you think automated techniques can affect bias in the recruitment process?
  - *[Please talk about both benefits and risks]*

C.5 *The Tasks*

Now, I present to you 4 pages of a prototype we have designed based on the findings of our previous work. On each page, I will ask your opinion on different features one by one. Please consider that this is not a usability test, and mostly, we want to know your thoughts about the features' potential to address bias and misjudgment. Please keep in mind This prototype is not a finished product; we have only included the features that we plan to research and evaluate for their potential to reduce bias and error in judgment.

- What did you like about this feature, and what didn't you like about it and why? Do you expect to see something you don't see here?
- Would this feature address any kinds of challenges (related to bias, misjudgement, or not) you have been facing? and how? (how can it address the bias in their workflow?)
  - *[If no]*How do you think one can address this challenge?

The Features I will explain the features one by one on each page.

- item Home Page
  - Banner feature
  - Data Analytic Feature
  - CV Recommendation Feature
  - Rejected CVs Feature
  - Process Overview Feature
- Job Description Page

  - CV Filtering Qualification
  - Job Description's Edit and Share Feature
  - Commenting Feature
- Applicant's Page
  - Traits' Analysis Feature
  - Recommended Applicants Feature
  - Notes Feature
- Online Meeting's Room
  - Real-time Recommendation Feature
  - Note, Transcript and Resume, and Interview Questions Features

At the end of all the tasks...

- What did you see on the platform that you liked?
- What do you like to see on the platform but don't see?
- How would a platform like this help you address bias and misjudgement in a recruitment process?

