Master 2 in Computer Science - Interaction Specialty

Visualization for Academic Hiring

Author:
Yumin Hong

Supervisors:
Pierre Dragicevic
Petra Isenberg

Hosting lab/enterprise:
Aviz, Inria

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Secrétariat - tel: 01 69 15 66 36 Fax: 01 69 15 42 72
email: Murielle.Benard@u-psud.fr

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Summary

Academic hiring committee members usually have difficulties when they evaluate the application materials: Going through the huge amount of unstructured information, comparing applicants, and discussing their ranking during the committee meeting. The objective of the thesis is to see whether a visualization tool can alleviate these problems, improving not only academic recruitment outcomes but also user experience during the process.

In the literature review, I analyzed the current evaluation methods used in academic hiring through literature research methods and presented their limitations. Meanwhile, I examined the application of visualization approaches in this context, and discussed research topics that have received little attention.

I conducted interviews and an online survey to understand the hiring process of French research institutes and figured out the behavior patterns and problems of evaluators in academic recruitment. These results helped me identify the design goal and the description of usage context. In the design process, nine design concepts were prototyped, and I developed the final one by javascript, which was used in evaluation studies.

The study suggested that visualization could have many positive impacts on academic hiring by reducing the time spending on reviewing applicant's materials, providing an overview of all applicants, helping evaluators better understand information, and serving as a medium for discussion. After that, the limitations of my work and future work are discussed.

Keywords

Information Visualization, Academic Hiring, Publication visualization

CHAPTER 1

Introduction

1.1 Motivation

Academic recruitment is often a complex process. When hiring new researchers, universities and academic institutions often require applicants to provide qualified application materials, which are sometimes called application packages. An application package contains the candidate's detailed curriculum vitae (CV) and a range of supporting documents such as Ph.D. defense report [1]. At the initial stage, the hiring committee members review, evaluate and discuss the content of these materials to select candidates. The information in the application package is in large amount and complex, as well as unstructured. This requires hiring committee members, including members with relatively little experience, to spend a lot of energy and time searching, locating, organizing, and summarizing information during the evaluation.

The human visual system provides a high bandwidth channel for dealing with information. Compared to the extraction of information from text, visualization helps users improve the capacity to receive and understand information beyond the limitations of internal cognition and memory [27]. Although there has been research on visualizing personal histories and scientific output, and tools have been proposed for visualizing CVs on the market, as far as we know, no one has yet researched or designed visual tools for helping with academic hiring.

1.2 Research Objective

This thesis targets academic hiring committee members as final users, who want to select researchers that are a good fit for the institution and are likely to have a scientific impact in the future. The objective of this thesis is to see whether a visualization tool can improve not only recruitment outcomes but also user experience. Therefore, a visualization tool should be designed to increase the accuracy and quality of the evaluations, as well as efficiency and confidence of user during the hiring process.

1.3 Methodology

In this thesis, I started with a literature reviewing about related topics: I reviewed current academic evaluation methods and their drawbacks. Since I focus on a visualization approach, I introduce previous works on visualizing publication information and career experience, and discuss their limitations. As part of the user research,

I conducted interviews of academic hiring committee members to understand the recruiting process and user problems, as well as online surveys to better understand how researchers may use visualizations in their online profiles and application materials. I combined the brainstorming, prototyping, and heuristic evaluation methods during the design process to verify design concepts iteratively. In order to study the influences of this visualization tool on the hiring process, I ran a evaluation study simulating an academic hiring committee with three participants. By analyzing the study results with both qualitative and quantitative methods, I validated my design goal then discuss its limitations.

1.4 Contribution

The key contributions in this thesis consist of: (1) a review of current evaluation methods and visualization approaches relevant to the context of academic hiring, (2) an analysis of user scenarios and problems in the academic hiring process, (3) several visualization design concepts meant to improve the quality of academic hiring output and user experience during the process, (4)a discuss about the influence of visualization in academic hiring.

1.5 Thesis Organization

The structure of this thesis will be organized as follows: **Chapter 2 (Related Work)** describes the problems of current evaluation approaches in academic hiring. Then it discusses previous research on visualizing publication records and personal career experience, and finally discusses research topics that have received little attention. **Chapter 3 (User Research)** describes the interviews with four hiring Committee members in French academic institutions, as well as the surveys about real examples of visualization in academic context through E-mail and online search. This chapter also describes the hiring process and user problems that need to be addressed. **Chapter 4 (Design)** presents the design process. First, it introduces the usage context and design problems. Then it lists the data used for visualization design. Finally, it describes four main design concepts and iterations, and some elaborations of design detail. **Chapter 5 (Evaluation)** introduces two studies on evaluating one of the visualization designs. Then it describes the study methodology and processes, and the results from the observations and user feedback. **Chapter 6 (Discussion)** discusses the limitations of the proposed visualization designs and the possibilities of improvements in the future. **Chapter 7 (Conclusion)** concludes the thesis and summarizes the contributions of the presented work.

CHAPTER 2

Related Work

Previous work has emphasized the limitations of current evaluation approaches in academic hiring, such as oversimplification [10, 24], over-relying on evaluator's ability [13] and over-confidence in judgments [15]. In addition, going through application packages is tedious, error-prone and time-demanding. In order to alleviate these problems, this thesis focuses on a visualization approach. In this chapter, I present related work about visualizing publication data and personal experience, and discuss their limitations in the context of academic hiring.

2.1 Academic Evaluation Approaches

Evaluation approaches in academic hiring include bibliometrics and qualitative methods. In this section, I introduce some frequently-used approaches in academic recruitment contexts and discuss their current limitations.

Bibliometrics

In academics, scientific output is often a significant part of how a researcher is evaluated. In the process of academic hiring, recruiters would like to have an overview of the candidate's research performance in a quick and effective way. Bibliometrics, which is "the application of quantitative analysis and statistics to publications such as journal articles and their accompanying citation counts" [31], becomes a major quantitative analysis approach in this context, and provides a certain perspective on the analysis of research activities and achievements. Bibliometric indicators are related to visualization for academic hiring because they could either be used as an alternative to visualization, or as additional data to visualize. Commonly used indicators of bibliometrics include *Citation*, *H-index* and *Journal impact factor*.

A lot of researches have however pointed out the defectiveness of these quantitative indexes. Firstly, the meaning of citation counts is doubtful, since they only measure the usefulness of papers to the authors of other papers rather than measuring the impact of those papers on anything else [10]. Then, each citation should not be given equal weight because the citing purpose is uncertain. There are various motivations for citing, including positive purposes (e.g., acknowledge intellectual influences) and negative ones (e.g., disclaiming work or ideas of others), even for non-scientific reasons (e.g., paying homage to peers) [11, 36]. Furthermore, a study pointed out that citation impact is not significantly correlated to perceived impact [30], and some researchers claimed these kinds of indexes are too simplistic to evaluate their complex research

works fairly [24]. Additionally, when comparing works from different research fields, these indicators fail [10]because the amount of publications in different discipline varies. Many studies explored more optimal quantitative indicators [36, 8], but there are still some drawbacks and in the end, these metrics are not widely used. Even if an innovative indicator is created then gets popular, it will possibly follow Goodhart's Law [3], which implies "when a measure becomes a target, it ceases to be a good measure." This is probably why the usefulness of citation-based indicators decreased in recent years [19].

Taking advantage of large-scale publication data, researchers have started to study the underlying factors that drive scientific success, or patterns of successful academic careers. Researchers are now better understand good career trajectories, but they found that the highest-impact contributions in an outstanding scientist's career are randomly distributed across all their works [33]. However, by focusing on how such simplistic indicators correlate with past success, this data mining approach can easily hinder innovation and exacerbate existing inequalities in the scientific system [14].

Curriculum Vitae, Letters of Recommendation and Interviews

Because of the major limitations of bibliometrics, text-based qualitative assessment methods are almost universally used for evaluating candidates for academic positions. These qualitative methods include reviewing Curriculum Vitae (CV), Letters of Recommendation (LoRs), as well as interviews. Unlike bibliometrics, Reading CVs to evaluate a candidate in academics, requires evaluators to spend time gathering and comprehensively summarizing past scientific achievement of a particular candidate. Not only the contents of the documents, but also an evaluator's ability to extract information will influence hiring decisions [13], which means relying on text-based reviewing activity is error-prone.