APPENDIX D THE DASHBOARD DESIGN

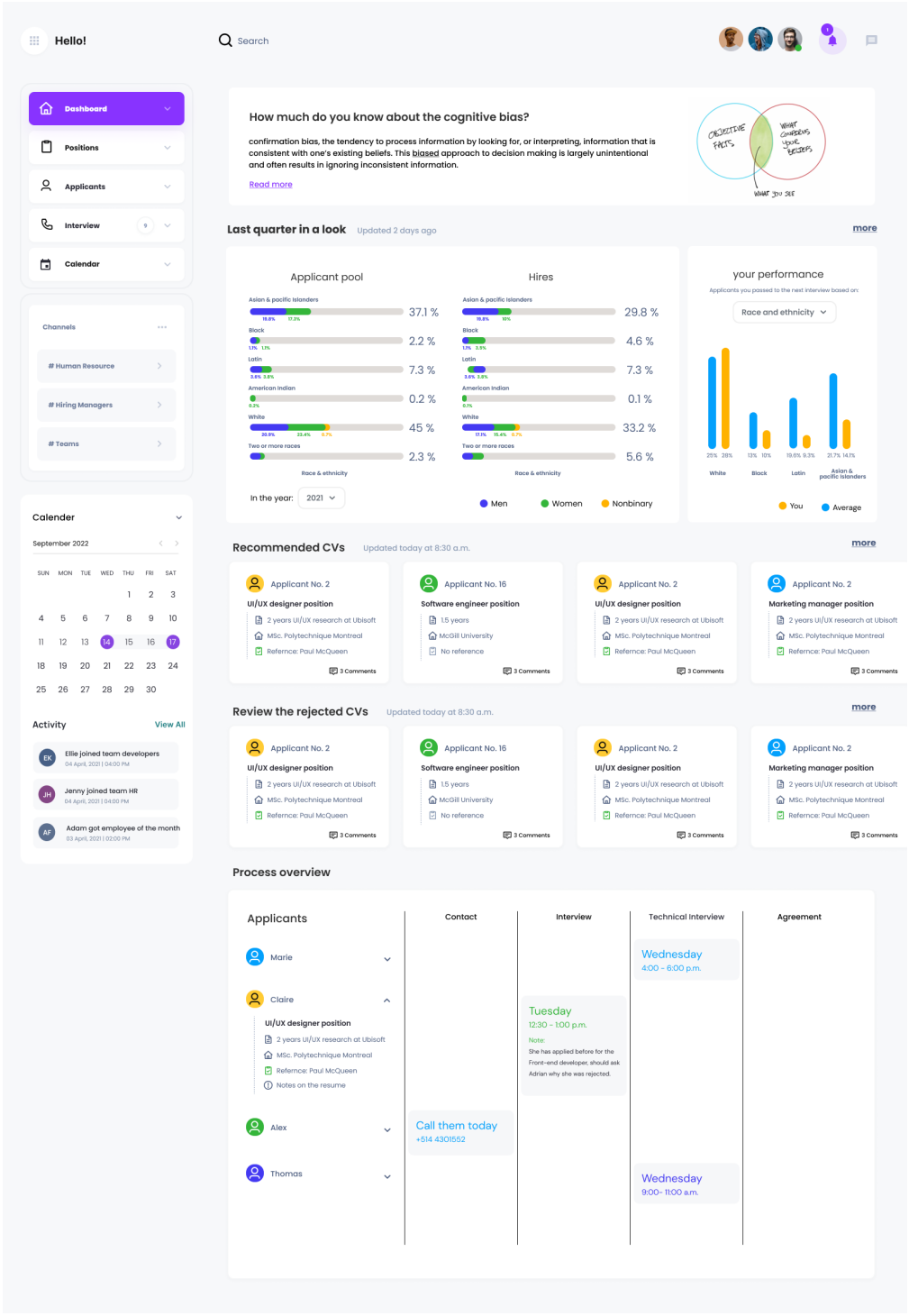

Figure D.1 Home Page

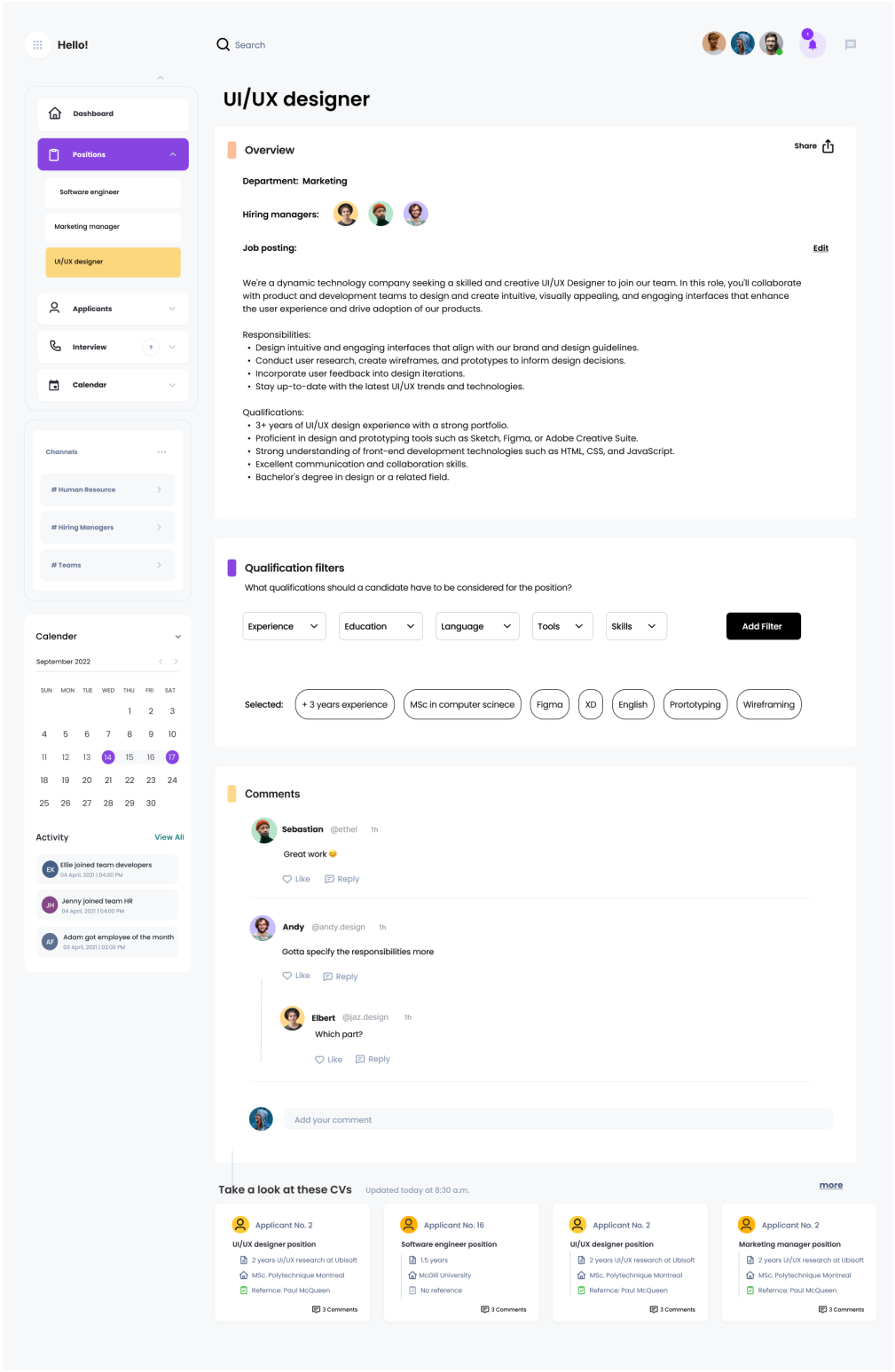

Figure D.2 Job Description Page

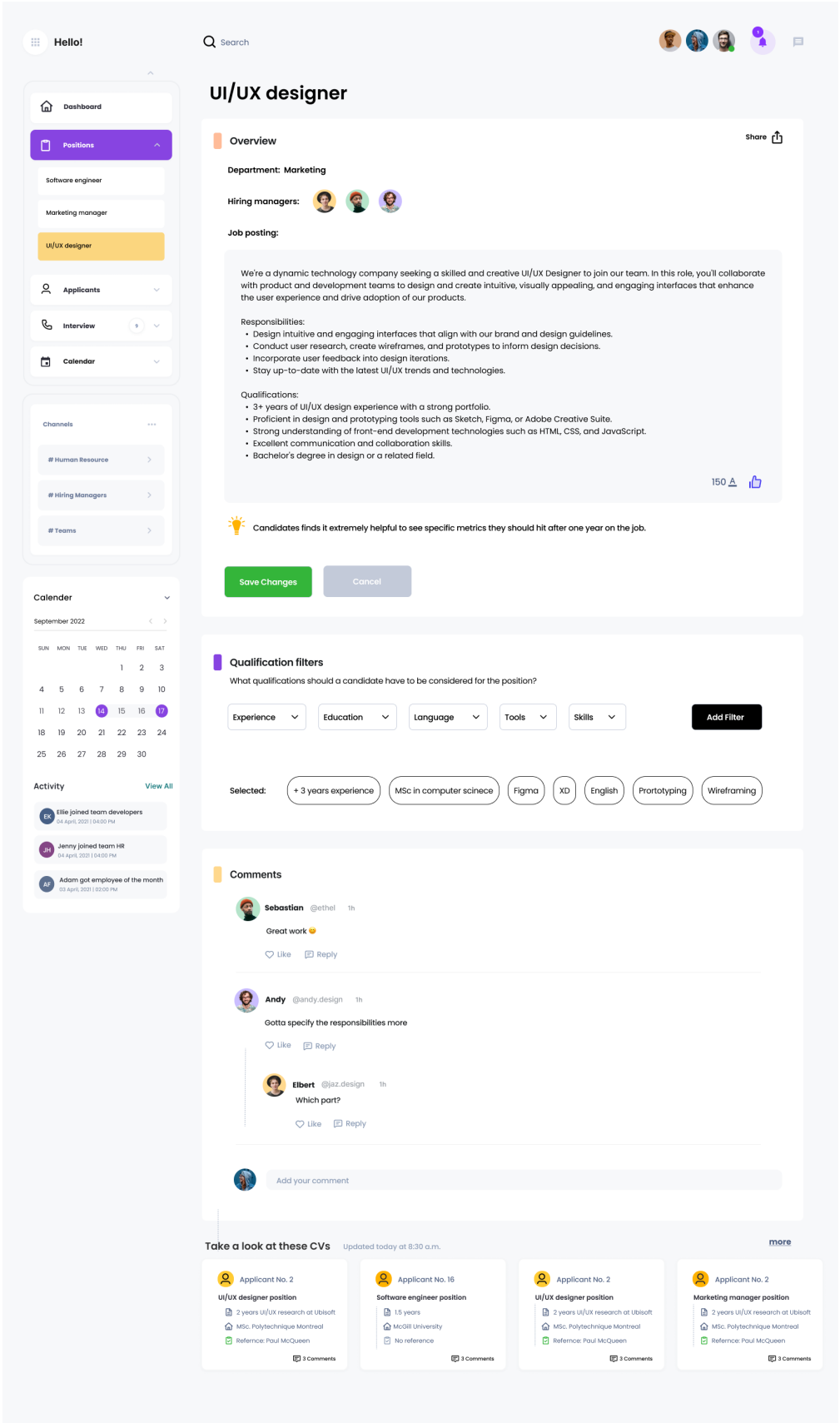

Figure D.3 Job Description Edit Mode in Job Description Page