Unfortunately, like CVs, letters of recommendation (LoRs) are regarded as a poor predictor of performance, especially in graduate admission scenarios, due to the incentives, leniency of referrers, and their knowledge about the applicant [16, 17, 7]. Even if LoRs are weakly correlated with various performance aspects [23], there are still five traits categories of descriptive adjectives in LoRs that have been suggested to be valid predictors: mental agility, vigor, dependability-reliability, urbanity and cooperation-consideration [7, 28].

Interviews are an alternative choice to thoroughly evaluate a candidate, from the professional skills and scientific ability to even personality. However, an unstructured face-to-face interview has been shown to be a poor predictor of a candidate's subsequent performance, sometimes recruiters will even fall into the situation of overconfidence in their own judgment ability during an interview [15].

Evaluating candidates is extremely difficult. There is no perfect solution. Currently, a reasonable approach is to evaluate applications thoroughly and discuss extensively, but searching for information takes evaluators much time and is likely error-prone. Therefore, using visualizations as part of the process could help.

2.2 Visualization of Academic Careers

Information about academic careers consists of scientific output and career trajectory. Previous researchers have visualized these data and proposed several visualization approaches. In this section, I present related work about visualization practices, then discuss the limitations of these research works.

Visualizing Publication Records

Publication records contain rich information useful for academic hiring. The evaluation of publications not only involves bibliometrics, but also considers the content and impact of the work itself, the time distribution of publications, the collaboration networks, and so on. Existing digital publication libraries (e.g., Google Scholar, Microsoft Academic, Scopus, etc.) provide a very basic presentation of author-centered data, through only simple layouts and representations, instead of rich visualizations. For example, Google Scholar, shown in Figure 2.1(a), uses a histogram on the profile page to show the citations in the last seven years, and shows the collaborative network in the form of a list.

Latif and Beck introduced a web-based visual analysis tool called *VIS Author Profiles* to present publication records and researcher profiles [25], which is shown in Figure 2.1(b). The system provided a novel way for combining both text and visualization to represent publication information, by embedding interactive small visualizations into the descriptive text of profiles. In this work, the system was validated by simulating an academic hiring scenario, and it was suggested to be valuable in terms of representing temporal publication distributions, research topics, and collaboration networks.

SurVis, as shown in Figure 2.1(c), is a visual analytics system for bibliographic searching [9]. The embedding of sparkline visualizations in publication details and the enriched timeline representation inspired my work. Rind et al. conducted a design study to develop the system *PubViz*, providing an autobiographical publication information solution with several separated blocks that visualize amount, keywords, and co-authors of someone's works [32]. To address the problem of publication impact, Maguire introduced an innovative visualization that represents each citation impact by a glyph representation [26].

Existing solutions do not address the problems in the specific scenario – academic hiring – that I target with my thesis work. Although these visualizations reflect

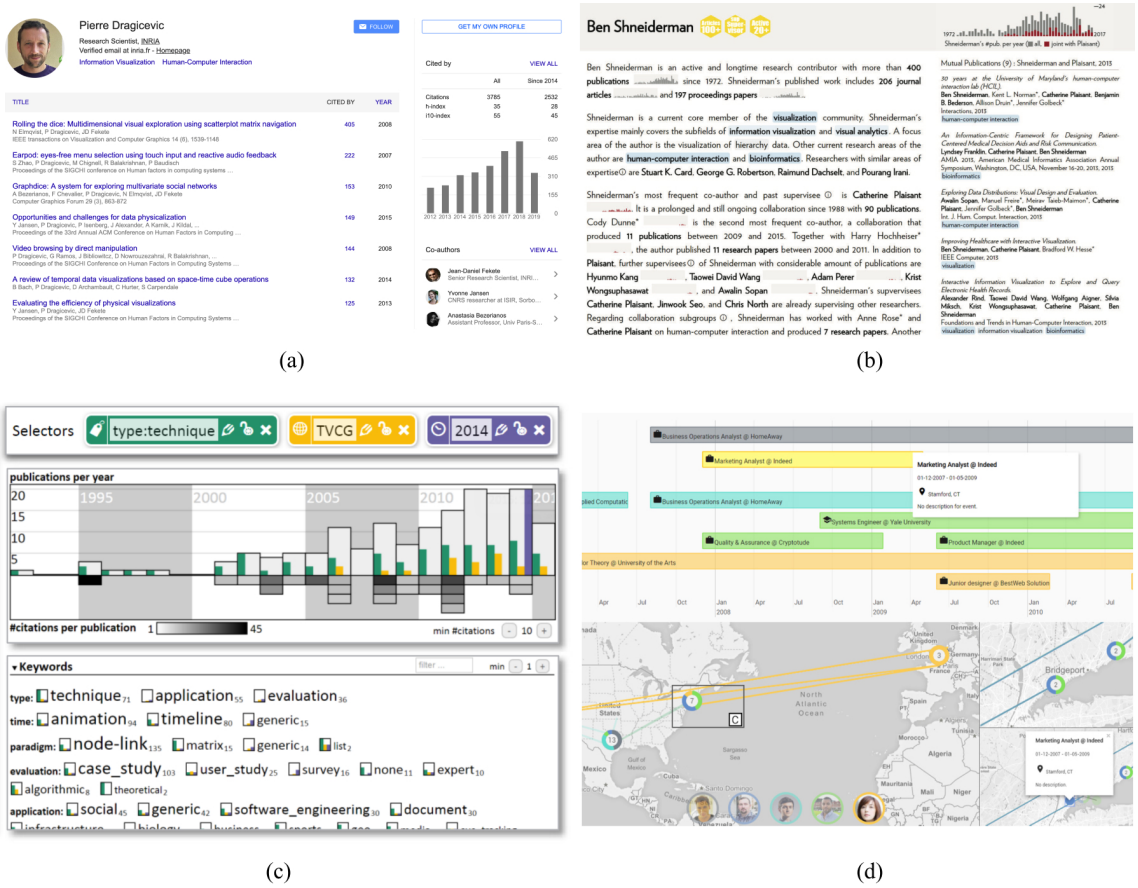

Figure 2.1: Related works of visualizing publication records and career experience: (a) Google scholar; (b) VIS Author Profiles; (c) SurVis; (d) CV3

publication data, it is difficult to compare multiple people, which is essential in recruiting scenarios. Moreover, evaluators need to consider all aspects comprehensively, such as scientific outputs, mobility, education background and collaboration ability. Therefore, the goal of my work is to expand on past approaches by providing the capability of visualizing information from other sources as well, such as CV, at the same time.

Visualizing Personal Experience

Academic hiring committee members need to understand an applicant's career trajectory. This career experience is reflected in their education background, mobility, teaching experience, reviewing experience for conferences and journals, and changes in research directions. Visualizing complicated autobiographical information is not easy,

especially when there is a lot of unstructured data from different sources. In terms of academic recruiting, Thudt et al. pointed out that one challenge is integration, that is, combining data of diverse aspects [34]. A strategy is using temporal, social and location-based connections as multiple links [34], assisting in constructing the whole story for the audience. Fung et al. studied three visualization techniques: node-link diagrams, adjacency matrices, and botanical trees to visualize a researcher's academic experience [20]. The results suggested that these representations have both advantages and drawbacks, and it depends on the task. But there is little doubt that the timeline is the most popular form used for personal experience visualization. According to research from Brehmer et al., the linear timeline is the most common way to represent the timeline, which guides the audience to acquire the information following a certain order [12].

Many research papers introduced new solutions for visualizing personal experience. *LifeLines* were proposed as a simple visualization to represent multiple personal history records [29]. It was suggested that the tool could reduce the chances of missing information when reading paper records, and could help the user recognize trends. As for recruitment purposes, there are already many tools for visualizing or beautifying CVs on the market, for example, *Represent* [4], *Visual CV* [6], and *EnhanCV* [2]. These online tools only provide basic visualizations on the resume, and are far away from visualizing someone's whole career life. *CV3* goes further, by combining multiple sections associated with spatio-temporal, nominal, hierarchical, and ordinal data, thus offering a novel way to recruiters to explore, assess, and compare different candidates' CV [18]. Its screenshot is shown in Figure 2.1(d). The system targets a hiring scenario and uses different visualization for comparing professional skills, career timeline, and mobility, but it has been designed for industry instead of academics.

2.3 Summary

Although bibliometrics hides the rich data, it is an intuitive and straightforward way to show the overall academic achievements of researchers. Text-based assessment methods are often less reliable due to the individual differences of recruiters, but people still rely on them to gain insights in such abundant information. Therefore, in this thesis, I will focus on how to represent the data more effectively, so that users can acquire rich information straightforward and easily during hiring process. As for existing visualization solutions, there is none providing a visualization system for both publication records and personal career experience at the same time, while being specific for the academic hiring scenario and offering the ability to compare candidates.

CHAPTER 3

Requirements Analysis

Through the literature review, I established a general direction of research: how to improve academic hiring with visualization support? In order to understand the details of a specific academic hiring process and the problems hiring committee members might encounter in this context, I interviewed four researchers with past experience in academic hiring in France. In parallel and in order to understand how researchers utilize visualization to present themselves, I conducted an online survey through e-mail. In this chapter, I introduce the methods, processes, and results of these two complementary parts of my requirements analysis, and then I discuss the user problems that can be solved by design in the next stage.

3.1 Interviews

The goal of these interviews was to have a deeper understanding of the academic hiring process and the problems encountered by committee members. The analysis of user behavior, thoughts, and feelings in this context can benefit my thesis in identifying more specific design requirements.

Methods

I interviewed four researchers (two male, two female), who were involved in academic hiring committees in French research organizations recently. Three of them were from research institutes, one was from a university. Their research domains were different (Database, Distributed Systems, Human-Computer Interaction and Numerical Analysis). Three of them were experienced (they were involved in hiring committee more than ten times), while it was the first time for the last one.

All participants were interviewed in their own office for about one hour. At first, I asked them about background information (e.g., job title, details of the organization), the hiring procedure at their organization, and their responsibilities on a recent committee. Then I asked more detailed questions about their behaviors and thoughts on reviewing, evaluating, comparing and discussing during different stages of the process. Three of them used a visualization tool designed by one of my supervisors, Petra Isenberg, in their latest hiring committee meeting, so I probed their opinions about this tool while I asked the other interviewee to think about the possibilities of embedding visualization in the application package.

During each interview, I recorded audio and ensured the confidentiality of the interviewees' personal information. Then I transcribed the recording into text and

Stage	*Duration*	*Tasks*
1. Individual Reviewing	Two weeks	Give a comprehensive review Give a grade Write a summary
2. First Committee Meeting: Preselection	Half day	Decide who should be interviewed
	Four weeks Interval	
3. Second Committee Meeting: Interview	A day	Interview applicants selected in the first meeting one by one
4. Third Committee Meeting: Admissibility	A day	Categorize the applicants Decide a final rank

Table 3.1: Academic Hiring Process described by Interview participants

analyzed the content for the next step. The total duration of the recordings exceeded 175 minutes, which took me fifteen hours to transcribe.

Results

The results are divided into two parts: the specific academic hiring process of French research organizations, and the behaviors of the hiring committee members in the process.

Academic Hiring Process

The academic hiring process described by the participants during the interviews is shown in Table 3.1. The research organizations the participants covered included Inria and Sorbonne University. According to the interviews, although some tasks and implementation methods of institutes and universities are slightly different, the whole process and the stages are generally similar.

Each applicant is asked to provide an application package according to the requirements of the organization. This submission will be sent to the hiring committee. Each application package will be reviewed by two committee members separately in the beginning. In research institutes, the pair of reviewers is chosen to be close to the research domain of the applicant, in university recruitment the pair consists of an internal staff and an external researcher. Each reviewer has to write an evaluation

summary (or report), using a standard form, then give a grade (rank as A, B, C). After the first stage, there are three meetings among the committee members. In the pre-selection meeting (the second stage), each the committee decides those competitive applicants they want to interview in the next interview meeting (the third stage), which will be held after around four weeks. Directly after the interviews were held, they will meet again to rank and categorize the applicants (The fourth stage).

Experiences in Academic Hiring

In this subsection, I describe what the respondents experienced in a recent academic hiring, including their behaviors and thoughts.

(1) The methodology of individual reviewing: During the interview I asked the interviewees what tools did they use in individual reviewing. Two experienced interviewees said that they often rely on their own experience and intuitive feeling when reviewing candidates' application materials. One of them said *"When you have as much experience that I have, I know exactly in the files where to look for, every bit of information that I'm looking for, so it's much simplified in my case by experience"*. The other interviewee with little experience also tried to get a "feeling", but she found it challenging to find and integrate information in the documents. The last one believed a visual approach could improve review efficiency. He said what he usually do was to take a blank paper, then put every candidate on a scale based on subjective judgment, and sometimes put some comments. Finally, he made a graphical view of the candidates.

(2) Evaluating applicants from research fields different from one's own: To answer the question about the ways to evaluate applicants in different research fields from theirs, all interviewees indicated that they would turn to experts in the corresponding research field when they encounter this problem, either through a personal relationship or through discussions with other committee members. One of them said that he would also refer to the rankings of journals and conferences on the website called *CORE Ranking*[1], as he said *"It is not very good but it is interesting. It gives some ideas."*.

(3) Comparing applicants: As for my questions: how did you compare applicants, they believed comparing often requires a lot of mental and physical energy at the same time, as one of the interviewees said: *"I find it is difficult to keep an overview of the profile of a person because it is very complex. There are so many details in their history that it is very difficult to keep an overview and to be able to really compare people...I think what I need is something that really helps my memory of... quickly switching between different profiles."* Since everyone has limited understandings of different research fields, in most cases, the difficulties brought by such comparisons

[1] http://www.core.edu.au/conference-portal

Category	*Problems*
Reviewing application packages	1.Too much text to read and search 2.No standard form for every piece of information 3.Handwritten documents are hard to read
Evaluating scientific outcomes	4.Evaluate the usefulness and applicability of their work 5.Domain-dependent publication standards 6.Hard to predict the potential fairly 7.Knowledge barrier between different domains
Comparing candidates	8.High Memory Load: Hard to always keep the overview of numerous applicants' profiles in mind 9.High Physical Load: Need to switch between different applicants' profiles quickly 10.Hard to compare applicants from different domains 11.Easy to become subjective

Table 3.2: Problems encountered by the hiring committee members

will be solved through discussion. Despite frequent disagreements, interviewees said that through constant communication, such disagreements could easily be reconciled. **(4) Reviewing publications:** When talking about the evaluation on publications, two of the interviewees would go through all of an applicant's publications very quickly, even when they are not in the same research field as the applicant's. The citations were not taken too seriously by interviewees, and they believed that most researchers do not pay too much attention to this number: *"It is not fair to the researcher, and even more if it is a young researcher because it does not make any sense that this younger career."* Additionally, one of them said *"If you merge different subjectivity, then, in the end, you know you will have some objectivity."* Besides, the time distribution of publishing and implicit Ph.D. background of candidate's work were mentioned in terms of publication evaluation.

Problems of hiring committee members

According to the interview results, I list eleven problems of hiring committee members in the academic hiring process and divided them into three categories: Reviewing application packages, Evaluating scientific outcomes, Comparing candidates. The specific problems are shown in Table 3.2.

3.2 Online Survey

To understand how researchers use visualizations to illustrate their careers and scientific output, I emailed researchers in the Aviz (the team where I did my internship, which is a multidisciplinary team in Inria, focus on visualization research) alumni email list to ask and get their use cases. In order to get more examples, I also used web search to find design works of personal career visualization from the industry.

Method

The email were sent to Aviz alumni, whose research topics are related to visualization and human-computer interaction, and have more considerations on the practical applications of visualization. In parallel, searching for relevant work by designers allowed me to gather more design inspirations.

In the email survey, we inquired Aviz alumni members whether used visualizations in CV, and asked for file links or screenshots of these works. In the web search I conducted, I searched for examples in the design community (e.g., Behance, Flickr, Pinterest) and Google image search tool.

Results

In response to my email, I received 15 different visualizations from fifteen researchers, as summarized in Figure 3.1. 67% (ten cases) of visualizations used a *timeline* to represent the chronological information of education, publication and career. Other visualization forms included *pie Chart* (one case) to show the time spent on teaching different type of courses, *bar chart* (one case) to show the numbers of publications and citations, *scatterplots* (one case) to show the participation in program committee and reviewing, *color levels* (one case) for the self-assessment of software production, and use *photo gallery* to present co-authors network. Participants created these visualizations for job applications (six cases) and presentation (two cases), while the rest of them are for just displaying on personal websites.

As for web search results, I removed those examples that were homogeneous and low-readability, and only kept six typical cases that had reference value in both aesthetics and effectiveness aspects. Only one example uses a *radar chart* to demonstrate the abilities, while others use *timeline* to present their work and education experience, and three of them also show the development of personal interests and professional skills.