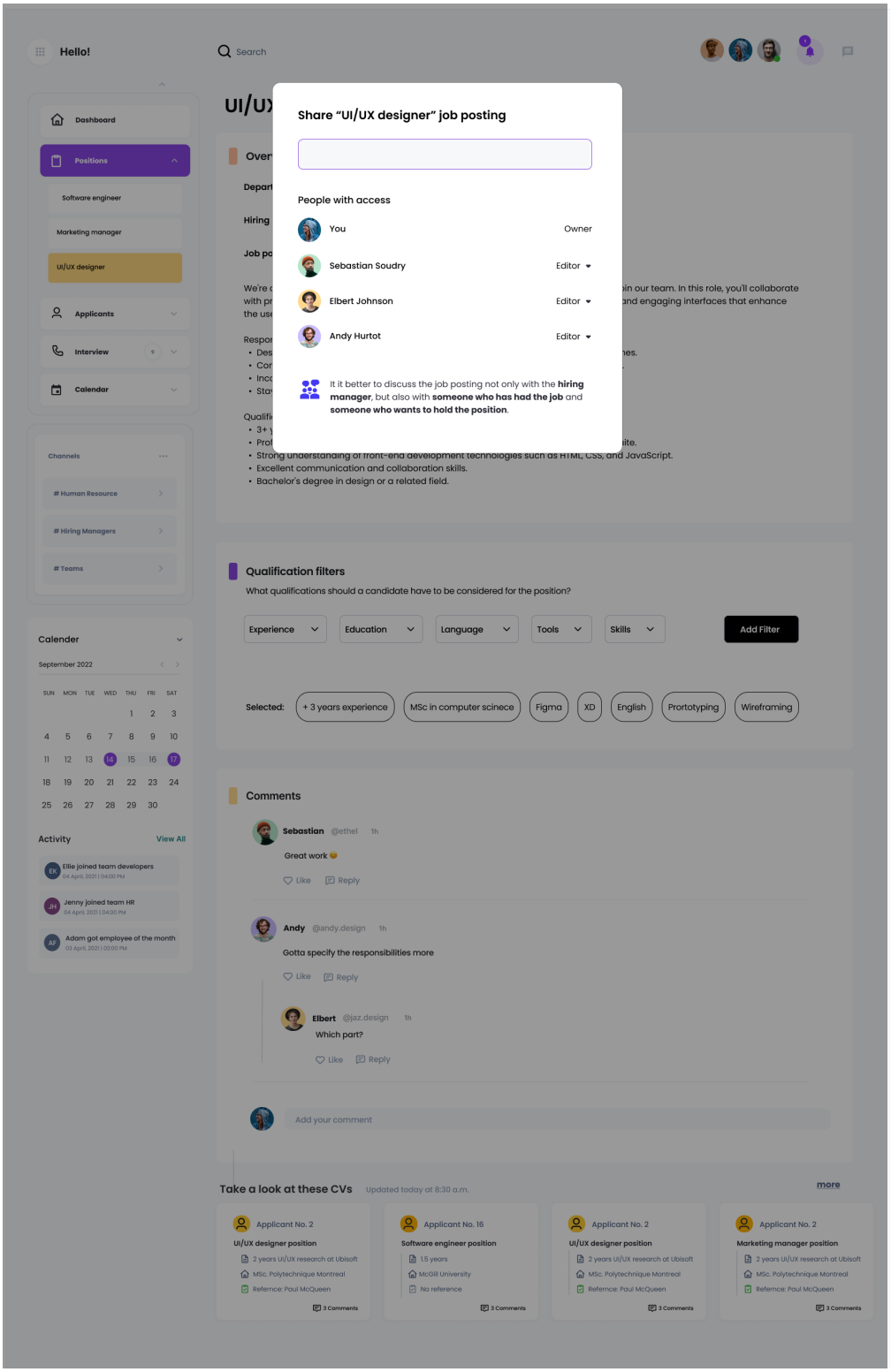

Figure D.4 Job Description Share in Job Description Page

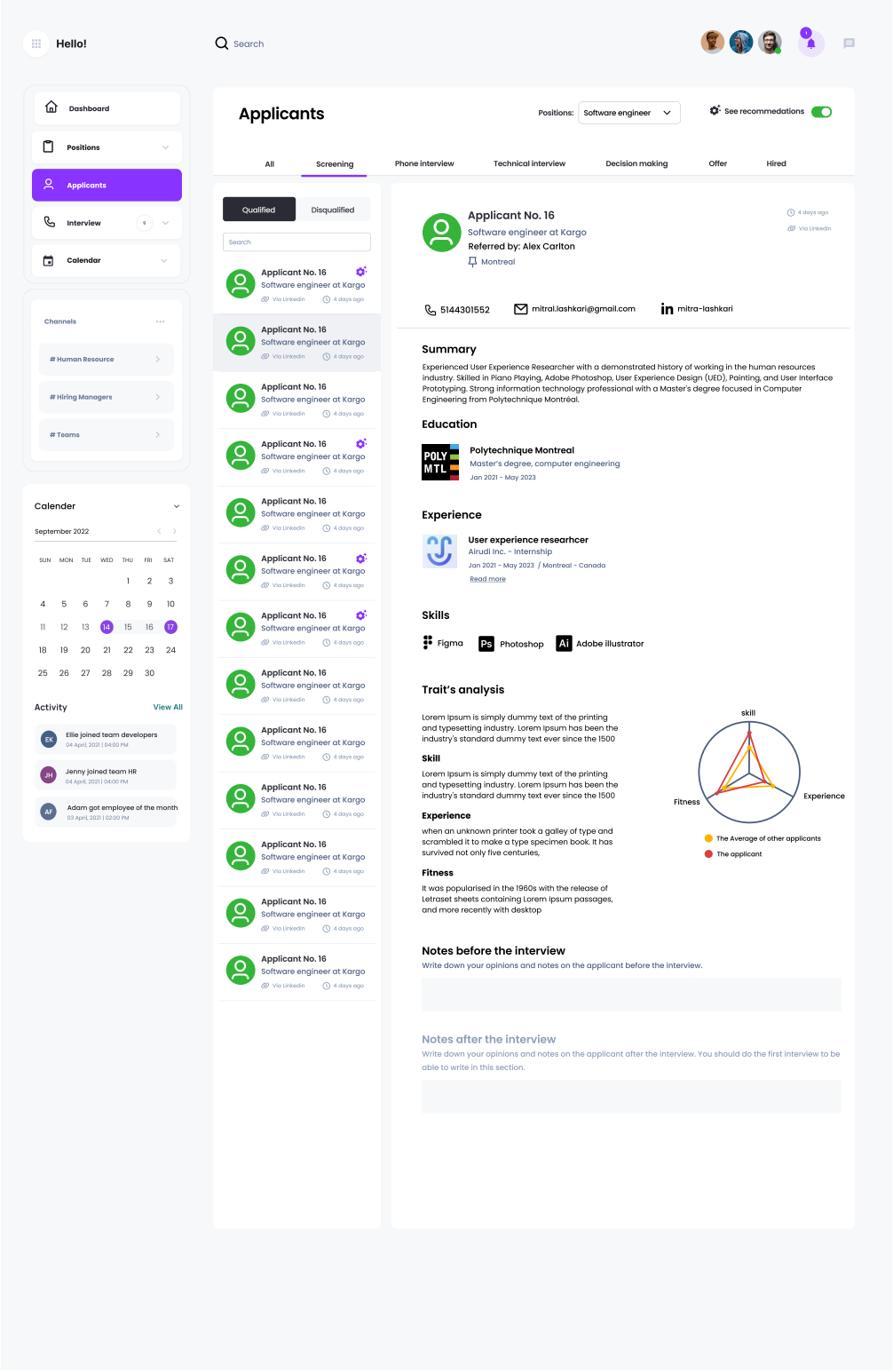