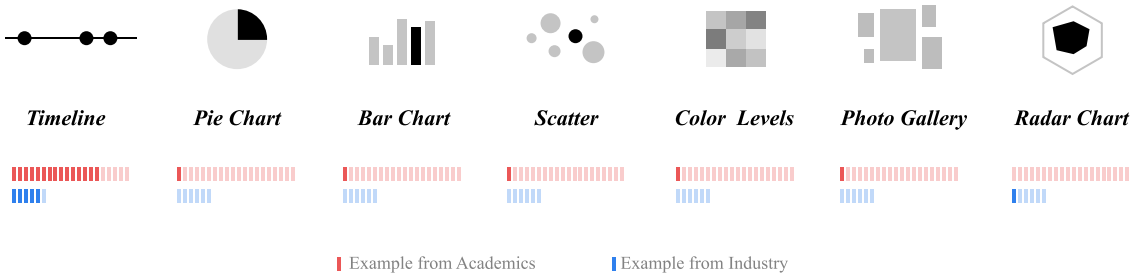

Figure 3.1: Visualization forms from online survey

3.3 Summary

According to the interview results, eleven typical problems encountered by the hiring committee members are divided into three categories: Reviewing application package, Evaluating scientific outcome, Comparing candidates. These problems come from several aspects: efficiency (e.g., Need to switch between different applicants' profiles quickly), availability of information (e.g., Evaluate the usefulness and applicability), and understandability of information (e.g., Knowledge barrier of the different domains). Through email and web search, I found that it is apparent that most people tend to use *timelines* to present their chronological experience, including education, works, research activities, and publications.

From my requirements analysis I gathered the following requirements for my work: (1) Give enough candidate's information (e.g., Scientific outcomes, education background, mobility) for those evaluators who are not in the same domain, so that they can have a rough but relatively accurate image of the candidates. (2) Give a global picture of all candidates, so that evaluators can have a baseline when evaluate. (3) Allow comparing different candidates, so that evaluators can recognize their strength and weakness easily.

CHAPTER 4

Design

The direction of visualization design in this thesis is based on research opportunities identified through literature review and design problems refined through user research. In this chapter, I will clearly define the design goals, outline the usage context, and explain what data I visualized. I used an iterative design approach. Several design prototypes are shown with explanations of my considerations and reflections. Finally, I will describe how I implemented these visualization prototypes.

4.1 Design Goals

The visualization is designed to help academic hiring committee members to improve both the quality and their evaluation experience. **Quality** means a suitable candidate for the job position is more likely to be given a high rank or be selected. **User Experience** means that hiring committee members are more efficient in the evaluation procedure and have confidence in evaluation outcomes.

4.2 Visualization Usage Contexts

To narrow down my research, we decided to focus my visualization on the hiring of junior researchers with a relatively short academic history. The visualization tool will be used by evaluators in two different scenarios: *Individual Reviewing* (Stage 1) and *Committee Meeting* (Stage 2,3 and 4). The stages were described in the results of the interview in Chapter 3.

Individual Reviewing

At this stage, there are three main problems faced by evaluator: (1) If the evaluator does not have enough experience in academic hiring, he or she will take a longer time to review the application package to find the key information inside, then analyze and summarize. (2) If the evaluator is not in the same domain as the applicant, he or she will ask friends who are in a close field for help, or search for relevant information online. It takes extra effort in either way. (3) Since he or she does not know the average level and baseline of all applicants, the grade will become very subjective.

Therefore, in this application context, I chose to design a visualization to address the above problems: when an evaluator conducts an individual review, with the assist of the visualization tool, he or she should ideally be able to quickly understand the applicant's basic information even with limited knowledge in the applicant's domain.

At the same time, the evaluator should roughly know the applicant's level among all applicants, which will presumably make the final grade more objective and accurate at this stage. According to work about visualizing comparison [21], the comparison behavior in this stage can be defined as *"Summarize Somehow"*, which means the tool should support comparisons at multiple levels: raw data, features of abstracted data and resulting imagery.

Committee Meeting

At this stage, the problems of knowledge barrier are generally resolved through discussions among the committee members, so how to compare different applicants effectively becomes the most significant goal. When deciding applicant's ranking, discussion is easily limited to a specific dimension, and everyone has to look through the application packages to find the corresponding information – All participants have to be highly focused, constantly remember new information, and continuously use this information to analyze and summarize. In this situation, the visualization tool should provide a comprehensive and intuitive perspective that reduces the cognitive burden on the evaluators. In addition, committee members should be able to compare applicants visually by targeting specific dimensions (e.g., the quality of papers published without a Ph.D. advisor) from a global perspective.

4.3 Data

The data I chose to use in the visualization comes from applicant's CV, online digital library, and subjective rating by experts. These data used in the design are presented in Table 4.1. The information in an applicant's CV is provided and validated by the applicant himself or herself. Education background, career experience, teaching experience, and publication list can be obtained directly from applicant's CV as well. The citations of publications is dynamic so it is challenging to be shown on CV. Thus I collected this data from the digital library Google Scholar[1], which is widely used in academics. The rating of journals and conferences is also critical because it helps evaluators to roughly evaluate the quality and impact of a publication in research fields they are not familiar with. For the rating of journals and conferences, I used both subjective ratings by experts in the particular domain, and data from CORE Ranking, which provides a relatively authoritative assessment. These two data sources can complement each other and increase reliability. Considering the thesis focuses on junior researcher recruitment, some indicators such as H-index are not very informative, because these researchers are just starting their research career and do not have plenty of publications.

[1] https://scholar.google.com/

Data	*Source*
Education Background (Name of position, Name of university or institute, location, start and end time)	CV
Research Experience (Name of position, Name of university or institute, location, start and end time)	CV
Publications (Title, Authors, Name of journal or conference, Published Time)	CV
Personal Information (Age, Contact)	CV
Citation count for each publication	Google Scholar
Rating of journal/conference for each publication	CORE Rank+Expert suggestion

Table 4.1: Data Source

4.4 Design Iterations

We began with an ad-hoc design and then experimented with four significant iterations. After each design my advisors (who served in several academic hiring committees) and I went through a critique phase where we discussed the pros and cons of the design choices. In particular we discussed (1) Was the real information illustrated accurately and objectively? (2) Can this design support comparison efficiently?

Ad-hoc Design

The ad-hoc design came from Petra Isenberg. Figure 4.1 is its screenshot with anonymized data. It was a temporary design for a French academic hiring committee where Petra Isenberg served as committee president, and was designed to help in the comparison and to remember individual candidates.

Description of the Design

A *Juxtaposition* layout [22] was used to present each applicant's information separately. The visualization of each applicant is divided into five columns: applicant's name,

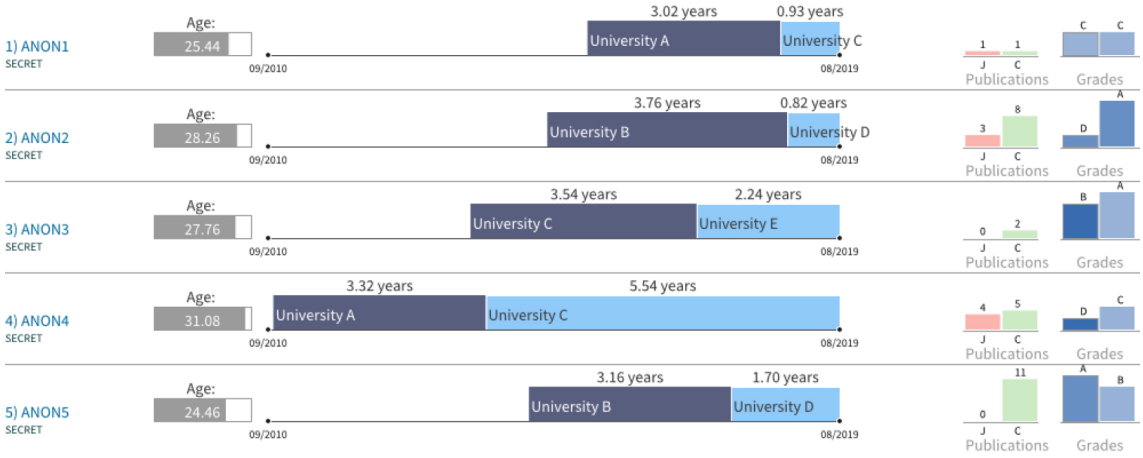

Figure 4.1: Ad-hoc Design by Petra

age, timeline of education and research experience, publication statistics, and grades given by the two evaluators in the first stage. The age column can be seen as a bar chart that makes applicant as the key attribute, so that committee members can compare them in the horizontal dimension. On the timeline, Ph.D. and postdoc periods are encoded by dark blue and sky blue, which provids a clear picture of the time distribution of all applicants.

Discussion

During the interview mentioned in the previous chapter, I asked three interviewees' opinions about this design (These three interviewees were in the same hiring committee as Petra Isenberg, and they had used this visualization). Two of them gave very positive feedback. However, at the same time, shortcomings were apparent as well. In the representation of information, they believed that this design would produce more cognitive bias because it only shows quantitative data (e.g., the number of publications, the period of Ph.D.), and ignores the quality of the candidate's scientific achievements. As for improving the visualization, one interviewee suggested: *"It would be good to have more space that just to put comments. Basically, you could have more space..."*. In addition, since the applicants' ages do not vary significantly, it is difficult to observe the disparity with the numerical range from zero to the maximum age among all applicants.

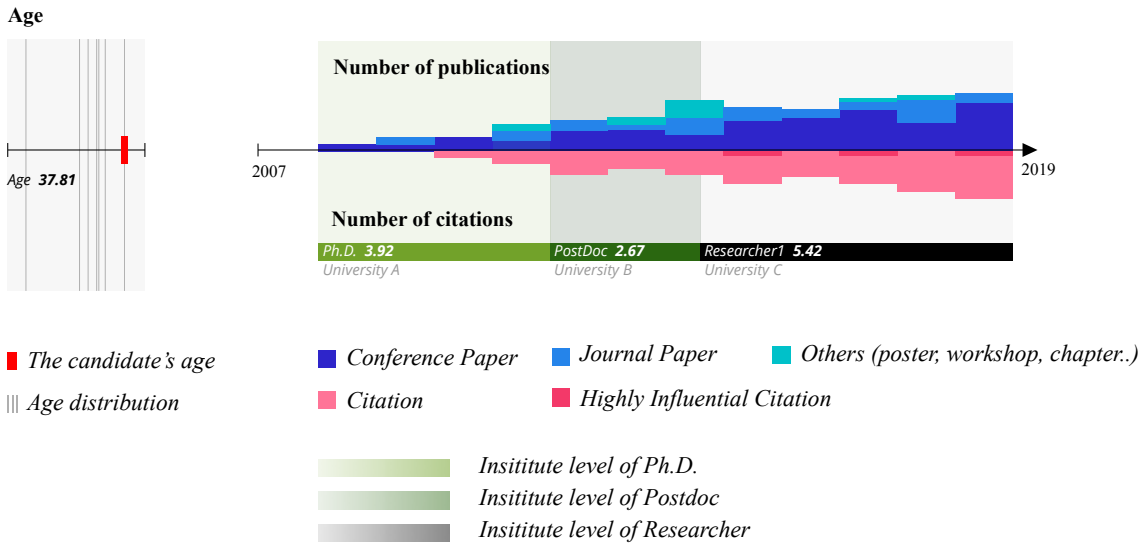

Figure 4.2: First design

First Design

Based on Petra Isenberg's work, my first design, with one applicant's anonymized data, shown in Figure 4.2, is to improve the readability of applicant's age, and provide more details in the publication visualization.

Description of the Design

A linear scale axis shows the age, which uses minimum and maximum age among all applicants as scale range. A red notation indicates the present applicant's age, meanwhile the multiple gray lines show the age distribution of other applicants. In addition, publication data is merged into the timeline. The positive Y-axis shows the number of publications, while the nagetive Y-axis shows the number of citations. Additionally, I use the bright colored blocks in order to create a resulting imagery of each applicant for comparison.

Discussion

Publication counts and citation counts are still numbers of sum in the current design, though these numbers are distributed over the time dimension. The goal of design is to provide a accurate and objective information expression, but the current design is more to provide statistical results instead of showing rich data. In addition, the highly influential citation is only used in the digital library *Semantic Scholar* [5],

which will result in an inaccurate evaluation due to the introduction of unreliable data.

Second Design

In this design iteration, I made seven variations and removed the age information (See Figure 4.3), in order to facilitate the subsequent discussion about the choice of visual elements. In these designs, the real publication and mobility data of Pierre Dragicevic from 2000 to 2007 were used.

Description of the Design

In order to augment the visual importance of publication information, I made the representation of mobility less salient. Each publication contains its published time, type (whether a journal paper or a conference paper), rating (Level of journal or conference), author order, number of citations. In designs 2A and 2B, each publication is represented by a rectangle, stacked on the timeline according to its published time. Journal papers are encoded with red and conference papers are blue, and the rating of the publication venue is displayed by the transparency of its color. The number of citations is represented by the size of the background semi-transparent circle and the height of the rectangle respectively in 2A and 2B.

In designs 2C and 2D, rounded-rectangles and circles indicate individual publications. Their vertical position is author order. The rating is encoded with the height and the size of node respectively. Design 2E looks similar, but these nodes are placed in different Y-position according to its rating.

In design 2F, the "bar" made up of a square and a rectangle is represented a publication, arranged in the horizontal direction. The hue and transparency of the small squares represent the type and rating of the publication, respectively, and the transparency of the rectangle indicates the number of citation. The small dots on the rectangle represent the author order: the further away from the square, the higher the author's order. In design 2G, the height of green lines is used to indicate the number of citations.

Discussion

Compared to the first design, the rating and author order represent the quality of a publication and the contribution of the applicant better, but some glyphs will still be confusing, especially the author order. Moreover, the current visual expression of mobility is too weak, likely making it difficult for committee members to compare the applicants' experiences between timelines. For young researchers, their independence should be considered: an applicant who always publishes with his Ph.D. advisor is