Figure D.5 Applicants Page

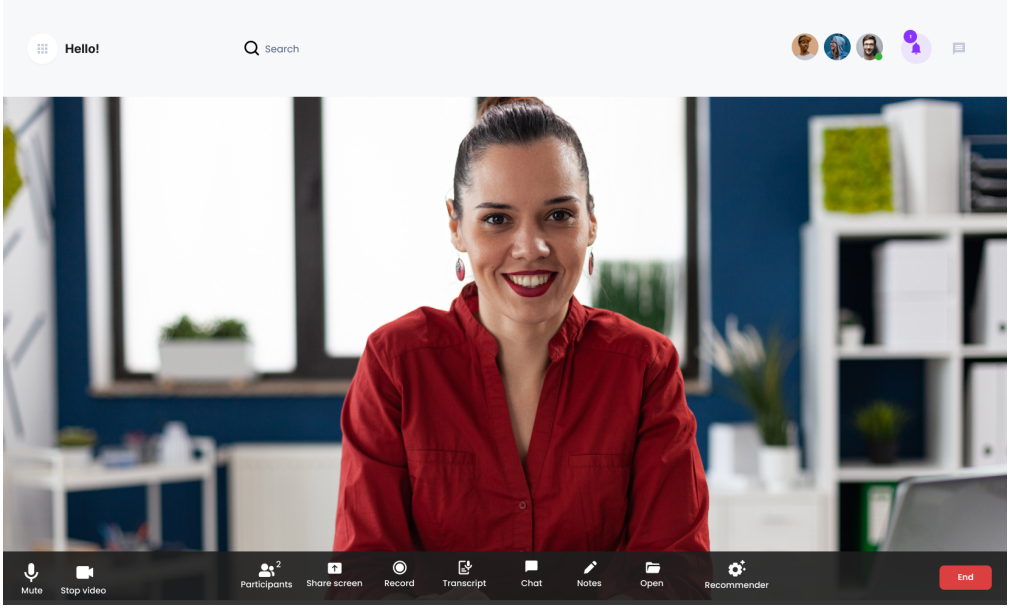

Figure D.6 Online Meeting Room

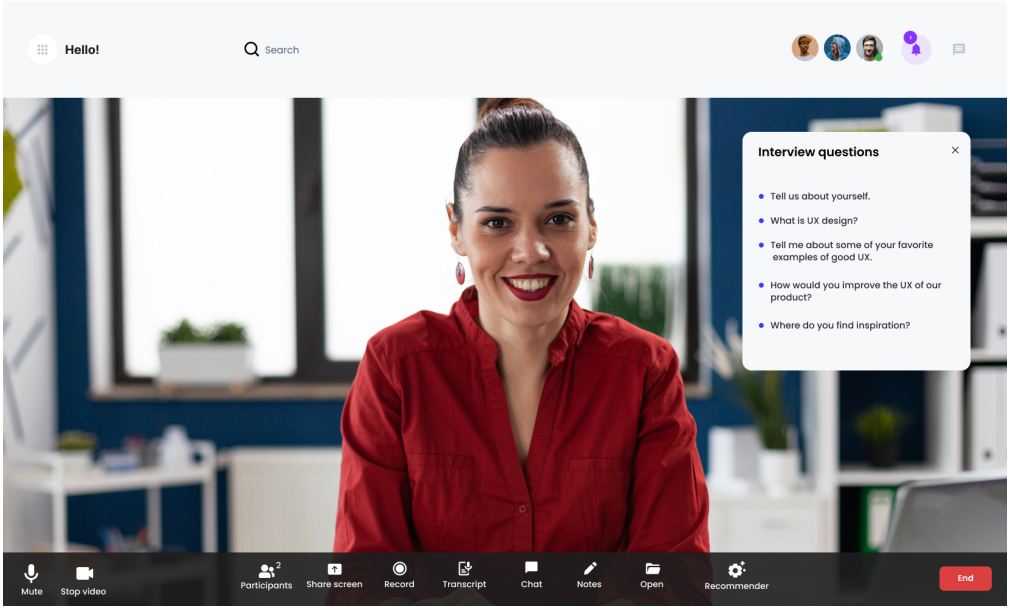

Figure D.7 Interview Questions in the Online Meeting Room

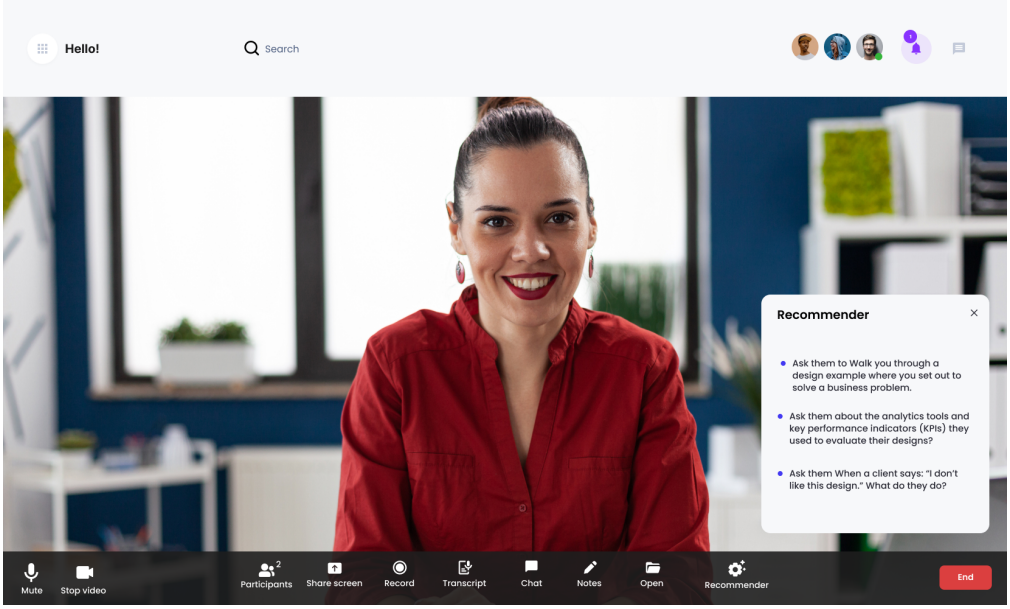