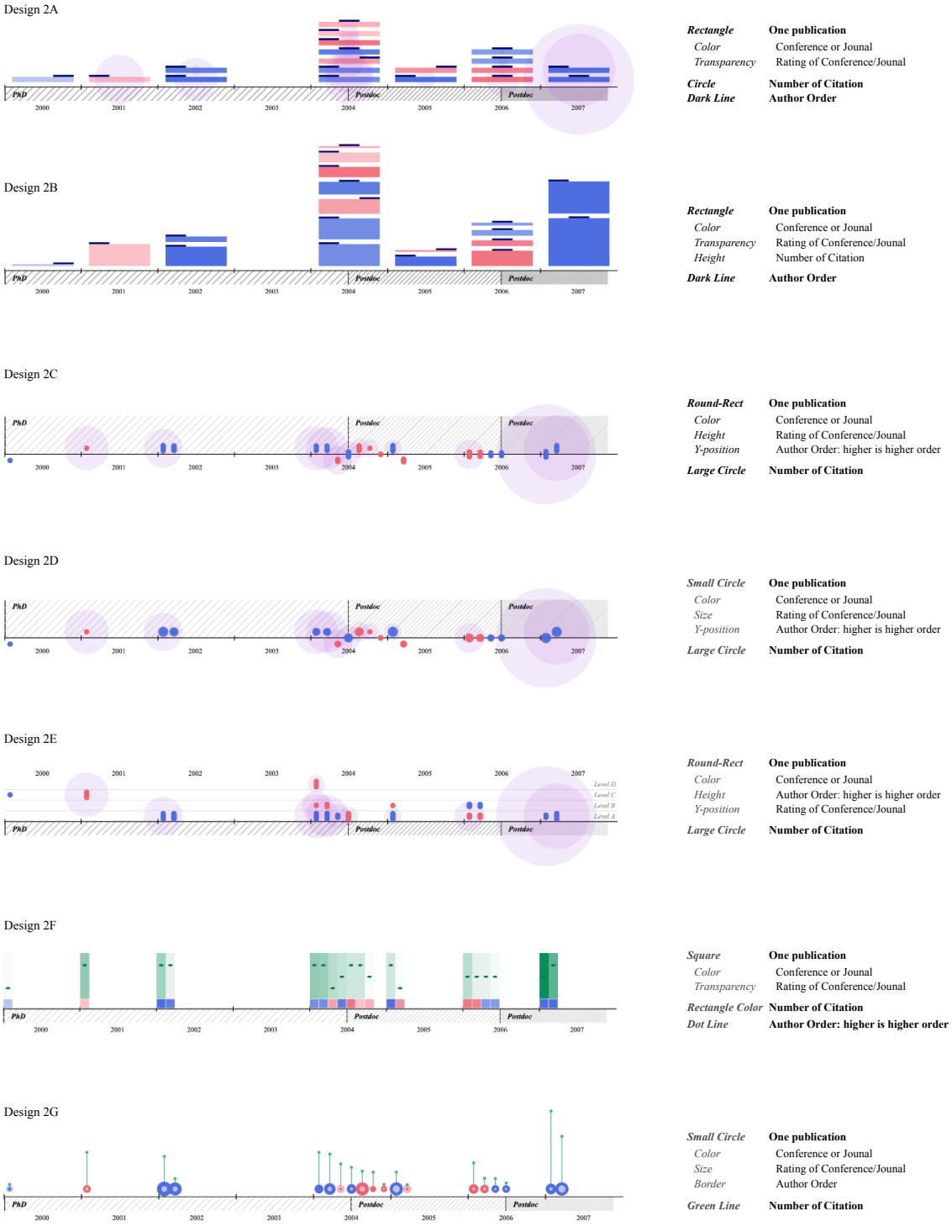

Figure 4.3: Second design with seven prototypes

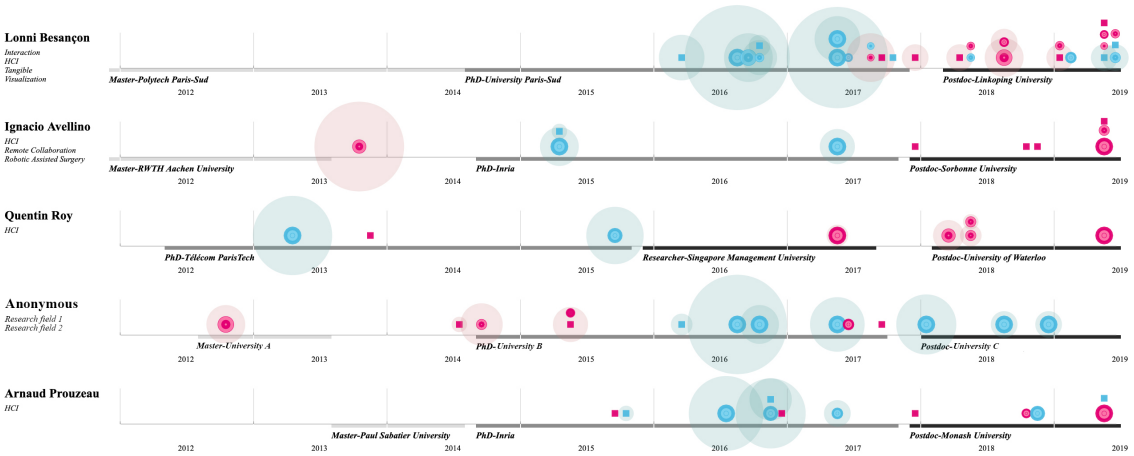

Figure 4.4: Final design

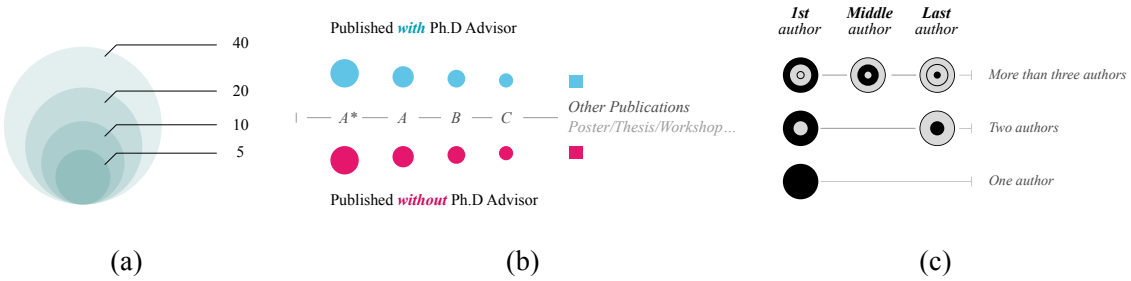

Figure 4.5: Visual details of final design: (a) Number of citation; (b) Subjective importance rating for journal/conference; (c) Author order

significantly different from an applicant with rich collaboration networks. Therefore, these differences need to be better revealed in the visualization.

Final Design

Final design is based on design 2D and 2G, as shown in Figure 4.4, and the legend is in Figure 4.5. In this design, I used real data from six junior researchers in the HCI field [2].

[2] All researchers agreed for their visualized data to be included in this thesis, and one researcher requested their data to be anonymized.

Description of the Design

In the final design, applicants' research fields were added under their name. I also changed the layout of the publication nodes to the arrangement by both publishing year and month. In addition, I implemented the interaction, so the user can check the details of each publication by hovering the cursor on the publication node. Four main modifications of visual expression are described as follow:

Number of citations: The size of the semi-transparent large circle behind each publication node is used to display the citation counts of this article. See the Figure 4.5(a). There is a function between human's judged (J) and actual(D) size: $J = \lambda D^{\alpha}$, where α is an exponent and λ is a constant [35]. In order to allow the user to accurately perceive the difference in size, I chose $\alpha = 0.82$ as the exponent value [35].

Independence: We reasoned that it is more valuable to distinguish whether an applicant is working with their Ph.D. advisor than to distinguish between journal paper and conference paper, because for a junior researcher, being able to work independently from the advisor and build their collaboration network is an essential indicator of research ability. Therefore, I used color to show the partnership with the applicant's Ph.D. advisor in each publication node, as shown in Figure 4.5(b).

Type of publication: For evaluators, the difference between full paper and other publications, such as poster and workshop paper, is important. I used circles and squares to represent two types of publications. For full papers, the size of the shape represents the subjective rating of journal and conference.

Author Order: I simplified the author order of each publication into three categories: First position, last position, and middle position. These categories have different symbolic representations in three cases of total author number: one author, two authors, and more than two authors, as shown on the right of Figure 4.5(c). The painted area is the metaphor of applicant's contribution. Thus the glyphs of first author are presumably more pre-attentive, and the publications by only one author will presumably attract more visual attention as well.

4.5 Implementations

In order to better carry out subsequent evaluations, and in order to allow users to use the tool across platforms and devices, I developed this visualization tool for the web. I chose javascript and used the p5.js library to render the interactive visualization. Since there is a lot of date and time information in the dataset that determines the position of different elements, I used the moment.js library to help identify date and time information in the data. In addition, I developed a basic interaction letting users hover on each publication instance to check the more detailed information.

CHAPTER 5

Evaluation

In order to understand the effect my visualization may have on the academic hiring process, I conducted two evaluation studies with the final visualization (see Figure 4.4 in the previous chapter) with my supervisors. Considering the cost and time of the evaluation process, we could not verify all the design goals mentioned in the previous chapter. Therefore, the evaluation study focused on two most important dimensions: (1) assessing the usability of the visualization, and (2) assessing the influences of the visualization on discussions in an academic hiring committee. In this chapter, I will describe two different evaluation studies, explain the evaluation methods, and state the evaluation results.

5.1 Evaluation Methods

We designed two different studies with junior researchers and evaluators respectively. We first conducted a survey on the information accuracy and usability of visualization with six junior researchers, then optimized the design through the results. After that, we used the optimized visualization for the second study, in order to study the influence of the visualization on discussions in an academic hiring committee.

Study I: Junior Researchers

The first study was aimed at evaluating our design with six junior researchers who provided real research career data for my final design. We chose this participant group because they are most sensitive to the accuracy of their data, and their research fields are related to human-computer interaction, which means that they are more likely to provide valuable feedback for my thesis whose work is in the same domain.

In order to ensure the privacy of the researchers' data, we respectively sent the visualizations with their own data by email, meanwhile provided a survey form and data permission request. The form and permission request is shown in appendix A. In the mail, they were asked to evaluate the visualization of their research career data and provide feedback using Likert-scale ratings and comment fields. The aspects they evaluated are: subjective impression, accuracy of the data, accurate reflection of scientific outputs and mobility, usability and readability. The results of the first study were used in following analysis, as well as to optimize the visualization design, in order to ensure the accuracy of the visualization in the Study II.