Figure D.8 Recommendation in the Online Meeting Room

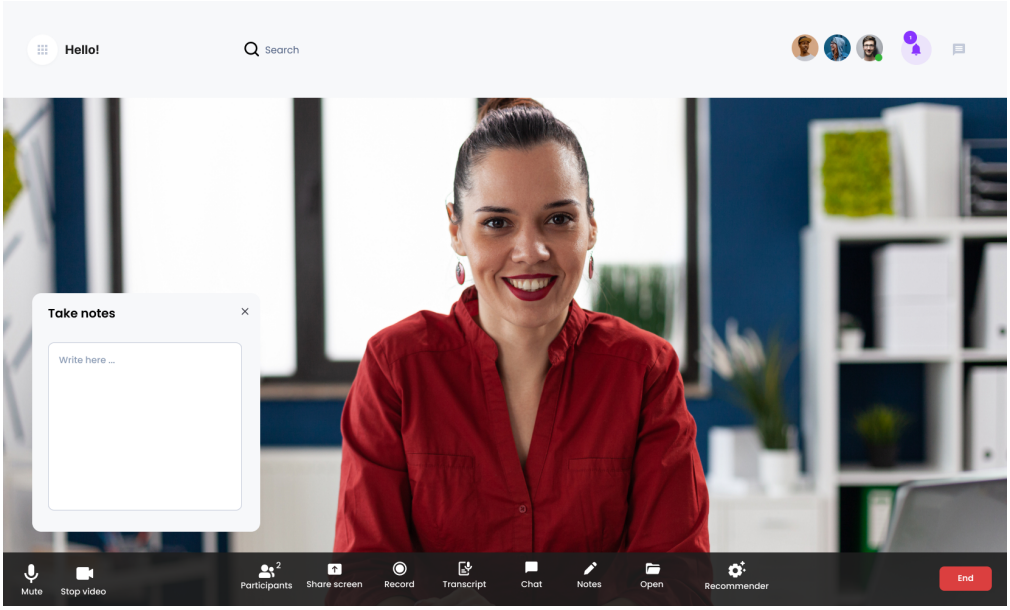

Figure D.9 Note Taking Space in the Online Meeting Room