Study II: Evaluators

The second study was a simulated hiring committee. Three participants were invited to act as evaluators in a hiring committee. They discussed five applicants and finally submitted a ranking of the candidates as recommendations for upcoming interviews. The three participants (two male, one female) had different backgrounds: one of them was very experienced in visualization, had more than fifteen years of research experience and had participated in many hiring committees; the other two had seven years and five years of research experience, in HCI and mathematics respectively.

There were three phases of the study. In the first phase, the whole committee was provided with five printed CVs of real junior researchers (The five junior researchers were the participants in Study I who gave the permission for their visualization to be used in Study II). Each participant was assigned three to four applicants' documents, and was given 10 minutes to review their materials. Then, each participant was asked to present the assigned applicants to other members of the committee in 3 minutes. After that, they took another 10 minutes to discuss together then gave a final rank.

In the second phase, the committee was provided with the visualizations of the five applicants (digital interactive version on a shared display and their laptops, as well as three printed ones) as additional material, then discussed again to see whether to modify the previous rank in 10 minutes.

In the third phase, they were asked to fill a questionnaire about the usage of the visualization. Additionally, we conducted a short post-study interview with them and asked questions that we found interesting during the process. At the same time, we also collected their behaviors and words in the study through video and audio recordings for subsequent analysis.

5.2 Results

Feedback from Study I

The quantitative results are shown in Figure 5.1(a). In terms of the accuracy of data, most of them gave a high grade, meanwhile pointed out missing information and mistakes. As for whether it accurately reflects the scientific outputs and mobility, they held different opinions. One of them claimed that the visual element of "Published with Ph.D. advisor" is too prominent, making it seem that the applicants did not do well in the absence of their advisor, which might not only leave a bad impression on the hiring committee, but also an unfair assessment for a newcomer who just finished Ph.D.. Another said that teaching should be considered as a form of scientific output. Additionally, one participant doubted subjective ratings of conferences, because he thought it does not truly reflect the impact of a conference. When asked about

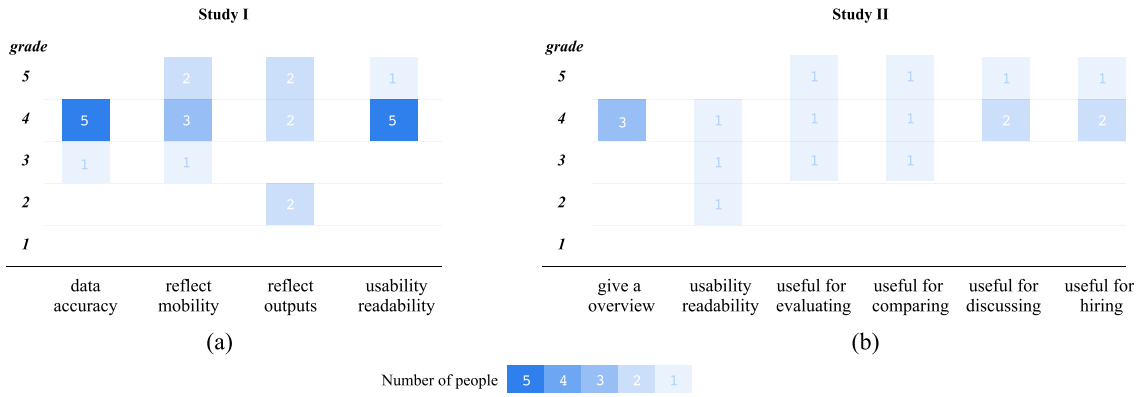

Figure 5.1: Grades given by participants in the two studies

readability, three respondents mentioned it was hard to understand the glyphs of author order, and one participant thought that the areas showing citations is difficult to compare.

Observations in Study II

To analyze the influence of the visualizations on their discussions, our observations are divided into two parts in this study: (a) the purpose of using the visualizations, and (b) the way of using the visualizations. The four different purposes are listed below, along with the corresponding users' behaviors.

Verify the previous rank

Because of study design, participants had already discussed a ranking in the first phase before using the visualizations, so the first thing they did was to verify the previous ranking. Surprisingly, in order to show the previous ranking for easy visual verification, one of the participants cut the printed visualization into five small pieces (each piece containing one applicant's timeline), and then rearranged these pieces to match the previous ranking.

Find information

The participants reviewed the visualizations to find interesting or debatable information and brought them into the discussion. When reviewing, they rarely used the mouse to check details, but generally looked at a printout of the visualization we gave them. When the information was not sufficient, they did analysis. For example, the countries and regions were not displayed in the mobility, then they used existing

information in the visualizations to calculate how many regions the applicant has visited, and how far he or she moved. When they found confusing information, they returned to the applicant's CV to find more specific details.

Aid in understanding

Generally people found publications in CVs hard to evaluate. In the visualization they checked those publications to see what it looks like. These visual representations could apparently help them better understand and evaluate publications.

Use as a medium

The participants used the visualizations as a medium of communication, organizing statements through looking at graphics. In most cases, they used the utterance "this" or "that", meanwhile pointing at the place they were describing. When someone talked with a printed visualization, the other two's eyes focused on where the finger was pointing, which was easy to keep pace with the speaker. In contrast, in the first phase without visualization, they appeared as if they had to maintain a high concentration, meanwhile looked through the text material to find the information the companion said.

Feedback in Study II

The quantitative results are shown in Figure 5.1(b). All three participants agreed that the visualization could provide them with an overview of all applicants. In terms of usability and readability, the glyphs of author order were difficult to understand and hardly used in the discussion; mobility only showed the duration, and the display of the place was not clear enough; and for the citations of publication, they suggested that self-citations could be marked. The participants' overall assessments were positive for using the visualizations in evaluation, discussion, and comparison. They thought the biggest improvement to the evaluation process brought about by the visualization is the significant reduction in reviewing time.

The Participants believed that more interactions could be developed: for example, dragging each applicant's timeline directly on the interface to sort and compare; switching the way of alignment, such as aligning start time of Ph.D. and putting annotations and comments on the interface. Another interesting suggestion is that when the participants discussed the rankings, they needed to state their reasons, and these reasons were usually trade-offs of several essential criteria. Therefore, if the visualization can show the distribution of the weights of the criteria added by evaluators, they might have agreement on criteria faster. As a result, the discussion might be much more efficient.

CHAPTER 6

Discussion

In this chapter, I will first discuss the possible influence and value of visualization in the academic hiring process. Then, based on the results of the evaluation study and reflections in the design process, I will analyze the limitations of the current visualization design and the design of the evaluation study.

6.1 Influences of visualization in academic hiring

My research suggests that visualization can positively impact academic hiring in several ways. First, it can significantly reduce the time spent in reviewing an applicant's materials, and it can help the evaluator get a basic knowledge about the research background of all applicants quickly. Although the quality of an applicant's work requires carefully evaluating, the efficiency of information acquisition appears to be improved for quantifiable data.

Second, visualization can aid in the acquisition and understanding of textual information on CVs. In many situations, people are better at gaining insights quickly from graphics than text. In our research, I found that users' strategy often consists of "Obtaining insights by viewing the visualization then reviewing text to find more details." Conversely, users often have problems when reading a text, especially the publication list, then get understanding through visualization, which also suggests that the visualization can help people in information understanding.

Moreover, the visualization often served as a medium to help committee members focus on the information that was discussed. The study found that when there was no visualization as a support, members usually sought relevant information in the pages of CVs while listening to what the speaker was saying, which required them to maintain a high concentration of attention. In contrast, once visualization was used, they can locate and find relevant information easily and quickly.

As for comparison, my study suggested that ranking candidates visually can help the committee to gain quick reflections. Although my design did not support ranking, one participant in the evaluation study used a printed visualization and made a fast prototype that can rank applicants. It has proved to be useful in advancing the discussion process. Therefore, a visual ranking could help committee compare applicants easily.

However, the introduction of visualization also poses risks. As one interviewee said, if too much quantitative data is displayed, evaluators will pay more attention to them, and the importance of the remaining qualitative data will be covered up. Another interviewee also mentioned that trying to quantify information that

requires experience to judge will bring bias to the evaluation process. This view was more or less restated by a junior researcher involved in the evaluation Study I. He mentioned that even if the scientific outputs are visualized in an objective and accurate way, the quality of the applicant's publications seems to be declining in the visualization because newer publications receive fewer citations due to time accumulation. However, this misreading is relatively implicit in the academic hiring scene without the visualization.

6.2 Limitations

According to the feedback from the evaluation studies, there are still many limitations in the visualization I designed.

In terms of information design, the data used for the design is only a small part of what evaluators consider in academic hiring. Some data is easy to visualize, such as during of Ph.D., citation count, and types of publications. However, information that capture the quality of research work, such as its influence, and the relative contribution of the applicant requires to be evaluated in other ways. Also, the representation of author order for each publication was difficult for everyone to understand, so it played a limited role in the evaluation activities. Furthermore, the way mobility was visualized was too simplistic, as it only provided position and name of institution, and could not directly reflect applicant's movement.

The limitations of interactive features also affected usage. The current design did not provide the capability to reorder timelines, which made a comparison between applicants less easy. The visualization also lacked different ways to align the timeline of individual candidates. The study showed that users sometimes wanted to align the start time of each applicant's Ph.D. period, in order to compare their trends of publication. Another limitation is that the functions of collaboration were not taken into account at present. Users could not annotate in their own views, and share the view with the rest of the committee. As for the tooltip design, the information was presented only through text, which led to low readability.

The evaluation study design also had limitations. First, five young researchers from the same domain were selected to act as "applicants" in Study II, but in real academic recruitment scenarios, applicants often come from different domains. Then, two of the three "evaluators" never had experience in an academic hiring committee, which also increased the difference between the simulated meeting and an actual meeting. As for the procedure of study, we used the same participants for the control condition (no visualization) and the experimental condition (visualization), which likely caused their behavior and decisions with the visualization to be affected by their initial decisions. Future studies could use between-subject designs.

CHAPTER 7

Conclusion

In this thesis, I first discussed the current evaluation methods used in academic hiring through a literature research and presented their limitations. I then examined how visualization is applied in contexts similar to academic hiring. Although previous work has studied the visualization of publication records and career experience, to our knowledge there is no research on visualization in academic hiring specifically.

In the next chapter, I presented the results of interviews describing the academic hiring process of French research institutes, and analyzed the behavior patterns and problems encountered by the evaluators in this context. I then discussed the results of an online survey on the ways researchers use visualizations to present their research experience and scientific output. Together, the results of the user research helped in identifying design goals and design scenarios for the design phase.

In chapter 4, I presented the iterative design of a visualization to assist evaluators in hiring committees. After discussions and reflections, a final design was identified and implemented. I reported on an evaluation study suggesting that visualization can have positive impacts on academic hiring. By providing an overview of all applicants and allowing them to be more easily compared, visualization can reduce the time spent on reviewing applicant's materials, help evaluators better understand information, and serve as a medium for discussion. Meanwhile, I discussed several limitations in terms of interaction and information design of visualization, as well as the limitations of the evaluation study design.

To better assess how visualization can assist in academic hiring, first, a better visualization tool needs to be designed. In terms of information design, different forms of representation could be explored, and more data about the applicant (e.g., teaching experience and academic activities), could be incorporated into the design. In terms of interaction design, future work should provide convenient comparison functions, such as ranking applicants to compare visually, providing different alignments for the timeline, and a capability to add annotations to facilitate collaboration. In addition, the process of academic hiring is different among countries, and future research could consider these differences in the design.

Acknowledgments

I would first like to thank my thesis advisor Pierre Dragicevic and Petra Isenberg. The door to their office was always open whenever I ran into a trouble spot or had a question about my research or writing. They consistently allowed this thesis to be my own work, but steered me in the right the direction whenever they thought I needed it.

I would also like to thank Arnaud Prouzeau, Ignacio Avellino, Lonni Besançon and Quentin Roy who are willing to provide me with their research record data, as well as the permission that I can use thse data in my study, thesis and website without any anonymization requirement.

I would also like to thank all the participants in my interviews and surveys who willingly shared their precious time and gave me very useful insights and opinions.

Finally, I must express my very profound gratitude to my family and to my friends for providing me with unfailing support and continuous encouragement throughout my years of study and through the process of researching and writing this thesis. This accomplishment would not have been possible without them. Thank you.

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Brief survey on the visualization of your academic output

This survey is part of Yumin Hong's master thesis project Visualization for Academic Hiring, advised by Pierre Dragicevic and Petra Isenberg. It should take you no more than 5 minutes to complete.

* Required

1. **Please enter your name** *

Feedback on the visualization

2. **Briefly, what is your impression of your scientific output and mobility, judging from the visualization? (optional)**

3. **Is the data accurate?** *
   Mark only one oval.

	1	2	3	4	5	
Not at all	◯	◯	◯	◯	◯	Yes, entirely

4. **Please briefly explain what needs to be fixed (optional)**

5. **Do you feel the visualization accurately reflects your scientific output?** *
   Mark only one oval.

	1	2	3	4	5	
Not at all	◯	◯	◯	◯	◯	Yes, entirely

6. **Please briefly explain how it could better reflect your scientific output (optional)**

7. **Do you feel the visualization accurately reflects your mobility?** *
   By mobility we mean your experience studying and doing research in different locations.
   Mark only one oval.

	1	2	3	4	5	
Not at all	◯	◯	◯	◯	◯	Yes, entirely

8. **Please briefly explain how it could better reflect your mobility (optional)**

9. **Do you feel the visualization is easy to use and to read?** *
   Mark only one oval.

	1	2	3	4	5	
Not at all	◯	◯	◯	◯	◯	Yes, entirely

10. **Please briefly explain how we could improve its usability or readability (optional)**

11. **Other comments (optional)**

Permission requests

Please let us know if we have your permission to use the visualization we sent you as described below.

ALL check boxes are optional. If you do not want your visualization to be used at all, leave all check boxes unchecked. In that case, we will only report your anonymized responses to the "Feedback on the visualization" questionnaire from the previous page.

(*) The study mentioned below will consist of assembling a small group (3-4) of permanent researchers from local teams (Aviz, Ilda, Ex-Situ,...) and asking them to participate in a mock hiring committee meeting for about one hour. If you agree, they will be shown your CV and the visualization of your academic output, along with CVs and visualizations of 3-4 other young researchers in HCI or visualization. The permanent researchers will be asked to review candidates mostly based on their scientific output and mobility, to discuss their strengths, and to rank them. The comments and rankings will be treated confidentially and will not be shared outside the mock hiring committee and the research team (Yumin Hong, Pierre Dragicevic, Petra Isenberg). A qualitative analysis of the data will be reported in Yumin Hong's Master thesis, including general quotes that will not permit your identification, or the identification of the participants to the mock hiring committee. If you agree for a screenshot of your visualization to be included in the Master thesis or in the thesis defense as an illustration, we will not reveal that this visualization was included in the study.

(**) Please note that even if we anonymize your name, the author lists and the publication titles on the visualization, it will still be possible to retrieve your identity from the pattern of your publications (years, venues and citation counts)

12. **Use in study**
    I give my permission to the research team (Pierre Dragicevic, Petra Isenberg, and Yumin Hong) to use the visualization of my academic output in the study described above (*)
    Check all that apply.

    ☐ I give the above permission provided that my name and the publications shown on the visualization (author lists and titles) are anonymized (**).

    ☐ I give the above permission without any anonymization requirement.

13. **CV**
In case you gave your permission above, do you have an updated CV in PDF format with a list of your publications you can email to us? Otherwise we will use your Google Scholar publications and/or LinkedIn profile.
Check all that apply.

☐ Yes

14. **Use in Master thesis**
I give my permission to Yumin Hong to use a screenshot of this visualization in his Master thesis, as an illustration. It may be shown next to visualizations of other young researchers from HCI or visualization.
Check all that apply.

☐ I give the above permission provided that my name and the publications shown on the visualization (author lists and titles) are anonymized (**).

☐ I give the above permission without any anonymization requirement.

15. **Use in Master defense**
I give my permission to Yumin Hong to show this visualization in his Master defense, as an illustration. It may be shown next to visualizations of other young researchers in HCI and visualization.
Check all that apply.

☐ I give the above permission provided that my name and the publications shown on the visualization (author lists and titles) are anonymized (**).

☐ I give the above permission without any anonymization requirement.

16. **Use in public website**
I give my permission to the research team to make this visualization available on the Web as part of an online demo. It may be shown next to visualizations of other young researchers in HCI and visualization.
Check all that apply.

☐ I give the above permission provided that my name and the publications shown on the visualization (author lists and titles) are anonymized (**).

☐ I give the above permission without any anonymization requirement.

17. **Acknowledgements**
Check all that apply.

☐ I give my permission to Yumin Hong to acknowledge me by name in his Master thesis.

18. **Optional comments (questions, special requests)**